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ANNUAL REPORT IN COMPLIANCE WITH THE REACTOR SHARING PROGRAM

For the Period
September 1, 1994 - August 31, 1995

BY

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Neely Nuclear Research Center
Georgia Tech Research Reactor

PREPARED FOR

U.S. Department of Energy
Under Contract No. [redacted]

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PREFACE

Administrative responsibility for the Neely Nuclear Research Center (NNRC) resides in the Office of the Dean of Engineering of the Georgia Institute of Technology. The NNRC houses two major facilities: the Georgia Tech Research Reactor (GTRR) and the Hot Cell Laboratory. The NNRC is a facility of the University System of the State of Georgia and is available to all universities.

This annual progress report of the operation of the GTRR and NNRC is submitted to DOE in accordance with the requirement of Contract [redacted].

HIGHLIGHTS

The following universities (other than Georgia Tech) have used the facilities at the Neely Nuclear Research Center:

1.	Arizona State University	Arizona
2.	Medical College of Georgia	Georgia
3.	Tuskegee University	Alabama
4.	University of Oklahoma	Oklahoma
5.	Oklahoma State University	Oklahoma
6.	Emory University	Georgia
7.	University of Alabama	Alabama

The inventory of Co-60 sources at the Hot Cell Laboratory is 250,000 Ci. Dose rates of up to 1.0 E7 rads per hour are possible.

Fifteen commercial companies have used the facilities at NNRC.

The sum of $319,475 in sponsored research and services was obtained during the year to support the Center's activities.

Seven graduate students were financially supported by the Center last year.

Thirty-seven undergraduate and five graduate students have used the NNRC facilities in laboratory courses.

Over one thousand-one hundred visitors from high schools, educational institutions, industry and foreign countries have had conducted tours at the Center.

Over 120 students from Georgia Tech were trained in radiological safety.

Nineteen new or revised procedures were written, approved, and instituted at the Neely Nuclear Research Center to bring the use of radioactive substance on the campus under better national safety standards.

Collaboration on Boron Neutron Capture Therapy (BNCT) with Emory University continues. A new Georgia Tech-Emory Center for cancer research has been formed. The main thrust of this center is BNCT research.

I. INTRODUCTION

The Neely Nuclear Research Center, Georgia Institute of Technology, has been a participant in the University Reactor Sharing Program since 1970. During this period, NNRC has made available its 5 MW research reactor, its Co-60 irradiation facility, and its activation analysis laboratory to large numbers of students and faculty from many universities and colleges.

This report of NNRC utilization is prepared in compliance with the requirement of Contract No. DE-FG05-80ER10771 between the U.S. Department of Energy and the Georgia Institute of Technology. The report contains information with regard to facilities descriptions (brief), personnel, organization, and programs.

The Neely Nuclear Research Center of the Georgia Institute of Technology houses two major facilities: the Georgia Tech Research Reactor and the Hot Cell Laboratory.

The GTRR is a heterogeneous, heavy-water moderated and cooled reactor, fueled with plates of aluminum-uranium alloy. It is designed to produce a thermal flux of more than 1.0 E14 $n/cm^2/sec$ at a power of 5 MW and an exit moderator temperature of 139°F.

The reactor core is approximately two feet in diameter, two feet high and, when fully loaded, contains provisions for up to nineteen fuel assemblies spaced six inches apart in a triangular array. Each assembly contains sixteen fuel plates. The total uranium-235 content of a full loading is 3.6 kg. The fuel is centrally located in a six foot diameter aluminum reactor vessel which provides a two foot thick D_2O reflector completely surrounding the core.

II. NNRC Activities

II.1. Reactor Location and Other Specifics

II.1.1. University: Georgia Institute of Technology
Atlanta, GA 30332-0425

II.1.2. Program Director: R.A. Karam (404-894-3620)

II.1.3. Grant #: [redacted]

II.1.4. Reactor Type/Power Level: Tank Type/5 MW Heavy Water

II.2. Staff and Administration

II.2.1. The following personnel were employed at NNRC full time for the entire reporting period:

1. R.A. Karam, Director
2. Rodney D. Ice, Manager, Office of Radiation Safety
3. Billy Statham, Electronic Engineer
4. Dixon Parker, Reactor Supervisor
5. Debbie McGeorge, Administrative Coordinator
6. Fritz Strydom, Senior Engineering Safety Assistant
7. Edgar Jawdeh, Health Physicist
8. Bill Downs, Senior Reactor Operator
9. Arlene Smith, Administrative Secretary

II.2.2. The following personnel were employed part time:

Jeremy Sweezy, SRO; Dwayne Blaylock, RO; Peter Newby, RO; Ralph DeMeglio, RO; Katherin Norton, Tina Weatherman, Chris Comfort and Shane Klima

II.2.3. The following Graduate Students were given GRA's during the reporting period:

1. Jeremy Sweezy
2. Hannah Mitchell
3. Peter Newby
4. Dwayne Blaylock
5. Michelle Coulter
6. Melinda Gwitt
7. Nick Jenkins

II.3. Educational Output

II.3.1. The following courses were taught using the GTRR:

N.E. 4205 Nuclear Reactor Laboratory
N.E. 4260 Radiation Transport and Shielding
N.E. 4210 Reactor Operation

II.3.2. Degrees

Hannah Mitchell - Ph.D. Health Physics

II.3.3. Short Courses Taught

Radiation protection short course given every quarter and attended by more than 30 students each quarter.

II.3.4. Other Courses which used NNRC Facilities

N.E. 6110 Radiation Detection
N.E. 6110 Radiation Detection

N.E. 3110 Radiation Detection

II.3.6. High School Student Tours

NNRC conducted tours to high school students interested in nuclear science. More than 1200 students have toured the NNRC facilities.

II.3.7. Use of NNRC Facilities by Other Universities

The following table shows how principal investigators from various universities used NNRC facilities, primarily the GTRR, through the Reactor Sharing Program funded by DOE.

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TABLE I
Reactor Sharing Services
September 1, 1994 - August 31, 1995

Institution	P.I.	# Students Involved	Program	Reactor Sharing Support
Arizona State	(1) Dr. Paul Fitzgerald (2) E. Stump	6	Fission track dating, uplift and formation of mountain chains	16,549.00
Emory Univ.	Dr. Raymond Schinazy	5	BNCT	3,850.00
Medical College of Georgia	Dr. R. Whitney	3	Bone marrow transplant in mice variation in atmosphere	500.00
University of Oklahoma	Dr. Barry Weaver	8	Rare earth elements determinations as a tool for rock origin verification	4,500.00
Oklahoma State Univ.	Dr. Brian Carter		Fission track dating	1,500.00
University of Alabama			Irradiation services	4,500.00
High School Tours		1200		5,000.00
TOTAL				36,399.00

II.4. NNRC's staff efforts under U.S. NRC's License No. R-97 and under the State of Georgia License No. 147-1 and License No. 21-2.

II.4.1. Procedure Writing and Revision

Significant effort was made to upgrade and write new procedures to bring the use of radioactive substances on the campus of Georgia Tech under national safety standards. A list of these procedures follows.

Proc. #	Title
4902	Corrective Maintenance
3800	Liquid Waste Disposal
7272	Log N Period Amplifier Calibration
7280	MAP-1 Recorder Calibration
7281	Temperature Recorder Calibration - Thermocouple
9013	Calibration and Testing of Moving Air Particulate Monitor
9018	Charcoal Cartridge Analysis
9160	Calibration of the LB5100-W Counting System
1500	Irradiated Fuel Discharge to Storage Pool
1501	Lower Top Shield Plug Removal from Spent Fuel
1505	Preparation and Off-Site Shipment of Irradiated Fuel
1506	Physical Protection of Irradiated Fuel in Transit
1507	Emergency Threats to Irradiated Fuel in Transit
1508	Inspection, Testing and Operating Procedure for 6-M Drums
1510	BMI-1 Maintenance, Inspections and Tests

1511 BMI-1 Cask Operating Procedure

1512 Irradiated Fuel Shipment by NAC-LWT Cask

9400 Environmental Monitoring

9501 Control & Accountability of Radioactive Sources

There were two procedures canceled:

4900 System Work Sheet

4901 Preventive/Corrective Maintenance on Safety Related Equipment

II.4.2. U.S. NRC and State Inspections

During the reporting period there were four U.S. NRC inspections and one State of Georgia inspection.

II.4.3. Requalifications Program for Reactor Operators

The U.S. NRC examined four candidates for RO licenses, and two for SRO licenses. Three RO's and two SRO's passed.

II.5. Research Output

II.5.1. PhD Granted

Hannah Mitchell

II.6. Budget Information

II.6.1. Institutional Funds

II.6.1.1. Regular institutional allocations to NNRC during reporting period were $427,386. This money was spent to partially cover personnel services.

II.6.2. External Funds ($319,475.00)

II.6.2.1. DOE Funds

The following funds were obtained from DOE:

1. Reactor Sharing $25,000.00

II.6.2.2. ERDA Funding

The funding for ERDA Administration was $191,408.00.

II.6.2.3. Various Companies

Fifteen companies from the metropolitan area of Atlanta and the rest of the U.S. used the NNRC facilities. Revenues from these companies totaled $103,007.00.

III. Problems/Areas of Need/Priorities

III.1. Instrument

Instruments upgrade are needed in few areas. For the reactor the following are needed:

(1) Auto controller
(2) Intercom system

Other needed improvements include a new filter for BNCT applications.

IV. Plans for FY96

IV.1. Boron Neutron Capture Therapy

The reactor will be shut down for the Olympics. The HEU fuel was shipped to the Savannah River Site.

V. Partial Publications Generated Through the Use of the GTRR

1. Graham, Waverly (1966), "The Determination of Effective Delayed Neutron and Photoneutron Kinetics Parameters in Highly-Enriched Heavy-Water Reactor," School of Nuclear Engineering, Georgia Tech.

2. Macdonald, Robert (1966), "A Method for the Analysis of Modulated Neutron Experiments," School of Nuclear Engineering, Georgia Tech.

3. Johnson, Robert (1967), "Investigation of the Space-Dependent Zero-Power Reactor Source Transfer Function," School of Nuclear Engineering, Georgia Tech.

4. McGhee, (1969), "Measurement of Neutron Diffusion Parameters of Heavy Water and Spheres by the Pulsed Neutron Source Method," School of Nuclear Engineering, Georgia Tech.

5. Champlin, Jerry B. (1970), "The Transport of Radioisotopes by Fine Particulate Matter in Aquifers," School of Nuclear Engineering, Georgia Tech.

6. Walker, David, M. (1970), "An Investigation of Multiple Gamma Scattering in Germanium as Applied to GE(LI) Gamma Spectrometers," School of Nuclear Engineering, Georgia Tech.

7. Wilkie, William H. (1970), "Theoretical Image-Forming Quality of Fast-Neutron Radiography," School of Nuclear Engineering, Georgia Tech.

8. Bridges, Donald N. (1971), "An Investigation of the Spatially-Dependent Reactor Source Transfer Function with Temperature Feedback," School of Nuclear Engineering, Georgia Tech.

9. Ebert, David (1972), "Space and Energy-Dependent Noise Analysis Using Modal Expansions," School of Nuclear Engineering, Georgia Tech.

10. Lord, Robert J. (1972), "Simulated Boiling Effects in a Subcritical Assembly," School of Nuclear Engineering, Georgia Tech.

11. Lake, James (1973), "Measurement of Steady-State Space-Dependent Thermal Neutron Spectra in Beryllium," School of Nuclear Engineering, Georgia Tech.

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13. Sohrabi, M. (1975), "Electrochemical Etching Amplification of Low-Lit Recoil Particle Tracks in Polymers for Fast Neutron Dosimetry," School of Nuclear Engineering, Georgia Tech.

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19. Wahlig, Barry G. (1981), "Transport of Suspended Matter Through Rock Formations," School of Nuclear Engineering, Georgia Tech.

20. Sanders, Michael E. (1983), Design and Application of a Damage-Trac-K Neutron Dosimeter Useable in the 1 EV to 17 MEV Neutron Energy Region," School of Nuclear Engineering, Georgia Tech.

21. Noonan, Denise J. (1984), "An Epithermal Neutron Beam Approach to Boron Neutron Capture Therapy," School of Nuclear Engineering, Georgia Tech.

22. Dawes, M.A., R.S. Saini, M.A. Mullen, J.H. Brower, and P.A. Loretan (1986), "Sensitivity of Sweet Potato Weevil (Coleoptera: Curculionidae) to Gamma Radiation." Accepted for publication in Journal to Economic Entomology.

23. Lu, J.Y., C. Stevens and P.A. Loretan (1986), "The Effect of Gamma, Electron Beam and Ultraviolet Radiation on the Control of Storage Rot and the Quality of Walla Walla Onions." Submitted to the Journal of Food Science for publication.

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28. "Reaction of Benzenediazonium-2-carboxylate with Reactor-Produced No-Carrier-Added ^{18}F-Fluoride: A Novel Synthesis of 2-[^{18}F]-Fluorobenzoic Acid." A.D. Strouphauer, C.L. Liotta, and R.W. Fink, Int. J. Appl. Radiat. and Isotopes (accepted and in press for early 1984); accepted for presentation at the Symposium on Chemical Considerations in the Labeling of Radiopharmaceuticals with Short-Lived Radionuclides at the American Chemical Society meeting, April, 1984, St. Louis, Missouri.

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35. "Production of 14 Plus or Minus 2 MeV Neutrons in a Reactor with an Enriched LiD Irradiation Capsule," C. Papanicolopoulos and R.W. Fink, Nucl. Instr. Meth., 151, 53 (1978).

36. "The K-Shell Conversion Coefficient of the 135.5 keV M4 Transition in ^{193m}Pt decay," A.I. Saleh, R.A. Braga, and R.W. Fink, Z. Physik A279, 27 (1976).

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38. "Trace Elements in Normal and Malignant Human Breast Tissue," A.E. Schwartz, G.W. Leddicotte, R.W. Fink, and E.W. Friedman, Surgery 76, 325 (1974).

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