

Final Report

for

U.S. Department of Energy Grant  
DE-FG02-95NE38118-5  
University Reactor Sharing Program

By

R.S. Bean  
School of Nuclear Engineering  
Purdue University  
West Lafayette, IN 47907-1290

Final Report for the Reporting Period: 30 AUG 1995 – 31 MAY 2001

DOE Patent Clearance Granted

MP Dvorscak

3-8-02

Mark P Dvorscak

Date

(630) 252-2393

E-mail: mark.dvorscak@ch.doe.gov

Office of Intellectual Property Law

DOE Chicago Operations Office

from CHO 3/25/02

### **DISCLAIMER**

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

## **DISCLAIMER**

**Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.**

**Reactor Sharing Program  
U. S. Department of Energy**

University:	Purdue University	Location:	West Lafayette, IN
Program Director:	R. S. Bean	Telephone #:	(765) 496-7897
Grant Number:	DE-FG02-95NE38118-5	Reactor Type:	MTR pool type

During the period from August 30, 1995 to May 31, 2001 Indiana high schools were invited to participate in the reactor sharing program at Purdue University. In 1995 approximately seventy local area high schools were contacted. In 2000, the mailing list was expanded to include over 228 Indiana high schools. They were sent an invitation letter addressed directly to the science teacher or science chair of the school. Any high school teacher who had previously participated was sent a personal invitation letter. Additionally, beginning in 2000, public service announcements were placed in three regional newspapers, and arrangements were made to attend the Indiana High School Science Teacher's convention in Indianapolis, IN, in February 2002. Each year, between two and twelve area high schools responded and participated in the reactor sharing program; occasionally a single high school would bring more than one class on separate days. Finally, beginning in 2000, groups were encouraged to alternatively participate in tours of the reactor facility if they could not commit an entire day to the program. These groups included University classes and clubs that expressed an interest in touring the reactor facility.

The program for the high schools involved over 6 hours of time spent either in the reactor room or the associated laboratories. Additional time was spent in set-up and take-down, in making arrangements, in preparing material for handouts, and in acquiring expendable laboratory supplies. The neutron activation program requires two staff members for 8 hours and a third for 2 hours to assist with reactor operations. The program for the tour groups consisted of a 30 to 45 minute talk and question session explaining the basics of reactor operation and the design of PUR-1. The groups then toured the reactor facility, for a total staff time of approximately one and one-half hours. One or two staff members were required, depending upon the size of the group. If special arrangements were made, the group was able to tour the reactor while operating and see the Cerenkov glow. Operational tours necessarily required additional staff support. Due to staffing limitations of the School of Nuclear Engineering, the Purdue Student Chapter of the American Nuclear Society provided the additional personnel required for both the tour and neutron activation programs.

The arrangement with the Purdue University School of Health Sciences and The Department of Nuclear Pharmacy to use their larger teaching laboratory was very successful. Started in 2000, this arrangement allowed larger groups to either use the larger lab, or, more importantly, allowed us to borrow additional equipment to fit a larger than normal group into our own lab space. The size of classes allowed in our facility is the main limiting factor to high school participation, so this arrangement had a marked impact on the program. As an example, for the 200-2001 year six of the fourteen groups for the neutron activation activity either used the second lab or the borrowed equipment.

Additionally, a two week workshop was developed. A lesson plan was created to teach high school teachers about radiation and nuclear physics, and then have them perform laboratory experiments. Most of these experiments can be performed with a minimum of equipment and active material, allowing the teachers to incorporate them into public school classrooms. The workshop material encourages teachers to bring their classes to the University to perform those experiments (i.e. neutron activation) that require additional equipment and staff.

For the project reporting period, a total of 350 high school students participated in the neutron activation experiment, and 484 high school and University students, and members of the general public participated in reactor tours.

Specific reactor sharing projects during the total project reporting period of 30 AUG 1995 through 31 MAY 2001 were:

<b>Participating Institution 1995-1996</b>	<b>Principal Investigator</b>	<b>Number of Students/Faculty</b>	<b>Description of Project/Program Involved</b>
03 May 1996 Chesterton High School Chesterton, IN	William Bailey	8/1	Neutron Activation
10 May 1996 Rockville High School Rockville, IN	Russell Campbell	13/1	Neutron Activation

<b>Participating Institution 1996-1997</b>	<b>Principal Investigator</b>	<b>Number of Students/Faculty</b>	<b>Description of Project/Program Involved</b>
April 30, 1997 Peru High School Peru, IN	Richard Beeson	9/1	Neutron Activation
02 May 1997 Chesterton High School Chesterton, IN	William Bailey	8/1	Neutron Activation
09 May 1997 Rockville High School Rockville, IN	Russell Campbell	5/1	Neutron Activation
15 May 1997 Hobart High School Hobart, IN	Dave Sederburg	10/2	Neutron Activation

<b>Participating Institution 1997-1998</b>	<b>Principal Investigator</b>	<b>Number of Students/Faculty</b>	<b>Description of Project/Program Involved</b>
03 April 1998 Rockville High School Rockville, IN	Russell Campbell	7/1	Neutron Activation
14 April 1998 Plainfield High School Plainfield, IN	Ray Saxman	8/1	Neutron Activation
24 April 1998 Chesterton High School Chesterton, IN	William Bailey	8/1	Neutron Activation
12 May 1998 Western Boone High School Thorntown, IN	Michael Schlemmer	6/1	Neutron Activation
18 May 1998 North Putnam High School Roachdale, IN	Annette Maier	5/1	Neutron Activation
22 May 1998 Hobart High School Hobart, IN	Dave Sederburg	8/1	Neutron Activation

<b>Participating Institution 1998-1999</b>	<b>Principal Investigator</b>	<b>Number of Students/Faculty</b>	<b>Description of Project/Program Involved</b>
05 March 1999 Rockville High School Rockville, IN	Russell Campbell	8/1	Neutron Activation
09 April 1999 Frontier High School Brookston, IN	Julie Durr	7/1	Neutron Activation
23 April 1999 Frontier High School Brookston, IN	Julie Durr	8/1	Neutron Activation

<b>Participating Institution 1999-2000</b>	<b>Principal Investigator</b>	<b>Number of Students/Faculty</b>	<b>Description of Project/Program Involved</b>
17 March 2000 Rockville High School Rockville, IN	Campbell	6/1	Neutron Activation
24 March 2000 Zionsville High School Zionsville, IN	Testin	12/1	Neutron Activation
14 April 2000 Lebanon High School Lebanon, IN	Donnellson	12/1	Neutron Activation
21 April 2000 Western Boone High School Thornton, IN	Schlemmer	11/1	Neutron Activation
02 May 2000 Twin Lakes High School Monticello, IN	Thornberg	21/1	Neutron Activation
03 May 2000 Seeger High School West Lebanon, IN	Barry	8/1	Neutron Activation
20 March 2000 Benton Central High School Oxford, IN	Hover/Bean	54/3	Reactor Tour



<b>Participating Institution 2000-2001</b>	<b>Principal Investigator</b>	<b>Number of Students/Faculty</b>	<b>Description of Project/Program Involved</b>
16 March 2001 Mooresville High School Mooresville, IN	Zook	20/1	Neutron Activation
30 March 2001 Decatur Central High School Indianapolis, IN	Nickell	10/1	Neutron Activation
06 April 2001 Centerville High School Centerville, IN	Anderson	15/3	Neutron Activation
13 April 2001 Rockville High School Rockville, IN	Campbell	7/1	Neutron Activation
20 April 2001 Ben Davis High School Indianapolis, IN	York	14/1	Neutron Activation
27 April 2001 Arsenal Tech High School Indianapolis, IN	King	10/1	Neutron Activation
16 March 2001 Mooresville High School Mooresville, IN	Zook	20/1	Neutron Activation
30 March 2001 Decatur Central High School Indianapolis, IN	Nickell	10/1	Neutron Activation
06 April 2001 Centerville High School Centerville, IN	Anderson	15/3	Neutron Activation

13 April 2001 Rockville High School Rockville, IN	Campbell	7/1	Neutron Activation
20 April 2001 Ben Davis High School Indianapolis, IN	York	14/1	Neutron Activation
27 April 2001 Arsenal Tech High School Indianapolis, IN	King	10/1	Neutron Activation
01 May 2001 Zionsville High School Zionsville, IN	Berger	11/1	Neutron Activation
02 May 2001 Ben Davis High School, Indianapolis, IN	Jarosinki	15/1	Neutron Activation
04 May 2001 Western Boone High School Thorntown, IN	Schlemmer	6/1	Neutron Activation
08 May 2001 Cascade High School Clayton, IN	Smith	8/1	Neutron Activation
09 May 2001 Twin Lakes High School Monticello, IN	Thornberg	10/1	Neutron Activation
09 May 2001 Twin Lakes High School Monticello, IN	Thornberg	13/1	Neutron Activation
18 May 2001 West Lafayette High School West Lafayette, IN	VonWerder	13/1	Neutron Activation

21 May 2001 Zionsville High School Zionsville, IN	Testin	10/1	Neutron Activation
13 Sep 2000 NUCL 497A Intro to Energy Engineering Purdue University	Bean	27	Reactor Tour
28 Sep 2000 Nuclear Activities Week School of Nuclear Engineering Purdue University Public Tours	Bean	14	Reactor Tour
29 Sep 2000 ENGR 103 Freshman Engineering Lectures Purdue University	Bean	29	Reactor Tour
29 Sep 2000 ENGR 103 Freshman Engineering Lectures Purdue University	Bean	26	Reactor Tour
16 Oct 2000 ENGR 104 Freshman Engineering Small Group Purdue University	Bean	18	Reactor Tour
06 Oct 2000 ENGR 104 Freshman Engineering Small Group Purdue University	Bean	27	Reactor Tour

16 Oct 2000 ENGR 104 Freshman Engineering Small Group Purdue University	Bean	13	Reactor Tour
16 Oct 2000 ENGR 104 Freshman Engineering Small Group Purdue University	Bean	18	Reactor Tour
07 Dec 2000 Computer, Science, Math, and Engineering Students Purdue University	Wright/Bean	16/1	Reactor Tour with Operation
09 Feb 2001 NS 310 NROTC Training Class Purdue University	Bean	12	Reactor Tour
09 Feb 2001 NS 310 NROTC Training Class Purdue University	Bean	15	Reactor Tour
01 Mar 2001 Hilltop Apartments Residents Hilltop Apartment Complex West Lafayette, IN	Bean	8	Reactor Tour
22 Mar 2001 Harrison Hall Dormitory Residents Purdue University	Bean	7	Reactor Tour

26 Mar 2001 Society of Nuclear Pharmacy Purdue University Chapter Purdue University	Bean	13	Reactor Tour
06 Apr 2001 NUCL 120 Freshman Research Projects Purdue University	Bean	4	Reactor Tour
07 Apr 2001 EnVision Purdue University Engineering Activity Day Purdue University	Bean	120	Reactor Tour  (Note: 6 hours of tours for the public)
24 April 2001 Office of the Dean of Students Faculty and Staff Purdue University	Bean	13	Reactor Tour
25 Apr 2001 Youth Group Church of Jesus Christ of Latter-day Saints West Lafayette, IN	Bean	6	Reactor Tour
25 April 2001 NUCL 200 Introduction to Nuclear Engineering Course Purdue University	Bean	44	Reactor Tour

It should be noted that for the reactor tours, the principle investigator is listed as R. Bean, the person acting as the tour guide.

Totals for the project reporting period:

Reporting Year	Total Groups	Total Students for Neutron Activation	Total Instructors for Neutron Activation	Total Students for Reactor Tours
1995-1996	2	21	2	0
1996-1997	4	32	5	0
1997-1998	6	42	6	0
1998-1999	3	23	3	0
1999-2000	7	70	6	54
2000-2001	39	162	16	430
<b>Total</b>	<b>61</b>	<b>350</b>	<b>38</b>	<b>484</b>

Associated costs charged to the grant during the reporting period:

Reporting Year	Costs
1995-1996	\$4000.00
1996-1997	\$4000.00
1997-1998	\$5000.00
1998-1999	\$5000.00
1999-2000	\$5000.00
2000-2001	\$8000.00
<b>Total</b>	<b>\$31,000.00</b>