

# ANNUAL PROGRESS REPORT of the University of Florida Training Reactor

September 1, 1980–August 31, 1981



Engineering & Industrial Experiment Station  
Nuclear Facilities Division

DEPARTMENT OF NUCLEAR ENGINEERING SCIENCES  
COLLEGE OF ENGINEERING  
University of Florida  
Gainesville

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ANNUAL PROGRESS REPORT OF THE  
UNIVERSITY OF FLORIDA TRAINING REACTOR  
SEPTEMBER 1, 1980 - AUGUST 31, 1981

Submitted to the  
Department of Energy  
Nuclear Regulatory Commission  
and  
University of Florida

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## I. INTRODUCTION

The University of Florida Training Reactor's overall utilization increased by almost 100% over the previous two years, with the facility utilization time returning to its historical level. The energy generation, however, is still quite below average output although significantly higher than last year.

An analysis of the facility utilization shows that essentially all of the increase is due to educational and training uses. The use by University of Florida Courses and Laboratories more than doubled over the previous year and four training programs were conducted for nuclear utilities (Florida Power Corporation and Louisiana Power & Light). Research utilization was essentially unchanged and remains at very low level.

The facility administration has been strengthened by the addition of a Reactor Supervisor, responding to the Director of Nuclear Facilities. The new Final Safety Analysis Report and Physical Security Plan for the UFTR were submitted to the NRC during this reporting period. It is expected that the reactor staff will be able to dedicate themselves to enhancing the facility utilization since the large administrative work load should decrease significantly with the FSAR and PSP submittals.

The UFTR continues to operate with an outstanding safety record and in full compliance with regulatory requirements. The reactor and associated facilities continue to maintain a high in-state visibility and strong industry relationship through its multiple educational and training programs.

## II. UNIVERSITY OF FLORIDA PERSONNEL ASSOCIATED WITH THE REACTOR

### A. Personnel Employed by the UFTR

N. J. Diaz - Professor and Director of Nuclear Facilities  
A. W. Marvin - Reactor Supervisor  
H. Gogun - Senior Reactor Operator (full-time)  
G. Fogle - Reactor Operator (full-time)  
M. Constable - Student Reactor Operator (1/2 time)  
S. Jaffe - Student Reactor Operator (1/3 time)

### B. Other Licensed Operators

G. R. Dalton - Professor and Senior Reactor Operator, Nuclear  
Engineering Sciences Department  
(License expired Feb., 1981, not renewed)

### C. Radiation Control Office

T. J. Bauer - Radiation Control Officer (Aug. 80 - May 81)  
H. G. Norton - Radiation Control Technician (Sept. 80-81)  
- Acting Radiation Control Officer (May 81 - Aug. 81)  
G. R. Renshaw - Radiation Control Technician  
G. McCranie - Radiation Control Technician  
W. Coughlin - Nuclear Technician (1/2 time)  
D. Coffee - Nuclear Technician (1/4 time)  
A. Johnson - Nuclear Technician (1/4 time)  
M. Grote - Nuclear Technician (1/4 time)  
B. McCully - Nuclear Technician (1/4 time)

### D. Reactor Safety Review Subcommittee

G. R. Dalton - Chairman  
N. J. Diaz - Member  
A. M. Jacobs - Member  
M. J. Ohanian - Member  
W. E. Bolch - Member  
T. Bauer - Member (Aug. 80 - May 81)  
H. G. Norton - Member (May 81 - Aug. 81)

E. Line Responsibility for the UFTR Administration

- R. Q. Marston - President, University of Florida
- W. H. Chen - Dean, College of Engineering
- A. M. Jacobs - Chairman, Department of Nuclear Engineering Sciences
- N. J. Diaz - Director of Nuclear Facilities
- A. W. Marvin - Reactor Supervisor

F. Line Responsibility for the Radiation Control Office

- R. Q. Marston - President, University of Florida
- W. E. Elmore - Vice President, Administrative Affairs
- B. G. Dunavant - Director, Environmental Health and Safety
- T. J. Bauer - Radiation Control Officer (until May 81)
- H. G. Norton - Radiation Control Officer (from May 81)

### III. FACILITY OPERATION

The UFTR experienced a doubling of its overall utilization when compared to the last two years of use. The change is attributed to increases in UF course work and industry educational and training programs.

Research programs and irradiations continue to be at minimal levels. It is expected that the decision to develop the Nuclear Activation Analysis program will improve both research and commercial irradiation utilization.

The level of administrative work dedicated to regulatory activities should be reduced to a more manageable effort this upcoming year. The facility should receive its new operating license in the very near future since all regulatory requirements have been satisfied.

Shown in Table I is a summary of the reactor utilization for this reporting period. The list categorizes the twenty-six different research projects, teaching and training activities. The total reactor run-time was about 604 hours and the experiments used over 890 hours of facility time.

Table II summarizes the different categories of reactor utilization: university teaching, research and UFTR operator's training and requalification, commercial utilization (utility training program), testing and surveillance, and demonstrations. The research utilization consisted of four projects using about 65 hours of reactor run-time. The teaching and training use doubled from the level of the previous two years.

Detailed in Table III are the monthly and total energy generation, as well as the hours at full-power per month and total this year. The UFTR generated 15.2 Mw-hrs during this period.

Described in Table IV are the reasons and dates for unscheduled shutdowns for the reporting period. No reportable incident occurred during this year.

No uncontrolled releases of radioactivity have occurred from the facility and controlled releases are well within established limits. The personnel radiation doses were minimal and averaged well under 3% of the allowable dose. Environmental radioactivity surveillance continues to show no detectable off-site dose from the facility.



TABLE I  
SUMMARY OF FACILITY UTILIZATION  
(September 1980 - August 1981)

NOTE: The projects marked with a \* indicate irradiations or neutron activations. The projects marked with an \*\* indicate training use. The projects marked with a \*\*\* indicate demonstrations of reactor operations. "Utilization Time" is total time that the facility dedicates to a particular use, it includes "Run Time." "Run Time" is inclusive time from reactor startup to shutdown.

PROJECT AND USER	TYPE OF ACTIVITY	UTILIZATION TIME (hours)	RUN TIME (hours)
*** ENU 3002 - Dr. J. Wethington	Operation Demonstration	3.34	2.3
*** ENU 4104 - Dr. H. Campbell	Introduction to Nuclear Engineering II	1.83	0.58
** ENU 4505 - Dr. W. Ellis	Engineering Lab	29.42	20.89
** ENU 4612/5615 - Dr. W. Ellis	Instrument lecture and Reactor Operations	6.69	2.46
** ENU 4905 - Dr. N. Diaz	Reactor Operations Course	101.05	60.31
*** ENU 5005 - Dr. J. Wethington	Operation Demonstration	1.00	.42
** ENU 5176 - Dr. N. Diaz H. Gogun Reactor Staff	Reactor Operations Course	95.69	62.34
** ENU 6516L - Dr. W. Vernetson	Danger Coefficient Experiment, Determination of Resonance Integral	6.13	5.17
* ENU 6515L - Dr. W. Ellis	NAA of Foils, Delayed Neutron Studies, Angular Correlation Analysis	11.79	6.36
* Dr. G. Roessler	NAA of Pottery Samples and Standards	47.03	38.98
* Dr. G. Roessler	NAA of Biological Samples	1.73	.95
* Dr. H. Plendl, F.S.U.	Neutron Irradiation of Crystals	17.03	12.95
* Dr. W. Ellis, Dr. W. M. Goldberg, (F.I.U.)	NAA of Biological Samples	12.04	11.42
ENV 6932 - Dr. B. Dunavant	Area Monitor Calibration	1.55	
ENV 6932 - Dr. B. Dunavant	Area Surveys	2.50	2.50
*** ENU 4201 - Dr. G. Roessler T. Bauer	Reactor Lecture Radioisotopes Technology Short Course	1.00 1.00	 0.5

PROJECT AND USER	TYPE OF ACTIVITY	UTILIZATION TIME (hours)	RUN TIME (hours)
** T. Bauer	Basic Radiological Health Short Course	4.00	
** T. Bauer	Radiation Short Course Operational Demonstration	1.00	1.00
** Louisiana Power & Light Co. Dr. N. Diaz and Reactor Staff	NRC License Training	221.38	171.47
** Florida Power Corporation, Dr. N. Diaz and Reactor Staff	NRC License Training	125.9	99.64
** Florida Power Corporation Dr. N. Diaz and Reactor Staff	STA Training Program	50.03	37.33
M. McCoy, G. Fogle, H. Gogun	Argon 41 Measurements	9.53	9.3
H. Gogun, G. Fogle, S. Jaffe, M. Constable	UFTR Testing and Calibration	7.56	6.72
** Reactor Operators	NRC Requalification Training Requirements	10.15	2.53
** H. Gogun, G. Fogle, Operator Training	Training Operators for NRC License on UFTR	98.76	43.82
*** Reactor Tours and Demonstrations	Orientation, Lectures and Operation Demonstrations	<u>20.86</u>	<u>3.71</u>
	TOTAL	<u>889.99</u>	<u>603.65</u>

TABLE II  
UFTR UTILIZATION SUMMARY

	<u>Utilization Time</u> (hours)	<u>Run Time</u> (hours)
UF Courses and Laboratories	267.99	164.83
Research Activities	77.83	64.3
UFTR Operator Training and Requalification	108.91	46.35
UFTR Testing and Surveillance*	17.09	16.02
Commercial Utilization (Utility Operator and STA training)	397.31	308.44
Reactor Tours and Demonstrations	<u>20.86</u>	<u>3.71</u>
TOTAL	<u>889.99</u>	<u>603.65</u>

\*Console checkouts excluded.

TABLE III  
MONTHLY REACTOR ENERGY GENERATION

<u>Monthly Totals</u>	<u>Kw-Hrs</u>	<u>Hours at Full Power</u>
September 1980	804.77	7.25
October 1980	696.95	6.93
November 1980	390.51	3.93
December 1980	73.86	0.7
January 1981	196.75	1.97
February 1981	730.26	3.97
March 1981	942.04	8.3
April 1981	1,360.34	11.62
May 1981	2,608.46	22.63
June 1981	5,949.32	57.12
July 1981	1,263.98	12.63
August 1981	<u>183.39</u>	<u>1.83</u>
TOTAL	<u>15,200.63</u>	<u>138.88</u>

TABLE IV  
UNSCHEDULED SCRAMS

<u>Date</u>	<u>Occurrence</u>
October 28, 1980	Electrical Transient
December 2, 1980	Operation of FM Transmitter in Control Room Caused Low Flow Scram.
February 19, 1981	Operator Error. Inadvertently Interrupted Console Power.
June 17, 1981	Power Failure
June 27, 1981	High Voltage Power Supply Failure.
July 13, 1981	Power Failure
July 16, 1981	Electrical Transient

IV. MODIFICATIONS TO THE OPERATING CHARACTERISTICS OR CAPABILITIES OF THE UFTR

No significant modifications to the operating characteristics were done during the reporting period.

## V. SIGNIFICANT MAINTENANCE AND TEST OF REACTOR SYSTEMS

<u>Date</u>	<u>Description</u>
4 September, 1980	Changed ceramic filter in shield tank recirculating system
11 September, 1980	Reactor cell overhead lamps replaced
16 September, 1980	Replaced 6 volt battery in 12 volt power supply on Radiation Monitoring System
22 September, 1980	Replaced demineralizer cartridge in shield tank recirculating system
23 September, 1980	S-4 measurement of Stack Ar <sup>41</sup> concentration
24 September, 1980	A-1 measurement of stack flow rate
26 September, 1980	Filled south wall trench with concrete and capped three inch through-pipe
29 September, 1980	S-1 measurement of blade drop times
6 October, 1980	Changed resin in portable demineralizer
20 October, 1980	Replaced well pump fuses
27 October, 1980	Q-1 quarterly scram checks
29 October, 1980	S-2 blade worth measurements
30 October, 1980	Replaced batteries in security system control unit
20 November, 1980	S-4 determination of Ar <sup>41</sup> in stack effluent
26 November, 1980	Q-2 area monitors calibration check
26 November, 1980	Replaced V-belts on diluting fan
1 December, 1980	Completed replacement of city water piping in reactor building
10 December, 1980	Adjusted pipe hangers
12 December, 1980	Q-3 Evacuation Drill

<u>Date</u>	<u>Description</u>
12 December, 1980	Replaced shield tank recirculating pump power plug
17 December, 1980	Portal monitor relocated outside of air lock. Two pen recorder modified for installation of source monitor alarm.
5 January, 1981	Made up to primary coolant tank.
28 January, 1981	Made up to shield tank
28 January, 1981	Q-1 Quarterly scram checks
17 February, 1981	Q-2 Area Monitor calibration checks
17 February, 1981	Completed fuel pit monitoring system
1 March, 1981	Replaced nixie board on Safety #3
3 March, 1981	Replaced 60 amp fuse on well pump
5 March, 1981	North Area Monitor recorder failed. Cleaned electrical contacts.
6 March, 1981	Replaced ink pads on temperature recorder
7 March, 1981	Replaced motor bearings on APD, overhauled air pump
11 March, 1981	Replaced 60 amp well pump fuses
11 March, 1981	Replaced chart platen drive belt on 2 pen nuclear recorder
16 March, 1981	Replaced 4 magnetic clutch indicating lamps
23 March, 1981	S-1 Control blade drop time measurement
24 March, 1981	Replaced air conditioning system filters
27 March, 1981	Q-3 Radiological Emergency Drill
30 March, 1981	Replaced and relocated sensing lines for vent flow monitoring
9 April, 1981	Replaced Rupture Disk
9 April, 1981	Replaced the vacuum tubes in temperature recorder
20 April, 1981	A-1 Calibration of nuclear instruments and calorimetric heat balance



<u>Date</u>	<u>Description</u>
29 April, 1981	Q-1 Scram checks
29 April, 1981	Q-2 Area monitor calibration checks
11 May, 1981	S-2 Reactivity check of control blades
15 May, 1981	Changed resins in portable demineralizer
23 May, 1981	Adjusted striker on East area monitor recorder
2 June, 1981	Cleaned area monitor meter faces
22 June, 1981	Cleaned electrical contacts on North area monitor connections
23 June, 1981	Replaced Rupture Disk
27 June, 1981	Replaced Safety Channel #2 high voltage power supply
1 July, 1981	Installed training scram control
6 July, 1981	Removed training scram control
8 July, 1981	Repaired nuclear recorder
15 July, 1981	Changed batteries in security system control unit
16 July, 1981	Made up to shield tank
21 July, 1981	Repaired motor in nuclear recorder
21 July, 1981	Q-2 Area monitor calibration check
28 July, 1981	Q-1 Quarterly scram checks
31 July, 1981	Q-3 Emergency Drill
3 August, 1981	Performed maintenance on nuclear recorder
14 August, 1981	Repaired APD chart drive motor
27 August, 1981	Replaced ceramic filter in shield water system

## VI. CHANGES TO TECHNICAL SPECIFICATIONS AND STANDARD OPERATING PROCEDURES

- A. There were no changes to the Technical Specifications during this reporting period.
- B. Revisions to Standard Operating Procedures
1. UFTR-SOP-A.2 - Reactor Startup
    - a. Page 1 Rev. 7, 9/81
    - b. Page 2 Rev. 7, 9/81
    - c. Page 3 Rev. 7, 9/81
    - d. Page 4 Rev. 7, 9/81
    - e. Page 5 Rev. 7, 9/81
    - f. Page 6 Rev. 7, 9/81
  2. UFTR-SOP-A.3 - Reactor Operation at Power
    - a. Page 1 Rev. 6, 10/80
    - b. Page 3 Rev. 7, 9/81
    - c. Page 4 Rev. 7, 9/81
  3. UFTR-SOP-A.4 - Normal Reactor Shutdown
    - a. Page 1 Rev. 6, 9/81
  4. UFTR-SOP-A.6 - Operation of Secondary Water System
    - a. Page 1 Orig., 9/81
    - b. Page 2 Orig., 9/81
  5. UFTR-SOP-D.2 - Radiation Work Permits
    - a. Page 1 Rev. 7, 8/81

## VII. RADIOACTIVE RELEASES AND ENVIRONMENTAL SURVEILLANCE

A. Gaseous (Argon-41)

<u>Month</u>	<u>μCi Released</u>	<u>Concentration</u>
September 1980	$3.5 \times 10^6$ μCi/Mon	$5.6 \times 10^{-12}$ μCi/ML
October 1980	$3.1 \times 10^6$ "	$4.8 \times 10^{-9}$ "
November 1980	$1.74 \times 10^6$ "	$2.7 \times 10^{-10}$ "
December 1980	$3.29 \times 10^5$ "	$5.16 \times 10^{-11}$ "
January 1981	$8.57 \times 10^5$ "	$1.38 \times 10^{-10}$ "
February 1981	$3.2 \times 10^6$ "	$5.1 \times 10^{-10}$ "
March 1981	$4.2 \times 10^6$ "	$6.58 \times 10^{-10}$ "
April 1981	$6.06 \times 10^6$ "	$9.5 \times 10^{-10}$ "
May 1981	$1.16 \times 10^7$ "	$1.82 \times 10^{-9}$ "
June 1981	$2.72 \times 10^7$ "	$4.26 \times 10^{-9}$ "
July 1981	$5.63 \times 10^6$ "	$8.84 \times 10^{-10}$ "
August 1981	$8.17 \times 10^5$ "	$1.28 \times 10^{-10}$ "

TOTAL ARGON-41 RELEASED = 68.23 Ci

## B. Liquid Waste From The UFTR/Nuclear Sciences Complex\*

There were 1,060,000 liters discharged to the campus sanitary sewage system during this reporting period.

<u>Month</u>	<u>μCi/mlβ</u>
September 1980	NDA**
November 1980	NDA
December 1980	NDA
January 1981	$2 \times 10^{-8}$

<u>Month</u>	<u>μCi/mlB</u>
February 1981	NDA
April 1981	NDA
July 1981	NDA
August 1981	NDA

\*The effluent discharged into the holding tanks comes from twenty laboratories within the Nuclear Sciences Center as well as the UFTR complex.

\*\*NDA - No detectable activity, MDA =  $2.4 \times 10^{-9}$  μCi/ml

The UFTR normally releases approximately 1.5 liters of primary coolant per week to the holding tank due to waste from primary sampling. The average activity for this coolant was  $2.85 \times 10^{-8}$  μCi/ml for the reporting period.

There were two releases of primary coolant to the holdup tank during the reporting period. The first, on April 9, 1981, was approximately 55 liters at  $1.35 \times 10^{-7}$  μCi/ml. The second, on June 23, 1981, was approximately 77 liters at  $4.65 \times 10^{-6}$  μCi/ml. This activity was diluted and decayed to a level of NDA before release to the environment.

### C.

#### Environmental Monitoring.

The UFTR maintains film badge monitoring in areas adjacent to the UFTR complex. The following are the total for this reporting period, September 1980 through August 1981.

Badge Location	Total Exposure
A1	130
A2	50
A3	10
A4	M*
A5	70
A6	60
A7	10

\*Minimal

D.

## Personnel Radiation Exposure

The following is a list of any personnel exposures greater than minimum detectable during the reporting period.

October, 1980

N. Diaz	20 mrem
G. Fogle	20 mrem
H. Gogun	20 mrem
M. Constable	20 mrem

May, 1981

A. Marvin	40 mrem
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June, 1981

A. Marvin	10 mrem
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July, 1981

A. Marvin	30 mrem
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Dosimeter exposure measurements for visitors to the UFTR were all less than 5 mrem for this reporting period.

## VIII. EDUCATION, RESEARCH, AND TRAINING UTILIZATION

Note: The participating students are indicated with an \*. Other participants are faculty or staff members of the University of Florida, unless specifically designated otherwise. A \*\* indicates those students working on theses or dissertations.

1. NAA Research - U<sup>238</sup> and Th<sup>232</sup> Dating, Dr. G.S. Roessler

Epithermal irradiations were used for identification of U<sup>238</sup> and Th<sup>232</sup> in an archaeological sample. The levels of U and Th were then used to determine self-irradiation of the sample, which was then dated by thermoluminescent technique.

2. NAA Research - Dr. G.S. Roessler, L. Ewald\*, P. Salas\*

Short irradiation schemes were explored for use in biological samples, especially tissue in which murine melanoma had been introduced. The overall effort is aimed at identifying differences in normal and cancerous tissue.

3. NAA Research - Neutron induced crystal lattice disturbances - Dr. Hans Plendl, Mr. Peter Gidisse (Florida State University)

Samples of  $Al_2(SiO_4)(OH)$  were subjected to a wide range of neutron fluences. The lattice disturbances caused by thermal and epithermal neutrons were compared to those caused by x-rays by observing changes in optical properties.

4. NAA Research - Dr. W. Goldberg (FIU), Dr. W.H. Ellis (UF)

Biological samples and standards were activated and analysed for a study of parasitism of Florida coral.

5. LPL Reactor Operations Training Program - Dr. N.J. Diaz, Dr. W.G. Vernetson, Dr. E.T. Dugan, Reactor Staff

Cold license candidates for Louisiana Power and Light's Waterford Nuclear Power Plant spent three weeks operating the UFTR. This fulfills a federal requirement for a Reactor Operator's license.

6. UFTR Operator Training and Requalification - Dr. N.J. Diaz, H. Gogun

Lectures and hands-on operations on the reactor are necessary to license operators for the UFTR. The requalification programs established a required number of startups, weekly checks, daily checks, drills, and lectures for each operator to participate in to maintain proficiency.

7. FPC Shift Technical Advisor Training Program - Dr. N.J. Diaz, Dr. W.G. Vernetson, Dr. E.T. Dugan

Shift Technical Advisor from Florida Power Corporation's Crystal River Nuclear Plant spent three weeks performing hands-on operations at the UFTR. These operations are part of a one year STA educational program conducted by the University of Florida which exceeds INPO guidelines for Shift Technical Advisors.

8. Reactor Operations Demonstrations

<u>Course</u>	<u>Instructor</u>
ENU 3002	Dr. J.A. Wethington
ENU 4104	Dr. H.D. Campbell
ENU 4612/5615	Dr. W.H. Ellis
ENU 5005	Dr. J.A. Wethington

9. Nuclear Engineering Laboratory II (ENU 6516) - Dr. W.H. Ellis, Dr. W.G. Vernetson

ENU 6516 is the main laboratory course for Nuclear Engineering graduate students. It involves radiation and reactor measurements.

10. Nuclear Engineering Laboratory I (ENU 4505) - Dr. W.H. Ellis

ENU 4505 is the nuclear engineering laboratory for undergraduate students in Nuclear Engineering Sciences. The UFTR is used for a variety of exercises and experiments, including radiation dose measurements, measurement of induced radioactivity and reactor physics and operational measurements.

11. Reactor Operations Laboratory (ENU 4905 and ENU 5176) - Dr. N.J. Diaz and Reactor Staff

Students of The Reactor Operations Course (Spring '81) and The Reactor Operations Lab (Winter '81) spend 2-3 hours weekly at the controls of The UFTR performing reactor operations under supervision of licensed reactor operators. The lab encompasses training in reactivity manipulations, reactor checkouts, operating procedures, standard operations and all applicable regulations.



IX. THESES, PUBLICATIONS, REPORTS AND ORAL PRESENTATIONS  
OF WORK RELATED TO THE USE AND OPERATION OF THE UFTR

1. "INAA-PIXE Trace Element Analysis of Biological Tissues," Atlanta Meeting, American Chemical Society, March 31, 1981. W.H. Ellis, G.S. Roessler, J.W. Swanson, H. Van Rinsvelt, M.D. Williams.
2. "Trace Elements and Cancer," ANS International Meeting, June, 1981. G.S. Roessler, J.W. Swanson, W.H. Ellis, H. Van Rinsvelt, M.D. Williams.