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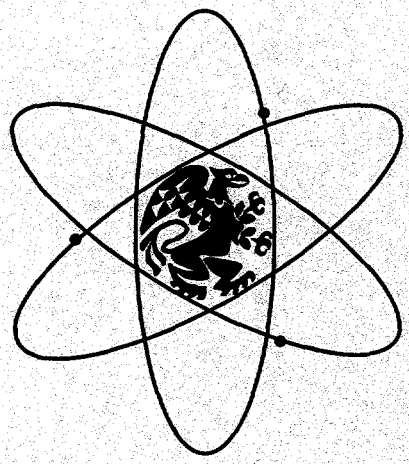

REED REACTOR FACILITY

ANNUAL REPORT

September 1, 1994 -- August 31, 1995

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EXECUTIVE SUMMARY

This report covers the period from September 1, 1994 to August 31, 1995. Information contained in this report is intended to fulfill several purposes including the reporting requirements of the U.S. Nuclear Regulatory Commission (USNRC), the U.S. Department of Energy (USDOE), and the Oregon Department of Energy (ODOE).

Highlights of the last year include:

- Student participation in the program is very high. The number of new licensed student operators more than replaced the number of graduating seniors. Seven Reed College seniors used the reactor as part of their thesis projects.
- The facility has been extraordinarily successful in obtaining donated equipment from Portland General Electric, U.S. Department of Energy, Precision Castparts, Tektronix, and other sources. Battelle (Pacific Northwest Laboratory) has been generous in lending valuable equipment to the college.
- The facility is developing more paid work. Income in the past academic year was much greater than the previous year, and next year should increase by even more. Additionally, the U.S. Department of Energy's Reactor-Use Sharing grant increased significantly this year.

There were 1115 visits of the Reactor Facility by individuals during the year. Most of these visitors were students in classes at Reed College or area universities, colleges, and high schools. Including tours and research conducted at the facility, the Reed Reactor Facility contributed to the educational programs of 12 colleges and universities in addition to 32 pre-college groups. Most of the reactor use by non-Reed personnel was conducted under the auspices of the Nuclear Science Consortium of the Willamette Valley, supported by a grant from the U.S. Department of Energy through the Reactor-Use Sharing Program.

During the year, the reactor was operated 225 separate times on 116 days. The total energy production was 24.6 MW-hours. The reactor staff consists of a Director, an Associate Director, a contract Health Physicist, and approximately fifteen Reed College undergraduate students as hourly employees.

All radiation exposures to individuals during this year were well below one percent of the federal limits. There were no releases of liquid radioactive material from the facility and airborne releases (primarily ^{41}Ar) were well within regulatory limits. No radioactive waste was shipped from the facility during this period.

INTRODUCTION

The Reed College Reactor Facility has been a resource for research and educational projects in the Portland area since its establishment in 1968. Cooperative programs between Reed and several public and private high schools, colleges, and universities in northwestern Oregon were established in 1970. These programs, fostered by the reactor staff, are an important part of the educational picture of the region. Partial funding from the U.S. Department of Energy's Reactor Use Sharing Program through the Nuclear Science Consortium of the Willamette Valley enables use of the reactor by educational institutions other than Reed.

The Reed College reactor is a TRIGA Mark I "swimming pool" reactor which uses zirconium hydride/uranium hydride fuel elements in a circular grid array. The uranium fuel is enriched to 19.9% in uranium-235. The reactor is situated near the bottom of a 25-foot-deep tank of water and is surrounded by a graphite reflector.

The Reed Reactor operates at various steady power levels. The reactor is brought up to a desired power level (up to the license ceiling of 250 kW-thermal) and is kept at that power until the experiment or irradiation is completed. This makes it possible to provide a defined neutron flux, as required for the experiment. This level is usually maintained for periods ranging from a few minutes up to eight hours. However, continued or repeated operation over several days can be arranged for long-term irradiations.

The main uses of the Reed Reactor Facility are instruction, research, and industry, especially, trace-element analysis. In addition to providing student research opportunities, the reactor staff has worked to educate the surrounding community on the principles of nuclear energy and radiation safety.

PERSONNEL

During the period from September 1994 through the present, the facility staff consisted of:

Director:	Stephen Frantz (4/94 – Present)
Associate Director:	Josh Filner (6/94 – Present)
Reactor Supervisor:	Kathy Reeves (6/95-Present) Phil Wilk (9/94 – 6/95)
Training Supervisor:	Chris Ghormley (6/95-Present) Aaron Mackey (9/94 – 6/95)
Radiation Safety Officer:	Cindy Savage (4/93 – Present)
Contract Health Physicist:	Marshall Parrott (8/91 - Present)
Assistant Health Physicist:	Traci Hilton (10/94 – Present) Aubin Whitley (9/94 – 10/94) Andy Funk (9/93 – 9/94)

Senior Reactor Operators:
Wendy Evans
Joshua Filner
Stephen Frantz
Chris Ghormley
Michael Pollock
Kathy Reeves

Reactor Operators:
Patricia Bennett
Juliet Browsing
Traci Hilton
Jimmy Huang
Noah Iliinsky
Chris Melhus
Aubin Whitley

Operators who held licenses during the period but who no longer have licenses:
Ernest Argetsinger
Justina Bolz
Andy Funk
Morning Howard
Aaron Mackey
Paul Terdal
Phil Wilk

Mr. Frantz has been Director since April 1994. Mr. Filner graduated from Reed in May 1994 and was hired as Associate Director in June of that year. Dr. Parrott works on contract to Reed College as Reactor Health Physicist. Ms. Savage is the Reed Campus Safety Officer. Dr. Brosing is a Professor of Physics at Pacific University. Mr. Pollock was the previous director of the reactor. All other staff members were Reed College undergraduates during the report period.

The Reed Reactor Facility has two oversight committees: the Radiation Safety Committee and the Reactor Operations Committee. The Radiation Safety Committee is concerned with emergency preparedness, health physics, radiation safety, physical security, environmental impact, and the interface between the Reed Reactor Facility and the Reed College Campus and the surrounding Community. The Reactor Operations Committee deals with the day-to-day operations of the reactor, reactor maintenance, reactor safety, and operator training, and requalification. The membership of the committees is shown below:

Radiation Safety Committee

Voting Members:

Curt Keedy (Chair) *(Chemistry Faculty, Lewis and Clark College)*
John Essick *(Physics Faculty, Reed College)*
Virginia Hancock *(Music Faculty, Reed College)*
Wayne Lei *(Portland General Electric)*
Jack Mahoney *(Neighborhood Resident)*
Cindy Savage *(Radiation Safety Officer, Reed College)*
George Toombs *(Radiation Control Section, Oregon State Health Division)*

Ex Officio:

Linda Mantel *(Dean of the Faculty, Reed College)*
Stephen Frantz *(Director, Reed Reactor Facility)*
Josh Filner *(Associate Director, Reed Reactor Facility)*
Marshall Parrott *(Contract Health Physicist)*
Phil Wilk *(Reactor Supervisor)*

Reactor Operations Committee

Voting Members:

Arthur Glasfeld (Chair) *(Chemistry Faculty, Reed College)*
Juliet Brosing *(Physics Faculty, Pacific University)*
Dan Gerrity *(Chemistry Faculty, Reed College)*
Bill Nicholson *(Portland General Electric)*
Michael Pollock *(Geology Faculty, Portland State University)*

Ex Officio:

Linda Mantel *(Dean of the Faculty, Reed College)*
Stephen Frantz *(Director, Reed Reactor Facility)*
Josh Filner *(Associate Director, Reed Reactor Facility)*
Marshall Parrott *(Contract Health Physicist)*
Phil Wilk *(Reactor Supervisor)*

FACILITIES

In addition to the reactor, the Reed Reactor Facility has associated space for a nuclear science lab although it is not currently in use. A floor plan appears as Figure 1.

The equipment available at the reactor facility uses a variety of instrumentation including gamma spectrometers (with HpGe and NaI detectors), surface barrier detectors, alpha spectrometers, SiLi X-ray detectors, gas flow proportional counters, ion chambers, beta counters, Geiger-Müller tubes and TLD readers. The instruments are used for experiments in basic nuclear science and radiation detection. New hand and shoe monitors have been installed in the reactor bay and the lab in the chemistry building. A liquid scintillation detector is available in the chemistry department and serves the campus radioisotope committee.

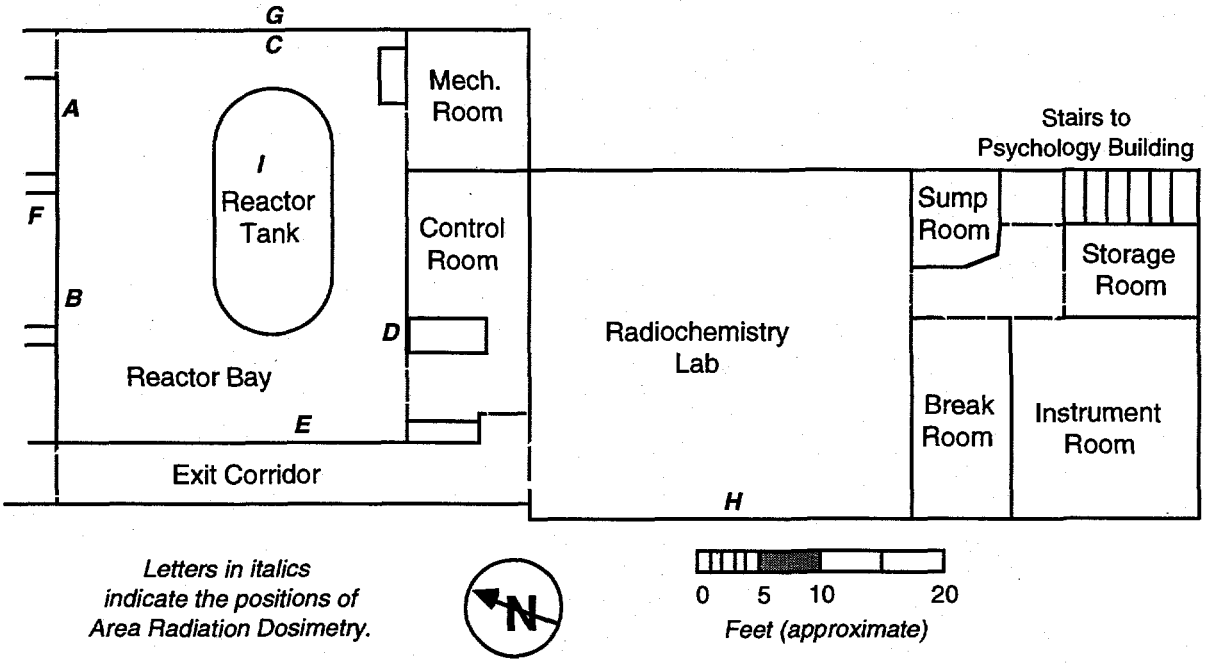

Figure 1 - Reed Reactor Facility Floor Plan

The reactor facility has several special facilities for performing irradiations. They are described below.

Pneumatic Transfer System

The pneumatic transfer system consists of an irradiation chamber in the outer ring of the core with its associated pump and piping. This allows samples to be transferred in and out of the reactor core very rapidly, while the reactor is at power. It is not currently in use.

Routine use of the pneumatic transfer system involves placing samples into vials, which in turn are placed in special capsules known as "rabbits." The capsule is loaded into the system in the radiochemistry laboratory next to the reactor and is then transferred pneumatically into the core-irradiation position for a predetermined time. At the end of this period, the sample is transferred back to the receiving terminal, where it is removed for measurement. The transfer time from the core to the terminal is about seven seconds, making this method of irradiating samples particularly

useful for experiments involving radioisotopes with short half-lives. The flux in the core terminal is approximately $5x10^{12}$ n/cm^{2}s when the reactor is at full power.

Rotating Specimen Rack Facility

The rotating specimen rack ("lazy susan") is located in a well on top of the graphite reflector which surrounds the core. The rack consists of a circular array of 39 tubular receptacles. Each receptacle can accommodate two TRIGA-type irradiation tubes, so that up to 78 separate samples may be irradiated at any one time. Vials holding up to 17 ml (four drams) are routinely used in this system. Depending upon its geometry, a sample up to about 40 ml could be irradiated by joining two vials. Samples are loaded in the specimen rack prior to the start-up of the reactor. The rack automatically rotates during irradiation to ensure each sample receives the same neutron flux. Typically, the rotating rack is used by researchers when longer irradiation times (generally greater than five minutes) are required. The average thermal neutron flux in the rotating rack position is approximately 1.7 $x10^{12}$ n/cm^{2}s with a cadmium ratio of 6.0 at full power.

The specimen rack can also be used for gamma irradiations when the reactor is shutdown. The shutdown dose rate in the specimen rack is approximately 3 R/min.

In-Core Facilities

The central thimble, which is a water-filled irradiation chamber about 3 cm in diameter, provides the highest available neutron flux, about $1x10^{13}$ n/cm^{2}s. Special sample holders can be designed for the central thimble to provide maximum flexibility in experiment design.

A source holder assembly can also be used. The chamber fits into a fuel-element position within the core itself. However, it holds only one specially positioned irradiation container, containing a cavity 7.5 cm in length and 2.5 cm in diameter. Use of the chamber as an irradiation facility necessitates special arrangements.

Foil-insertion holes, 0.798 cm in diameter, are drilled at various positions through the grid plates. These holes allow inserting special holders containing flux wires into the core, to obtain neutron flux maps of the core.

In-Pool Facilities

Near core, in-pool irradiation facilities can be arranged for larger samples, if required by the experimenter. Neutron fluxes will be lower than in the lazy susan and will depend on the sample location.

Beam Facilities

The central thimble can be evacuated with gas, producing a vertical neutron beam. This beam can be used to generate directional neutron flux, or for limited irradiations above the tank. Neutron radiography is also possible.

REACTOR USERS

Reactor Visitors

A total of 1115 individuals visited the Reed Reactor Facility during the year, as derived from the visitors log, Entry List B. A display of visitors by month is shown in Figure 2. Visitors include all individuals who are not listed as facility staff above. A large percentage of these were students in classes at area universities, colleges, and high schools as discussed below.

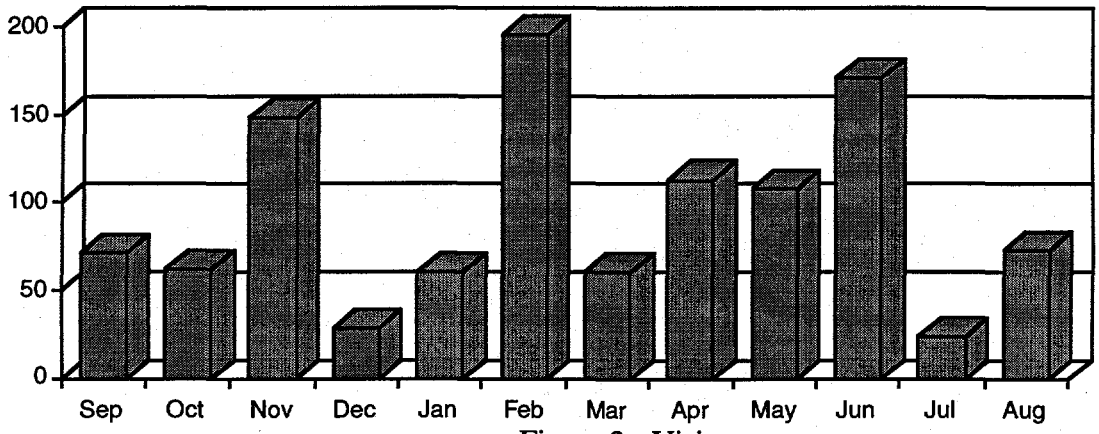

Figure 2 - Visitors

Reactor Operations Seminar

The Reed Reactor Facility conducts a seminar series which is attended by students and faculty from Reed and other area educational institutions. This non-credit course serves as an introduction to nuclear reactor theory, health physics, and reactor operation. Some of the students may continue with in-depth reactor operator training and subsequently be recommended and apply for a reactor operator license. If successful, the individual may be hired to operate the reactor as a member of the facility staff. In addition, existing reactor operators may take the NRC senior reactor operator exam to upgrade their licenses. For those NRC exams administered during this reporting period, five of six reactor operator candidates and all four senior reactor operator candidates passed.

Nuclear Science Consortium

In order to better use the resources of the Reed Reactor Facility, Dr. Scott and representatives of several area colleges and universities established the Nuclear Science Consortium of the Willamette Valley in 1970. Funding for the Consortium has been derived from Reactor Use Sharing Grants of the U.S. Department of Energy. This made the facility available without charge to classroom groups and unfunded research projects for consortium members.

The following institutions have participated in facility tours, experiments, and research projects in the reporting period. A chronological listing is attached.

COLLEGE TOURS

Clackamas Community College
George Fox College
Lewis and Clark College

Mt. Hood Community College
Oregon Health Sciences University
Pacific University
Portland Community College
Portland State University
Warner Pacific College

HIGH SCHOOL & MIDDLE SCHOOL TOURS

Beaverton Montessori
Centennial High School
Central Kitsap High School
David Douglas High School
Evergreen High School
Garfield High School
Hood River Valley High School
Lake Oswego High School
Lincoln High School
Mercer Island High School
Mount Vernon High School
Nyssa High School
Oregon Episcopal School
Punahou High School
Riverside High School
Rogers High School
Seattle Academy
St. Mary's Academy
Wilson High School

SPECIAL PRE-COLLEGE GROUPS

Adventures in Science Camp
Cub Scout Packs
I Have a Dream Foundation
Oregon Academy of Science
Pacific University's Science and Technology Camp for Girls.
Police Youth Athletic Association
Portland MESA (Mathematics, Engineering, and Science Achievement)
Project Plus
Saturday Academy
Science at Reed
Seattle Academy
Summer Science Program
Upward Bound

Most of the reactor tours include actual hands-on use of facility equipment to conduct experiments in basic radiation science, health physics, and nuclear physics. The most popular experiments for middle school students are a demonstration of the inverse square law and the absorption of radiation by different types of material. For high school classes, a typical lab experience would involve determining the background of a Geiger-Müller scalar system and then determining the half-life of a radioactive material.

College classes are generally more closely tailored to the individual interests and needs of the Consortium faculty member involved. Experiments include more direct use of the reactor itself by the students, more detailed analysis of materials, and emphasize the incorporation of other classroom activities as much as possible.

Several special programs for gifted children used the reactor. These are designed to enrich their educational program and prepare them for college. Many of the groups who use the reactor target minority and disadvantaged youth who are historically under-represented in science professions.

High School Student Projects

The Reed Reactor Facility continued to be used in independent science projects initiated by students from several Oregon high schools. A student from Gold Beach High School irradiated soil and plants to determine why some plants grew well in serpentine soils. Three students at Oregon Episcopal School investigated a method of removing pollution from pond water. Two students at Evergreen High School studied the effects of gamma irradiation on fruit flies.

Pacific University Student Projects

Three Pacific University students conducted senior thesis projects at the reactor. Two students continued an ongoing project to characterize the neutron flux of the Reed Reactor. Another student investigate a filtering technique for arsenic in water.

Pacific University Science and Technology Camp for Girls

The Pacific University Science and Technology Camp for Girls was a summer camp for 30 7th and 8th grade girls. This camp was funded by the U.S. Department of Energy. The overall goal was to encourage the participants to continue in math and science.

Pacific University Modern Physics Lab

In fall of 1994 the Modern Physics Lab at Pacific University spent two lab sessions (4-5 hours each) at the reactor. The six students did several labs including: basic health physics, subcritical multiplication, and neutron activation analysis.

Reed Classes, Theses, and Faculty Research

The Reed College Reactor Facility was used in three Reed College Classes and seven senior theses.

- The Chemistry 110 class conducted a lab using neutron activation analysis to analyze for copper and potassium in a compound synthesized earlier in the course, and the determination of the amount of various metals in breakfast cereals.
- Chemistry 315 students evaluated the presence of impurities in aluminum foil.
- Natural Science 100 students studied the effects of acid rain on sediment taken from the Reed Canyon.
- Thesis projects which used the reactor include:

  Justina Bolz, Chemistry - Advisor, Maggie Geselbracht
  "Titanium Oxides and a Pinch Of Salt: Towards the Synthesis of Ternary Reduced Titanium Oxides"

J. Dee Breshears, Chemistry - Advisor, Maggie Geselbracht
"In Reciprocal Space No One Can Hear You Scream: Investigations into the Crystal Structures of Reduced Alkali Niobates"

Sarah Dwiggins, Biology - Advisor, David Dalton
"Frustration and Flowering Plants: a Study in Negative Fruition"

Julie Hollien, BMB - Advisor, Arthur Glasfeld
"The Metal Binding and Activation of Specificity of D-Xylose Isomerase"

Yi-Kang Hu, Chemistry - Advisor, Ron McClard
"Towards a Kinetic Characterization of Recombinant Yeast Orotate Phosphoribosyl Transferase Expressed in E. Coli with a P-32 Labeled Substrate"

Noah Iliinski, Physics, - Advisor, John Essick
"Electron-Hole Pair Recombination Rates in Silicon Semiconductors"

John McDougal Biology - Advisor, David Dalton
"Fluorescence and Radioactive Studies of Rabinose Isomerase"

Industrial and Commercial Applications

The Reed Reactor Facility is available for use by industrial or commercial concerns whenever it does not conflict with our educational goals. As in past years, the primary operations involve neutron activation analysis of materials or environmental samples. Arrangements may be made either on a time lease basis or the industry may contract for sample analysis.

This year work included attempts to find trace elements in soil samples and renting analytical equipment. The facility is expanding its commercial activities by providing radiation protection training to interested parties and schools in the area.

REACTOR OPERATIONS

Operations

During the year, 116 reactor start-up checklists were completed with a total of 225 times critical. A reactor start-up is conducted on each day of reactor operation; each "time critical" represents one reactor operation. The total energy production amounted to 24.6 MWh. Operations by month appear in Figures 3-5.

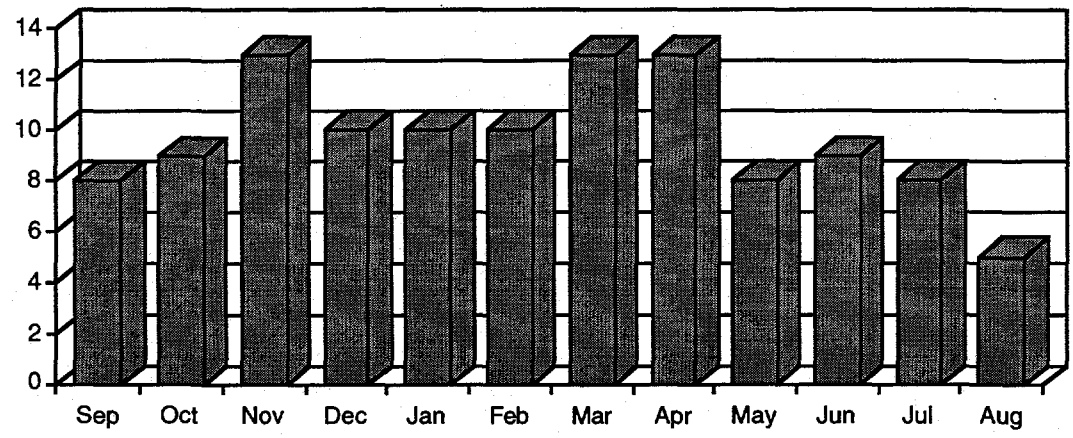

Figure 3 - Days of Operation

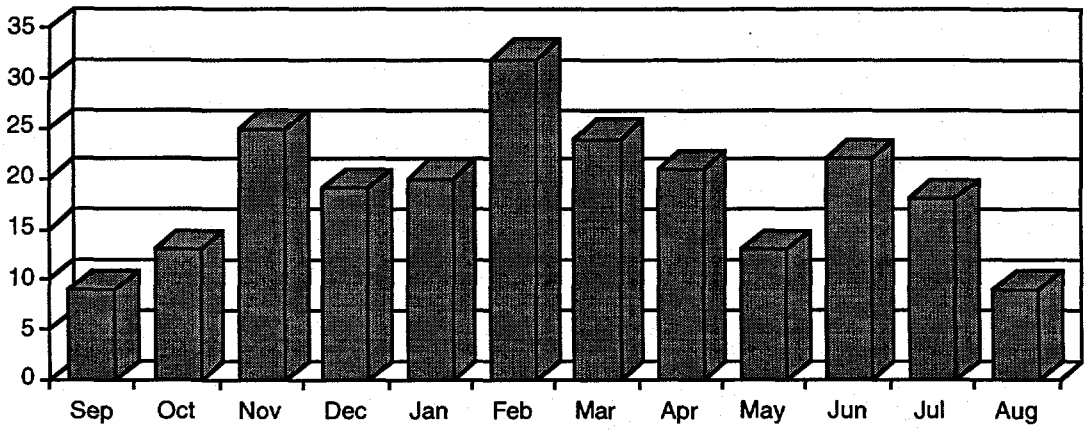

Figure 4 - Times Critical

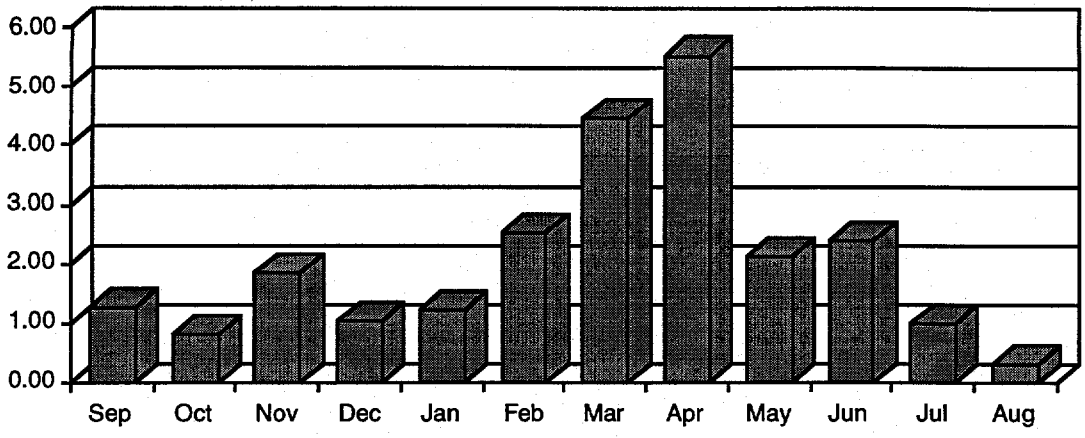

Figure 5 - Energy Production (MWh)

Unplanned Reactor Shutdowns (SCRAMS)

There were 21 unplanned reactor shutdowns during the period, as shown in Table A. All were classified as inadvertent. Two occurred when switching the reactor from manual to automatic operation at high power (a problem which has occurred sporadically for many years), six were due to instrument noise, and the rest resulted from operator or trainee error. The number of unplanned reactor shutdowns is consistent with previous periods, except for the instrument noise (discussed in the next section).

Table A - Unplanned Reactor Shutdowns

Date	Type	Cause Of Shutdown
11/17/94	Reactor Period	Operator error
11/28/94	Linear Power	Operator error
11/28/94	Reactor Period	Instrument noise
12/1/94	Linear Power	Operator error
1/12/95	Linear Power	Instrument noise
1/13/95	Reactor Period	Operator error
1/20/95	Percent Power	Operator error
2/3/95	Reactor Period	Operator error
2/22/95	Reactor Period	Operator error
2/23/95	Reactor Period	Trainee error
3/4/95	Reactor Period	Operator error
3/4/95	Linear Power	Automatic switch contact
3/4/95	Linear Power	Automatic switch contact
3/9/95	Reactor Period	Instrument noise
4/18/95	Linear Power	Instrument noise
4/14/95	Reactor Period	Instrument noise
4/21/95	Reactor Period	Operator error
4/24/95	Reactor Period	Instrument noise
6/16/95	Reactor Period	Operator error
6/16/95	Linear Power	Operator error
7/20/95	Reactor Period	Operator error

REACTOR MAINTENANCE

Routine equipment checks are conducted by reactor staff members on a daily, weekly, bimonthly, semiannual (January and July) and annual (January) basis as required by facility procedures. Reed College maintenance personnel assist with routine preventative maintenance to auxiliary equipment. Significant maintenance operations which were not part of a regular schedule are described in Table B.

This year the facility has experienced increased noise on its nuclear instrumentation. The instrument noise has been gradually increasing during the year and has caused some spurious scrams from the reactor period channel. Troubleshooting has indicated that the noise is associated with the installed high voltage power supply. A temporary replacement power supply is in use on the linear and log channels while completing the investigation and repairs.

Table B - Significant Maintenance Operations

Date	Maintenance
1/17/95	New motor installed for stack monitors (GSM/APM) pump loop.
3/15/95	Replaced capacitors in both console DC power supplies.
7/18/95	Replaced rod position indication cable.
8/31/95	Added supplemental voltage supply to nuclear instruments.

Safety Reviews

Table C contains a summary of the changes performed during the reporting period under the provisions of 10CFR50.59. The Reactor Safety Committee approved all of safety reviews, and verified that the actions did not require a change in the Technical Specifications or create an unreviewed safety question.

Table C - Safety Reviews

Placing Used Fission Chamber in Reactor Pool: The used fission chamber and other nuclear instruments from Northrop contributed to the background dose in the reactor bay and outside the facility. Those items that fit into the storage pits were sealed in plastic and placed there. A long activated hollow tube and a large fission chamber (≈1g of highly enriched U-235) did not fit in the pit. Both items were suspended in the southeast corner of the reactor pool.

Removing the Differential Pressure Requirements on the Heat Exchanger: The Administrative Procedures required maintaining secondary system pressure higher than primary system pressure in the heat exchanger, except during testing. This required throttling the secondary system flow leaving the heat exchanger, significantly reducing the performance of the cooling system. Higher secondary pressures also increased the possibility of leakage of secondary system pH control chemicals and algaecides into the primary, where the chemicals could attack primary system components or become activated. The differential pressure requirement was a remnant from when the canyon water was used as the secondary cooling system. Since a stand alone secondary cooling system was installed, the requirement is not necessary.

Special Experiment to Determine if Mica Wafers Are Directional Fast Neutron Detectors: This experiment involved placing mica wafers and a flux monitor in the central thimble beam. The experiment was performed in three phases. The first involved evacuating the central thimble (CT) with helium gas while the reactor was shutdown. The second involved a flux measurement to determine the length of irradiation in the final experiment. The third involved placing two stacks of mica wafers and a flux monitor in the central thimble beam.

SOPs: and EIPs: Updated the format, updated references to 10CFR20, included NRC recommendations, removed references to the rabbit, and corrected minor errors. The major changes were: removing the limit on primary-secondary pressure in heat exchanger (covered in a separate 50.59), adding an annual measurement of the maximum control rod insertion rate to comply with Technical Specifications, temporarily removing references to the rabbit, allowing power operation up to 5w before power calibration adjustment and ion exchanger maintenance, updating references to the secondary cooling system, allowing ROs to adjust the rod position servo voltage, and making the EIPs easier to use during an event.

SOP 91, Location of Leaking Fuel Elements: A new procedure which explains how to identify a leaking fuel element.

Emergency Plan, Emergency Implementation Procedures, and SOP-90 Elevated Radiation Levels: Replaced references to Derived Air Concentration (DAC) with references to Effluent Concentration (EC), allowed the use of hospitals other than Good Samaritan, deleted the requirement to train hospital emergency room personnel, eliminated references to Trojan, stated that emergency dose limits include internal dose, calculated preset readings on the GSM and APM that indicate when an Unusual Event or Alert are reached, included other NRC recommendations, reformatted the definitions in the E-Plan, and corrected minor errors.

Alternate Voltage Supply to Nuclear Instruments: Temporarily replaced the installed instrument power supply with a separate power supply. The installed supply appeared to be producing excessive noise, which disappeared when a different voltage supply was used. The excessive noise made operation very difficult. The replacement power supply was used for the linear and log-n channels. The count rate and percent power channels remained on the installed power supply.

RADIATION PROTECTION

Personnel Dosimetry

During the period from July 1, 1994 to June 30, 1995, personnel dosimeters were issued to 27 Reed students and staff and 1 contractor working at the reactor. Since dosimeters are changed on a calendar quarter schedule, this period is the closest to the reporting period. In almost all cases, individuals were issued both a ring badge for estimating hand exposure and a whole-body badge. A total of 104 person-quarters were reported.

Four individual ring badges met or exceeded the detection limit as indicated on Table D. No exposures exceeded one percent of the federal limit.

Table D - Personnel Dosimetry

	Ring	Whole-body
Total dosimeters issued	104	104
Reports below detection limit	102	102

Details of dosimeters exceeding detection limit in a calendar quarter:

Reed student: 80 mR to finger ring.
Reed student: 50 mR to finger ring.
Reed student: 15 mR to whole body.
Reed staff: 15 mR to whole body.

Gaseous Releases

The only routine release of gaseous radioactivity is from ^{41}Ar (1.8 hour half-life) which is produced in air irradiated in the rotary specimen rack. The detected activity includes an unknown, but significant percentage of activity from ^{16}N (7 second half-life). The total gaseous activity, averaged over a year, is approximately 5.3×10^{-9} mCi/ml; well below regulatory guidelines.

Liquid Waste Releases

No liquid radioactive waste was released from the Reed Reactor Facility during this report period.

Solid Waste Disposal

No solid radioactive waste was shipped from the Reed Reactor Facility during this report period.

Environmental Sampling

Soil and water samples taken from the area surrounding the facility showed no activity above background.

Area Radiation Monitors (Dosimeters)

Radiation levels are continually monitored to provide an indication of the average radiation levels in the reactor bay, and dose outside the facility. The locations of these dosimeters are shown on Figure 1. All are thermoluminescent dosimeters (TLDs) designed to monitor beta and gamma radiation. In addition, two locations have TLDs for neutron dose measurement.

The radiation doses measured during the period beginning July 1, 1994 and ending June 30, 1995 are shown in Table E. There are sample storage locations along the north wall: a radioactive source storage safe and a lead enclosed sample box where samples are placed immediately upon removal from the reactor.

Table E - Area Radiation Dosimeters
(doses in mR/calendar quarter)

Location (height above floor)		β,γ	n	β,γ	n	β,γ	n	β,γ	n
		7/1/94-9/30/94		10/1/94-12/31/94		1/1/95-3/31/95		4/1/95-6/30/95	
(A) North wall	(1.5 m)	30	-	0	-	110	-	0	-
(B) North wall	(2.5 m)	55	-	0	-	0	-	0	-
(C) East wall	(1.7 m)	0	0	0	0	0	0	0	0
(D) South wall	(1.7 m)	0	-	0	-	0	-	0	-
(E) West wall	(1.0 m)	45	0	0	0	0	0	0	0
(F) North outside	(3.0 m)	0	-	0	-	0	-	0	-
(G) East outside	(1.5 m)	0	-	0	-	0	-	0	-
(H) South outside	(0.2 m)	0	-	0	-	0	-	0	-
(I) Roof outside		0	-	0	-	0	-	0	-

"-" means no neutron dosimeter at that location

APPENDIX A
Reed Reactor Visitors 1994-95

Date	Institution	# in group	Comments
9/2/94	EG&G Nuclear	1	Equipment vendor
9/2/94	Reed Physical Plant	2	Inspection/Maintenance
9/8/94	Reed Student	1	Research Project
9/12/94	Pacific University	1	Thesis Project
9/14/94	Washington State University	1	Research Project
9/15/94	Reed Student	19	Reactor Seminar
9/16/94	Reed Staff	3	Admissions Department Photo
9/20/94	Pacific University	1	Research Project
9/20/94	Reed Chemistry Department	1	Maintenance
9/21/94	Neighborhood Resident	1	Tour
9/22/94	Oregon Department of Energy	1	Tour/Inspection
9/22/94	Oregon Department of Health	1	Tour/Inspection
9/22/94	Pacific University	2	Thesis Projects
9/22/94	Citizens	2	Tour
9/22/94	Reed Student	1	Tour
9/22/94	Hood River Valley High School	16	Tour
9/23/94	Portland Fire Bureau	5	Tour/Training
9/24/94	Reed Student	1	Training
9/26/94	Reed Physical Plant	1	Maintenance
9/27/94	Pacific University	1	Research Project
9/27/94	Reed Chemistry Department	1	Maintenance
9/28/94	Reed Chemistry Department	1	Maintenance
9/29/94	Pacific University Modern Physics Class	7	Experiments/Training
9/30/94	Reed Student	1	Training
10/3/94	Evergreen High School	2	Tour
10/5/94	Reed Student	1	Training
10/6/94	Pacific University Modern Physics Class	7	Experiments/Training
10/7/94	Reed Physical Plant	1	Maintenance
10/7/94	Reed Students	2	Training
10/7/94	Portland Fire Bureau	4	Tour/Training
10/17/94	University of Puget Sound	1	Tour
10/18/94	Reed Student	1	Training
10/18/94	Pacific University	1	Research Project
10/20/94	Evergreen High School	20	Tour
10/21/94	Pacific University	2	Research Project
10/21/94	Reed Physical Plant	3	Maintenance
10/24/94	Reed Physical Plant	3	Maintenance
10/24/94	Marquette University	1	Tour
10/25/94	Reactor Safety Committee	1	Audit
10/26/94	Reed Student	1	Training
10/27/94	Pacific University	4	Research Projects
10/27/94	Rogers High School	1	Tour
10/27/94	Central Kitsap High School	1	Tour
10/27/94	Garfield High School	1	Tour
10/27/94	Mount Vernon High School	1	Tour
10/27/94	Mercer Island High School	1	Tour
10/29/95	Reed Student	1	Tour
10/31/94	Reed Student	2	Tour
11/1/94	Pacific University	1	Research Project
11/1/94	Oregon Episcopal School	10	Tour
11/7/94	Portland Police	1	Tour/Training
11/7/94	Reed Students	3	Tour
11/9/94	Reactor Operations Committee	1	Audit
11/9/94	Reed Student	1	Training
11/10/94	Pacific University	1	Research Project

Date	Institution	#	Comments
11/11/94	Reed Parents	2	Tour
11/12/94	Reed Student	1	Training
11/14/94	Reed Student	18	Tour
11/15/94	Pacific University	1	Research Project
11/15/94	Reed Natural Science 110	14	Tour/Experiment
11/16/94	NW Reports Film Crew	2	Tour
11/16/94	Reed Natural Science 110	10	Tour/Experiment
11/17/94	Reed Natural Science 110	41	Tour/Experiment
11/17/94	Pacific University	1	Research Project
11/17/94	Northeastern University	1	Tour
11/18/94	Reed Natural Science 110	27	Tour/Experiment
11/22/94	Pacific University	2	Research Project
11/28/94	Reed Student	1	Training
11/29/94	Pacific University	1	Research Project
12/1/94	Reed Student	1	Training
12/1/94	Reed Chemistry 315	5	Tour/Experiment
12/2/94	Reed Student	1	Training
12/2/94	Reed Chemistry 315	5	Tour/Experiment
12/2/94	Reactor Safety Committee	1	Tour
12/2/94	Reed Student	1	Training
12/5/94	US Nuclear Regulatory Commission	1	Inspection
12/6/94	US Nuclear Regulatory Commission	1	Inspection
12/7/94	US Nuclear Regulatory Commission	1	Inspection
12/7/94	Pacific University	1	Research Project
12/7/94	Reed Student	1	Training
12/8/94	US Nuclear Regulatory Commission	1	Inspection
12/8/94	Reed Student	1	Training
12/8/94	Reed Student	1	Training
12/8/94	Portland Office of Emergency Management	1	Tour/Training
12/8/94	Reed Student	1	Training
12/14/94	Pacific University	1	Research Project
12/14/94	Reed Student	1	Training
12/14/94	Reed Relatives	2	Tour
1/5/95	Chemcoa	1	Maintenance
1/6/95	Evergreen High School	2	Research Project
1/9/95	Ohio Wesleyan	1	Tour
1/9/95	Reed Student	8	Training
1/10/95	Reed Student	4	Training
1/10/95	Interstate Mechanical	1	Maintenance
1/11/95	Reed Student	3	Training
1/12/95	Reed Student	4	Training
1/12/95	Ohio Wesleyan	1	Tour
1/13/95	Pacific University	6	Tour
1/13/95	DESCO Industrial Group	1	Tour
1/13/95	Reed Student	4	Training
1/16/95	Reed Student	4	Training
1/17/95	Reed Student	3	Training
1/18/95	Reed Student	2	Training
1/19/95	Reed Student	1	Training
1/20/95	Reed Student	1	Training
1/23/95	Reed Student	1	Training
1/24/95	Reed Student	1	Training
1/24/95	OAR Services	1	Tour
1/24/95	US Nuclear Regulatory Commission	2	Operator Examination
1/25/95	US Nuclear Regulatory Commission	3	Operator Examination
1/26/95	US Nuclear Regulatory Commission	2	Operator Examination
1/27/95	Reed Student	1	Tour
1/30/95	Reed Student	1	Tour

Date	Institution	#	Comments
1/31/95	Saturday Academy	4	Tour/Training
2/1/95	Reed Student	1	Tour
2/1/95	Centennial High School	21	Tour
2/2/95	Reed Staff	1	Additional Dosimetry
2/2/95	Pacific University	1	Research Project
2/6/95	Chemcoa	1	Maintenance
2/6/95	Reed Physical Plant	3	Maintenance
2/7/95	Reed Physical Plant	1	Maintenance
2/7/95	Saturday Academy	7	Tour/Training
2/7/95	Oregon Public Broadcasting	2	Film
2/7/95	Reed Student	1	Training
2/8/95	Reed Student	1	Training
2/9/95	Pacific University	1	Research Project
2/9/95	Reed Student	2	Training
2/16/95	Pacific University	1	Research Project
2/16/95	Oregon State University	1	Tour
2/17/95	Community Safety	2	Tour/Training
2/20/95	Reed Student	2	Training
2/21/95	Reed Chemistry 110	18	Tour
2/21/95	George Fox College	9	Tour
2/22/95	MESA	26	Tour
2/22/95	Reed Chemistry 110	21	Tour
2/23/95	Reed Student	1	Training
2/23/95	Reed Chemistry 110	31	Tour
2/24/95	Reed Chemistry 110	21	Tour
2/24/95	Reed Student	1	Training
2/25/95	Portland State University	2	Tour
2/25/95	University of Oregon	3	Tour
2/25/95	Moore Products Co	1	Tour
2/25/95	Oregon Academy of Science	8	Tour
2/25/95	Reed Student	2	Tour
2/27/95	Reed Student	2	Tour
2/28/95	Reed Student	1	Tour
3/2/95	Reed Student	3	Tour
3/2/95	Pacific University	1	Research Project
3/3/95	Reed Student	3	Training
3/4/95	Reed Student	2	Training
3/4/95	Evergreen High School	2	Research Project
3/7/95	Pacific University	2	Research Project
3/8/95	Project Plus	16	Tour
3/8/95	Oregon Episcopal School	3	Research Project
3/8/95	Reed Staff	1	Tour
3/9/95	Pacific University	2	Research Project
3/9/95	Reed Physical Plant	1	Maintenance
3/9/95	Seattle Academy	7	Tour
3/10/95	Reed Student	1	Tour
3/11/95	Reed Student	2	Tour
3/14/95	Pacific University	1	Research Project
3/14/95	Saturday Academy	3	Research Project
3/15/95	Mt. Hood Chemical Company	1	Maintenance
3/15/95	Reed Student	2	Training
3/20/95	Saturday Academy	1	Tour
3/20/95	Pacific Northwest Lab	1	Tour
3/23/95	Oregon Episcopal School	1	Research Project
3/29/95	Tour	1	Tour
3/30/95	Reed Staff	2	Additional Dosimetry
3/30/95	Pacific University	1	Research Project
3/30/95	Reed	1	Training

Date	Institution	#	Comments
4/7/95	Reed	1	Training
4/7/95	I Have A Dream	18	Tour
4/10/95	Reed Student	3	Tour
4/11/95	Pacific University	1	Research Project
4/11/95	Saturday Academy	5	Tour
4/13/95	Pacific University	1	Research Project
4/14/95	SLAC	2	Tour
4/14/95	Prospective Students	9	Tour
4/14/95	Chemcoa	1	Maintenance
4/14/95	Reed Student	2	Training
4/15/95	Evergreen State College	1	Tour
4/18/95	Warner Pacific College	12	Tour
4/19/95	Lewis & Clark	13	Tour
4/24/95	Reed Students	29	Tour
4/25/95	Reed Students	6	Tour
4/27/95	Lewis & Clark	10	Tour
5/1/95	US Nuclear Regulatory Commission	1	Operator Examination
5/2/95	US Nuclear Regulatory Commission	1	Operator Examination
5/3/95	Reed Students	6	Tour
5/9/95	Saturday Academy	8	Tour
5/11/95	Lincoln High School	24	Tour
5/11/95	David Douglas High School	12	Tour
5/12/95	Saturday Academy	1	Tour
5/12/95	Reed Student	2	Tour
5/19/95	Oregon Health Science University	14	Tour
5/19/95	University of Oregon	1	Tour
5/19/95	Rensselaer Polytechnic Institute	1	Tour
5/20/95	University of California - Berkeley	1	Tour
5/20/95	Reed Student	4	Training
5/25/95	Reed Student	2	Training
5/26/95	Reed Student	1	Training
5/30/95	Reed Student	2	Training
5/31/95	Reed Student	2	Training
5/31/95	Portland Community College	26	Tour
6/1/95	Reed Student	3	Training
6/1/95	Rex Putnam High School	1	Training
6/1/95	Clackamus Community College	18	Tour
6/2/95	Reed Student	2	Tour
6/2/95	Lake Oswego High School	16	Tour
6/5/95	St. Mary's Academy	2	Tour
6/6/95	Reed Student	3	Training
6/6/95	Rex Putnam	1	Training
6/6/95	Wilson High School	23	Tour
6/6/95	Reed Student	1	Tour
6/8/95	Reed Student	1	Training
6/12/95	George Fox College	2	Tour
6/12/95	University of the Pacific	1	Tour
6/12/95	Reed Reunion Tour	10	Tour
6/16/95	Reed Reunion Tour	17	Tour
6/20/95	Reed Student	1	Training
6/20/95	Reed Physical Plant	1	Maintenance
6/21/95	Reed Student	2	Training
6/22/95	Reed Student	2	Training
6/22/95	Summer Science Program	27	Tour
6/22/95	Fire Inspector	2	Inspection
6/22/95	Reed Staff	1	Inspection
6/26/95	Reed Student	2	Training
6/27/95	Reed Student	1	Training

Date	Institution	#	Comments
6/27/95	Pacific University Science Camp	30	Tour
6/28/95	Reed Student	1	Training
6/30/95	Reed Physical Plant	1	Maintenance
6/30/95	Reed Student	1	Training
7/5/95	Reed Student	1	Training
7/5/95	Reed Physical Plant	2	Maintenance
7/6/95	Reed Student	1	Training
7/7/95	Reed Student	1	Training
7/10/95	Reed Student	2	Training
7/12/95	Reed Student	1	Training
7/13/95	Reed Student	1	Training
7/14/95	Reed Student	1	Training
7/17/95	Reed Student	1	Training
7/18/95	Reed Student	1	Training
7/19/95	Reed Student	1	Training
7/20/95	Reed Student	1	Training
7/20/95	CC-STADUS	3	Tour
7/21/95	Reed Student	1	Training
7/24/95	Reed Student	1	Training
7/25/95	Reed Student	1	Training
7/27/95	Reed Student	1	Training
7/27/95	Reed Student	2	Training
7/31/95	Reed Student	1	Training
8/1/95	Reed Student	3	Training
8/2/95	Reed Student	1	Training
8/3/95	Reed Student	1	Training
8/4/95	Reed Student	4	Training
8/7/95	Reed Student	1	Training
8/8/95	Reed Student	1	Training
8/8/95	Rex Putnam High School	2	Training
8/8/95	Punahou High School	16	Training
8/8/95	Rex Putnam High School	2	Training
8/9/95	Reed Physical Plant	2	Maintenance
8/9/95	Reed Community Safety	2	Tour/Training
8/9/95	Clackamus Community College	10	Tour
8/10/95	Reed Student	1	Training
8/10/95	Rex Putnam High School	1	Training
8/9/95	Clackamus Community College	10	Tour
8/11/95	Reed Student	1	Training
8/11/95	Adventures in Science	7	Tour
8/14/95	Reed Student	2	Training
8/22/95	Reed Student	1	Training
8/23/95	Reed Student	14	Tour
8/25/95	Reed Staff	1	Tour
8/29/95	Reed Student	1	Training
9/5/95	Reed Student	2	Training
9/8/95	Reed Student	1	Training