DISCLAIMER

UNIVERSITY OF MISSOURI-ROLLA REACTOR SHARING PROGRAM

ANNUAL REPORT

Submitted to The Department of Energy

2001-2002

Grant No. DE-FG0295NE38124

University of Missouri-Rolla
Nuclear Reactor Facility
1870 Miner Circle
Rolla, MO 65409-0630

1.0 Introduction

The Reactor Sharing Program at the University of Missouri-Rolla Reactor is an active program that provides services to a large number of institutions throughout the Central Missouri area. A wide variety of Reactor Sharing activities are offered including tours, preplanned reactor laboratory sessions, and individual research projects. A large number of users participate in our program annually.

Costs incurred by our facility for Reactor Sharing activities during this reporting period totaled $38,167.45 while the Reactor Sharing grant awarded for this period was $12,000. This figure does not reflect our self-supported reactor trainee program (13 trainees), an increase in lab course commitments and temporary shortage of staff.

Over 1,258 students from greater than 17 institutions participated in Reactor Sharing Laboratory "Sessions", in which concepts and demonstrations related to radiation, radiation monitoring, nuclear energy and nuclear engineering. Among them, 23 students and faculty from 3 colleges participated in detailed laboratory sessions covering topics mentioned above. Detailed information summarizing the year's activities in the format requested in the grant application is provided in Appendix A. We expect this number to increase for the upcoming year. There were a total of 2,171 people that visited the reactor during this period.

Since April 2002, we have hosted a Nuclear Engineering Camp for 70 high-school students, and four training sessions for the United States Army radiological school located in Fort Leonard Wood, Missouri. This fall we are hosting 2 Missouri high-school students projects on radiation effects on various opto-electronic components.

2.0 Recent Improvements in the UMRR Reactor Sharing Program

The UMRR Reactor Sharing Program is continually being re-evaluated and reinvented. Five separate educational units, called "Reactor Sharing Sessions", have been developed, each presenting a 1 to 2 hour laboratory course on different aspects of nuclear engineering and science. The session topics are as follows:

1. Radioisotope Decay and Half-Life Determination
2. Neutron Activation Analysis
3. Reactor Systems and Operations
4. Radiation Shielding
5. Reactor Experiments

Educational outlines and teaching materials such as handouts and electronic presentations have been produced in order to facilitate the laboratory sessions. We are also incrementally producing electronic materials that can be accessed via Internet. The Sessions concept has greatly improved the quality of our laboratory presentations and content. New ideas and student feedback are being used to modify the sessions to maximize their impact and to adjust the scope of material presented. Our small facility staff are, committed to and recognize the importance of our educational and training mission.

We also offer individual research science projects in several areas. Some of the recent individual research projects have focused on the following areas of study:

Radiation resistance of opto-electronic components and devices
Characterization of Aluminum Uptake from Soil in Vegetables Using NAA
Characterization of Aluminum Absorption in Foodstuffs Using NAA
Development of Shielding Bricks using Lead Mine Tailings
Measuring Cerenkov Radiation with Fiber Optics
Temperature Stratification of the Pool and Heat Balance
Determination of Aluminum in Urine (NAA) as an Indicator for Alzheimer Disease
Determination of Iron Content in Various Cereals Using NAA
Determination of Aluminum in Various Chicken Foodstuffs Using NAA
Effects of Gamma Irradiation on Vitamin C Degradation in Various Fruit Juices
Effects of Gamma Irradiation on Bean Seeds over Successive Generations

Another area of strength in our reactor Sharing Program is in our solicitation process to potential user institutions. This year we targeted 225 high schools and colleges from as far away as 150 miles.

The feedback received has been very good. We regularly distribute questionnaires to solicit feedback. Students and instructors alike have commented on how informative and interesting our sessions were.

3.0 Summary

The Reactor Sharing Program at UMRR is a program that actively seeks to extend its educational and training outreach regarding nuclear engineering, science and technology. Under this grant period, 272 persons from 18 institutions participated. There were 287 UMR students that utilized the reactor during this period.

Under the Reactor Sharing Program, the UMR Reactor is made available to a large number of Universities and high schools throughout the Central Missouri area. We are the undergraduate nuclear engineering education focal point for the surrounding states who do not have such programs in their university systems. For the high schools who interact with us, we try to enhance the science curricula of the participating schools by providing both the facilities and the associated expertise to present "hands-on" laboratory sessions on fundamentals of nuclear engineering sciences. Additionally, tours provide many students with the unique opportunity to see an actual operating reactor and the opportunity to discuss concerns related to nuclear energy. We consider ourselves privileged to be able to offer this service. We recognized that the high school students who are in the process of selecting a college and a major are especially attuned to the experiences that we provide.

We would like to thank DOE for their financial support that makes this program possible. We will be requesting an increase in funding under next year's proposal so that we may continue at the high level of activity achieved during this reporting period.

APPENDIX A.

ANNUAL REACTOR SHARING REPORT

FOR 2001-2002 IN REQUESTED FORMAT

REACTOR SHARING PROGRAM 2000/2001 ANNUAL REPORT

University:	University of Missouri	**Location:**	Rolla, Missouri
Program Director:	Dr. Akira T. Tokuhiro	**Telephone:**	573/341-4236
Reactor Manager:	William E. Bonzer		

Grant Number: DE-FG02-95NE38124

Reactor Type/Power Level: Pool/200 kW

Participating Institutions:

Institution	Principal Investigator	Number of Persons	Cost
Southwest Missouri State University	Dr. Robert Mayonavic	6	$750.00

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. The principles of Neutron Activation Analysis were then explained. The students irradiated a vitamin sample and identified the gamma peaks. Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
Waynesville High School	Michelle Hill	40	$740.00

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
Waynesville High School	Christaine Domhoefer	33	$315.00

Description of Program:

Students were given a tour of the Facility Only

Institution	Principal Investigator	Number of Persons	Cost
Pleasant Hope High School	Lori Whitlock	30	$165.00

Description of Program:

Students given a tour of the Faculty Only.

Institution	Principal Investigator	Number of Persons	Cost
Parkway West High School	Ellen Wilke	22	$257.50

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations. Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
Licking High School	Barry Reynolds	10	$423.50

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations. Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction.

Institution	Principal Investigator	Number of Persons	Cost
Central High School Springfield		30	$502.50

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations. Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
Steelville High School	Charles Hawkins	21	$427.50

Description of Program:
Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations. Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
Pleasant Hope High School	Admissions Arranged	14	$397.50

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations.
Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction.

Institution	Principal Investigator	Number of Persons	Cost
Ash Grove High School	Admissions Arranged	13	$472.50

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations. Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction.

Institution	Principal Investigator	Number of Persons	Cost
Hazelwood West High School	John Schmogee Carl Herman	36	$612.50

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations. Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction.

Institution	Principal Investigator	Number of Persons	Cost
Parkway West	Ellen Wilke	21	$670.00

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. The principles of Neutron Activation Analysis were then explained.

Institution	Principal Investigator	Number of Persons	Cost
Fairgrove High School	Admissions	26	$35.50

Description of Program:

Students given a tour of the Facility Only.

Institution	Principal Investigator	Number of Persons	Cost
East Central College	Laura Deason	10	$605.50

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
NE Camp	Dr. Kumar	35	$1,130.00

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. The principles of Neutron Activation Analysis were then explained.

Institution	Principal Investigator	Number of Persons	Cost
Fort Wood	Walter McCluskey	25	$625.00

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
NE Camp	Dr. Kumar	35	$1,180.00

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. The principles of Neutron Activation Analysis were then explained.

Institution	Principal Investigator	Number of Persons	Cost
NE Camp	Dr. Kumar	35	$865.00

Description of Program:

Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
Altec Academy	Cindy Bolon	40	$482.50

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations.
Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction.

Institution	Principal Investigator	Number of Persons	Cost
Jackling 1	Dr. Kumar	40	$340.00

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations.

Institution	Principal Investigator	Number of Persons	Cost
Jackling	Dr. Tokuhiro	40	$340.00

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations.

Institution	Principal Investigator	Persons	Cost
Bear River	Lori Martin	20	$282.50

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations. Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction.

Institution	Principal Investigator	Number of Persons	Cost
Jackling Program	Dr. Tokuhiro	35	$440.00

Description of Program:

Students given a "Blue Glow" tour of reactor with emphasis on reactor systems and operations.

Institution	Principal Investigator	Number of Persons	Cost
Fort Wood	Walter McCluskey	15	$527.50

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
ANS Teachers work shop	Dr. Tokuhiro	10	$2,632.50

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically. Basic reactor operations were explained including the fission chain reaction. Students were provided with a "blue-glow" tour of the facility. Training with radiation meters, shielding.

Institution	Principal Investigator	Number of Persons	Cost
Kevin Johnson	High School Project	1	$3,460.00

Description of Program:

Individual Project.

Institution	Principal Investigator	Number of Persons	Cost
	Justin Munson	1	$2,255.00

Description of Program:

High School Project

Institution	Principal Investigator	Number of Persons	Cost
	Dustin Milke	1	$2,175.00

Description of Program:

High School Project

Institution	Principal Investigator	Number of Persons	Cost
	Alfred Schovanez	1	$2,090.00

Description of Program:

High School Project

Institution	Principal Investigator	Number of Persons	Cost
Preview UMR Admissions	Admissions	18	$175.00

Description of Program:

Tour of the facility only

Institution	Principal Investigator	Number of Persons	Cost
Preview UMR Admissions	Admissions	28	$637.50

Description of Program:

Tour of the facility only

Institution	Principal Investigator	Number of Persons	Cost
Preview	Admissions	32	$322.50

Description of Program:

Tour of the Facility only.

Institution	Principal Investigator	Number of Persons	Cost
Introduction to Engineering		70	$435.00

Description of Program:

Tour of the Facility only.

Institution	Principal Investigator	Number of Persons	Cost
UMC NE 404-Lab	Dr. Robert Thompson	7	$1,610.00

Description of Program:

Calibration of control rods concept in bay. Calibration of the regulating rod. Shut down margin and excess reactivity concepts in bay. Measurement of core excess reactivity and shut down margin.

Institution	Principal Investigator	Number of Persons	Cost
UMR Family Day	Admissions	33	$570.00

Description of Program:

Tour of the Facility only.

Institution	Principal Investigator	Number of Persons	Cost
Miner Monday Open House	Admissions	3	$166.00

Description of Program:

Tour of the Facility only.

Institution	Principal Investigator	Number of Persons	Cost
MO. H.S. Teachers & Counselors	Jerry Bayless	8	$422.50

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed

Institution	Principal Investigator	Number of Persons	Cost
Boy Scouts		52	$562.50

Description of Program:

Students were provided with a "blue-glow" tour of the facility .

Institution	Principal Investigator	Number of Persons	Cost
Presidents Day Open House	Admissions	47	$840.00

Description of Program:

Tour of the Facility only.

Institution	Principal Investigator	Number of Persons	Cost
FLW Tour	Walter McCluskey	26	$508.25

Description of Program:

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed. Students plotted data and determined half-life graphically.

Institution	Principal Investigator	Number of Persons	Cost
NE Camp	Dr. Kumar	35	$640.00

Description of Program:

Students were provided with a "blue-glow" tour of the facility .

Institution	Principal Investigator	Number of Persons	Cost
NE Camp	Dr. Kumar	54	$1,265.00

Description of Program:

Students were provided with a "blue-glow" tour of the facility .

Institution	Principal Investigator	Number of Persons	Cost
Chemistry Academy	Cindy Bolen	24	$660.00

Description of Program

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed.

Institution	Principal Investigator	Number of Persons	Cost
Introduction to Engineering		42	$460.00

Description of Program

Students were provided with a "blue-glow" tour of the facility .

Institution	Principal Investigator	Number of Persons	Cost
Jackling I	Dr. Tokuhiro	42	$450.00

Description of Program

Students were provided with a "blue-glow" tour of the facility .

Institution	Principal Investigator	Number of Persons	Cost
Jackling I	Dr. Tokuhiro	44	$565.00

Description of Program

Students were provided with a "blue-glow" tour of the facility.

Institution	Principal Investigator	Number of Persons	Cost
Introduction to Engineering		12	$323.70

Description of Program

Radioactive decay and half-life were studied by irradiating an aluminum sample and counting it as it decayed.

Institution	Principal Investigator	Number of Persons	Cost
Preview	UMR Admissions	28	$745.00

Description of Program:

Tour of the Facility only.

Institution	Principal Investigator	Number of Persons	Cost
UMC NE 404	Dr. Robert Thompson	7	$1,610.00

Description of Program:

Axial flux profile of the core determined by irradiating a wire installed in a fuel element, proceeded by diagnosing the activity and mapping each one-inch segment of the wire. Temperature effects and power defect demonstrated with student performing power changes to higher powers.