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

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Under Contract No.

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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.
HIGHLIGHTS

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

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

The inventory of Co-60 sources at the Hot Cell Laboratory is 250,000 Ci. Dose rates of up to 1.0 $\times 10^7$ 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 \( \times 10^{14} \) 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\(_2\)O 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 #: DE-FG05-80ER10771

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 DeNeglio, 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 Owitt
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

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

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


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.

32. "Preparation of Reactor-Produced No-Carrier Added $^{18}$F-Fluoride and Its Use in the Synthesis of Labeled Organic Compounds of Interest in Radiopharmaceuticals (tentative title), R.W. Fink, to be presented as a review paper at the Int. Conf. on Nuclear and Radiochemistry, Lindau, West Germany, October, 1984 (tentative, pending travel grant from Georgia Tech Foundation."


