

REED REACTOR FACILITY

ANNUAL REPORT

September 1, 1989 -- August 31, 1990

J. Michael Pollock
Acting Director, Reed Reactor Facility
Program Director, Nuclear Science
Consortium of the Willamette Valley

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EXECUTIVE SUMMARY

This report covers the period from September 1, 1989 to August 30, 1990. Information contained in the 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).

The reactor staff during this period consisted of 2 part-time individuals in the positions of Director and Associate Director with a total equivalent time commitment for the year of about 0.9 FTE. They were assisted by a Health Physicist at 5 hours per month, and 13 additional hourly employees, virtually all of whom were Reed College undergraduate students.

There were 709 visits of the Reactor Facility by individuals during the year. Most of these visitors were members of classes from Reed, area universities, colleges, and high schools. Including both tours and research conducted at the Facility, the Reed Reactor Facility contributed to the educational programs of 11 colleges and universities and 10 pre-college groups. A majority of the non-Reed reactor use was conducted under the auspices of the Nuclear Science Consortium of the Willamette Valley, supported by a grant from the USDOE through the Reactor-use Sharing Program.

During the year, the reactor was operated 186 separate times on 103 days. The total energy production amounted to 25.52 MWh. There were no problems during this period which required notification of the USNRC. An inspection on May 16-19, 1990 identified no items of non-compliance with NRC regulations within the scope of the inspection.

The whole-body radiation exposures to all individuals working at the Facility during this period were below the detection limit reported by the dosimetry service. There were no releases of liquid radioactive material from the Facility and airborne releases (primarily ^{41}Ar) were within regulatory limits. One shipment of radioactive waste is reported.

STAFF

During the 1989--1990 academic year, the Facility staff consisted of:

Reactor Director: J. Michael Pollock (Acting, beginning 4/90)
Dr. Larry Ruby (until 4/90)

Associate Reactor Director: J. Michael Pollock (until 4/90)

Reactor Supervisor: Sarah Herbelin (beginning 1/90)
Paul Terdal (until 1/90)

Health Physicist/Campus
Radiation Safety Officer: Dr. Marshall Parrott

Assistant Health Physicist: Jed Johnson (beginning 1/90)
Inga Sidor (until 1/90)

Senior Reactor Operators:

Michael Begel (upgrade from RO 6/90)
Jeffrey P. Bradford (on leave)
Sarah Herbelin
J. Michael Pollock
Larry Ruby
Paul Terdal

Reactor Operators:

Matthew Blackwell
Dr. Juliet Brossing
Chloë Lewis
David Moriwaki

Reactor Operators (licenses issued 6/90):

Eric Anderson
Ernest Argetsinger
Jed Johnson
Anna LeRoux
Inga Sidor

Reactor Assistants:

Skye Malcolm
Zach Nobel

Dr. Ruby also holds the position of Professor of Nuclear Science. Mr. Pollock has served as Director of the Nuclear Science Consortium since November 1988. The combined effort of Dr. Ruby and Mr. Pollock was supported by the college at a level of 0.9 FTE. Dr. Parrott works on contract to Reed College as both Reactor Health Physicist (5 hours/month) and campus Radiation Safety Officer (5 hours/month). Dr. Brossing is a Professor of Physics at Pacific University. All other staff members were Reed College undergraduates during the report year.

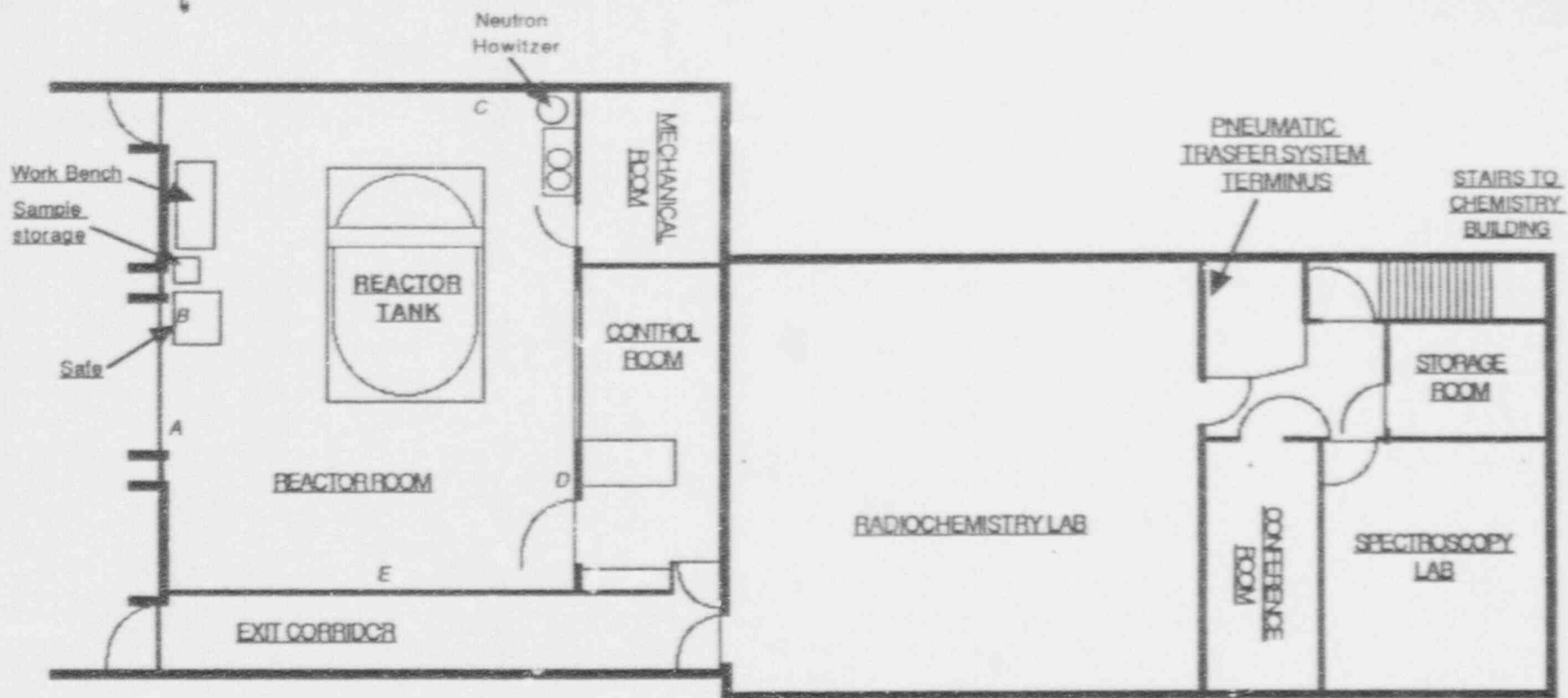


Figure 1.
REED COLLEGE REACTOR FACILITY
AND ASSOCIATED RADIOCHEMISTRY LAB

*Letters in italics indicate positions of
 Area Radiation Dosimeters.
 See text for explanation.*

five individuals listed under staff above passed this exam and became members of the reactor staff.

Reed Classes, Theses, and Faculty Research

The Reed College Reactor Facility was used this year in two Reed College Classes--Natural Science 110, and Chemistry 315. The Natural Science classes, taught by Dr. Tom Dunne, conducted a lab on the measurement of the half-life of a radioactive material. Dr. Dan Gerrity's chemistry 315 students evaluated the presence of impurities in aluminum foil.

Bruce Stephanson, a Reed Physics senior working with Dr. Robert Reynolds, studied the effect of high levels of gamma radiation on plant pigments. Samples of material prepared as part of faculty research by Dr. John Witte and Dr. Ron McClard were analyzed quantitatively for their phosphorus and bromine concentrations

The Reactor Facility participated again this year in a Saturday Science Symposium for high school students sponsored by Dow Chemical. Laboratory exercises and demonstrations on radioactive half-life measurement, interactions of radiation with matter, and thermoluminescent dosimetry were available.

The reactor staff hopes that Facility usage in Reed classes, and student and faculty research will increase over the next couple of years.

Nuclear Science Consortium

In order to better utilize the resources of the Reactor Facility, Dr. Scott and representatives of several of the 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 USDOE augmented in past years by generous contributions from Portland General Electric. These have allowed the reactor to be made available to classroom groups and unfunded research projects for consortium members without charge.

The following institutions participated in reactor tours, experiments, and research projects during this report period:

COLLEGE TOURS

- Warner Pacific College, Analytical Chemistry
- Lewis and Clark College, Physics
- Lewis and Clark, Geology
- Mt. Hood Community College--Occupational Safety and Health, Hazardous Waste Management associate degree program
- Portland State University, Advanced Geochemistry

The most popular experiments for middle school students (most of whom are participants in the Portland MESA Program discussed below) 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 would include determining the background of a G-M, scalar system and then determining the half-life of a radioactive material. The same radioactive material is often then analyzed by a Facility staff member on the gamma-spectrometry system, while being observed by the students, and the results and a list of gamma-ray energies provided to the class for identification of the isotope. Radioactive materials used are usually ^{137}Ba or an irradiated silver dime.

Along with expanding the number of experiments, we have expanded our program to utilize Reed College students who are licensed or training to operate the reactor as laboratory assistants. Comments from high school teachers indicate that the interaction which develops between college and high school students during these visits greatly increases the interest of the high school students and, consequently, increases the benefit they derive from the experience.

College classes are 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.

The Portland MESA (Mathematics, Engineering, and Science Achievement) Program continues to utilize the Facility for technical site visits, experiments, and mentorships for its high school and middle school students. This program, co-sponsored by the Portland Public Schools and Portland State University, targets minority and disadvantaged youth who are historically under-represented in professions related to mathematics, engineering, and the physical sciences.

The Portland Public Schools Talented and Gifted Student (TAG) Program has continued during the past year with a new group of about 10 students enrolled in the fall. This program, under the direction of Dr. Daniel Love, is an after-school class held weekly at the Reed Reactor Facility. Students utilize the reactor and associated analytical equipment for both class experiments and independent projects designed by the students.

NSF-sponsored Undergraduate Faculty Workshop

A faculty workshop, **Nuclear Methods in Geology**, included participants from 9 undergraduate colleges from around the U.S. and was conducted by Michael Cummings of Portland State University, in conjunction with Michael Pollock of the Reed Reactor Facility, during the summer months of 1989. Some of the work from this Workshop occurred during the present reporting period. Details on the workshop can be found in the 1988-89 Annual Report.

Industrial and Commercial Applications

The Reed Reactor Facility is available for use by industrial or commercial concerns whenever it does not conflict with educational goal. 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 one commercial customer utilized the reactor. NEA, Labs Inc. of Beaverton has been a regular user for several years. Their primary business with the reactor involves trace element analysis of air filters used for monitoring effluents from industrial plants.

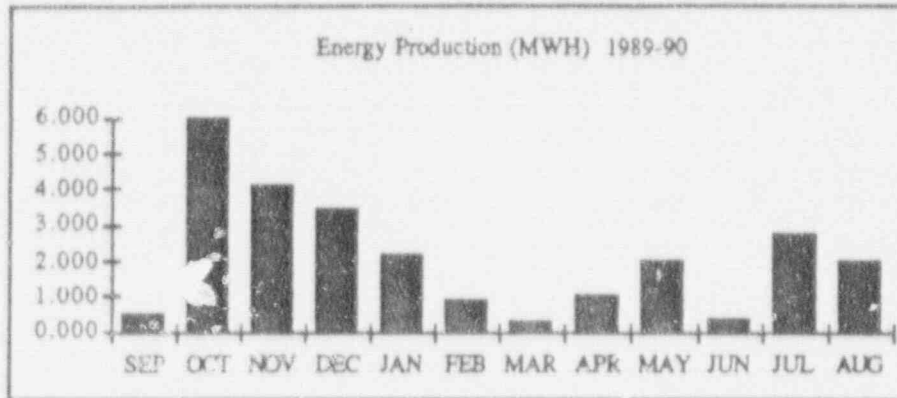


FIGURE 5

Maintenance

Routine equipment checks are conducted by reactor staff members on a daily, weekly, bimonthly, semiannual (January and July) and annual (January) basis as approved by the Reactor Operations Committee. 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 on TABLE A.

TABLE A. Significant Maintenance Operations

| | |
|---------|---|
| 11/3/89 | Oil cleaned from thermostat in reactor bay |
| 11/14 | Air Compressor replaced |
| 11/27 | Secondary water pump motor and power switch replaced |
| 1/3/90 | Oil cleaned from several rotary specimen rack positions |
| 1/10 | Physical inspection of control rods (routine biannual surveillance) |
| 1/12 | Loose electrical connection in regulating rod drive motor repaired |
| 2/27 | Loose connection in regulating rod position indicator repaired |
| 5/1 | Leak in compressor line repaired |
| 5/8 | Steam pipe leak in Facility heating system |
| 6/1 | Loose connections on rod position indicators repaired |

RADIATION PROTECTION

Personnel Dosimetry

During the period from 7/1/89--6/30/90, personnel dosimeters were issued to 34 Reed individuals and 10 participants in the NSF sponsored workshop on Nuclear Methods in Geology. Dosimeters were changed on a calendar quarter schedule thus this is the closest reporting possible to the school year. In almost all cases, individuals were issued both a ring badge for estimating hand exposure and a whole-body badge. A total of 107 person-quarters were reported.

There were zero reports of whole-body exposures exceeding the minimum reportable level of 20 mR/qtr. Five individual ring badges exceeded the detection limit of 30 mR/qtr as indicated on Table C.

TABLE C. Personnel Dosimetry 1989-90

| | <u>Ring</u> | <u>Whole-body</u> |
|-------------------------------|-------------|-------------------|
| Total dosimeters issued | 104 | 107 |
| Reports below detection limit | 99 | 107 |

Details of dosimeters exceeding detection limit (all are rings):

| | <u>mR/qtr</u> |
|---------------------------|---------------|
| NSF Participant (faculty) | 40 |
| NSF Participant (faculty) | 90 |
| NSF Participant (faculty) | 90 |
| Reactor Staff | 100 |
| Reed student* | 120 |

*Note: The reactor staff does not believe that this represents a real dose to the student since there is no record that the badge was used during the quarter the dose was reported.

Area Radiation Monitors (Dosimeters)

Radiation levels are continually monitored at four (4) locations designed to provide an indication of the general, average radiation levels in the reactor bay. The locations of these dosimeters are shown on Figure 1. All are thermoluminescent dosimeters, supplied by Radiation Detection Company, which are designed to monitor β - and γ -radiation. In addition, two have-TLD's for neutron dose measurement.

Liquid Waste Releases

No liquid radioactive waste was released from the Reed Reactor Facility during 1989-90.

Solid Waste Disposal

One shipment of solid radioactive waste totaling 3.909 μCi occurred during the report year and was the first shipment from Reed since 1986. This waste was shipped on 12/5/89, was contained in 3-55 gallon drums, and was shipped to the low-level disposal site in Washington by U.S. Ecology Inc. Included in these drums was all radioactive waste generated at Reed during the period 1986--1989 including that from the Biology and Chemistry Labs, Chemistry Stockroom, and the Reactor.

The waste was estimated to contain the following radioactive materials:

| | Activity <u>(μCi)</u> | Source |
|---|--|------------|
| Natural uranium | 0.75 (2.27 kg) | Chem stock |
| Thorium oxide powder | 0.2 (1.82 kg) | Chem stock |
| ^3H contaminated lab waste | 2.603 | Bio |
| ^{14}C contaminated lab waste: | 0.055 | Bio & Chem |
| Misc. irradiated materials and lab waste | <u>0.301</u> | Reactor |
| TOTAL | 3.909 | |

Wilkening, R. M., and Cummings, M. L., 1987, Mercury and uranium mineralization in the Clarno and John Day Formations, Bear Creek Butte area, Crook County, Oregon: Oregon Geology, v. 49, p. 103-110.

PRESENTATIONS

Cummings, M. L., 1987, Mineralization in the Tertiary volcanic province, Oregon, U. S. A., [abs.]: XVI Pacific Science Congress, Seoul, Korea, Abstracts, v. 1, p. 61.

Cummings, M. L., and Growney, L. P., 1988, Basalt hydrovolcanic deposits in the Dry Creek arm area of the Owyhee Reservoir, Malheur County, Oregon: Sedimentary features and stratigraphy [abs.]: Abstracts with Program Geological Society of America, v. 20, no. 6, p. 411.

McCulloch, W. R., and Cummings, M. L., 1988, Metamorphic assemblages in mafic and ultramafic bulk compositions, Tobacco Root Mountains, Southwest Montana [abs.]: Abstracts with Program Geological Society of America, v. 20, no. 6, p. 431.

Cummings, M. L., 1990, Stratigraphy, structure, and mineralization of the Deer Butte Formation, West of Lake Owyhee, Malheur County, Oregon [abs.]: Abstracts with Program Geological Society of America, v. 22, no. 3, p. 16.

Fassio, J. M., and Cummings, M. L., 1990, Geochemistry of ferruginous bauxite developed from Columbia River Basalt, southwestern Washington [abs.]: Abstracts with Program Geological Society of America, v. 22, no. 3, p. 22.

McCulloch, W. R., and Cummings, M. L., 1987, Metasomatism between Archean age metamorphosed mafic and ultramafic rock, Tobacco Root Mountains, Montana [abs.]: Abstracts with Program Geological Society of America, v. 19, no. 5, p. 320.

Northwest Science Expo (high school!), Portland State Univ., March 30-31, 1990

Smith, Cynthia, The Rate of Iridium Absorption in Fast Growing Brassicas, Oregon Episcopal School, Portland, OR

Yruegas, Jennifer, Factors Affecting Distribution of *Lepidium davisii* in Malheur County, OR, Nyssa High School, Nyssa, OR (First Place--Botany)

Howard, Morning Dove, Neutron Activation Analysis of Mineral Retention in Clinoptilolite Zeolite--Phase II, Gold Beach High School, Gold Beach, OR (First Place--Earth/Space Science)

Schulthies, Becky, Reduction of Plant Uptake of Metal Ions Using Zeolite, Nyssa High School, Nyssa OR (First Place--Environmental Science)

APPENDIX A
Reactor Tours, Demonstrations, Experiments and Research Projects
1989-90

| DATE | Institution | Group | Faculty | Students (or participants) | Activities | Funding |
|----------|------------------------|-------------|-------------------|-------------------------------|-----------------------------------|---------|
| 8/23/89 | Reed | Orientation | Admissions Office | 20 | Parents & new students | --- |
| 9/5/89 | Reed | Chemistry | J. Witte | 1 | Prelim. CI, P determination | --- |
| 9/6/89 | Reed | Chemistry | J. Witte | 1 | Prelim. CI, P determination | --- |
| 9/19/89 | Marietta College, Ohio | Geology | F. Voner | 1 | INAA; trace elements in muscovite | USDOE |
| 9/20/89 | Portland State | Geology | M. Cummings | 1 | Owyhee research | USDOE |
| 9/20/89 | Reed | Chemistry | J. Witte | 1 | CI, P determinations | --- |
| 9/20/89 | NEA Labs | | B. Tansy | 0 | Irrad. (1 hour) | NEA |
| 10/2/89 | Reed | Nat. Sci. | T. Dunne | 10 | Reactor Tour; Half-life Exp. | --- |
| 10/3/89 | Reed | Nat. Sci. | T. Dunne | 8 | Reactor Tour; Half-life Exp. | --- |
| 10/3/89 | OHSU | Dentistry | D. Downey | 1 | INAA; gum tissue | USDOE |
| 10/4/89 | Reed | Chem. Dept. | --- | 5 | Faculty Tour | --- |
| 10/4/89 | Reed | Nat. Sci. | T. Dunne | 10 | Reactor Tour; Half-life Exp. | --- |
| 10/4/89 | Portland State | Geology | M. Cummings | 1 | INAA; Owyhee research | PSU |
| 10/4/89 | NEA Labs | | B. Tansy | 0 | Irrad. (6 hours) | NEA |
| 10/5/89 | Reed | Nat. Sci. | T. Dunne | 7 | Reactor Tour; Half-life Exp. | --- |
| 10/6/89 | Reed | Nat. Sci. | T. Dunne | 8 | Reactor Tour; Half-life Exp. | --- |
| 10/9/89 | | | | 4 | Reactor Tour; Accre. Comm. | --- |
| 10/11/89 | NEA Labs | | B. Tansy | 0 | Irrad. (7 hours) | NEA |
| 10/13/89 | Lane Mid. Sch. | | | 1 | Reactor Tour | |
| 10/17/89 | Portland State | Geology | M. Beeson | 1 | INAA; Arsenic in soil | PSU |
| 10/17/89 | OHSU | Dentistry | D. Downey | 1 | INAA; gum tissue study | USDOE |
| 10/25/89 | NEA Labs | | B. Tansy | 0 | Irrad. (8 hours) | NEA |
| 10/31/89 | OHSU | Dentistry | D. Downey | 1 | INAA; gum tissue study | USDOE |
| 10/31/89 | Warner Pacific | Chemistry | D. Canoy | 1 | Sr. proj. planning and tour | USDOE |
| 10/31/89 | OHSU | Dentistry | D. Downey | 1 | INAA; gum tissue | USDOE |

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|------------|------------------------|---------------------------------|----------------|-------------------------------|---|---------|
| 10/31/89 | NEA Labs | | B. Tansy | 0 | Irrad. (1 hour) | NEA |
| 11/1/89 | Warner Pacific | Chemistry | D. Canoy | 1 | Irrad., Selenium in sediments | USDOE |
| 11/1/89 | NEA Labs | | B. Tansy | 0 | Irrad. (7 hours) | NEA |
| 11/8/89 | Rex Putnam H.S. | Gen. Chem. | T. Wooster | 14 | Demo, Neutron Activation Analysis of Lanthanum in Rock | USDOE |
| 11/9/89 | Reed | Chem. 315 | D. Gerrity | 4 | RRF Tour; trace elemts. in Al foil | --- |
| 11/9/89 | --- | MESA | | 6 | Reactor Tour | USDOE |
| 11/15/89 | Rex Putnam H.S. | Gen. Chem. | T. Wooster | 17 | Demo, Neutron Activation Analysis of La in Rock | USDOE |
| 11/28/89 | Reed | Admissions | | 3 | Student Tours | --- |
| 11/28/89 | NEA Labs | | B. Tansy | 0 | Irrad. (3 hours) | NEA |
| 11/29/89 | Hood River Valley H.S. | Science | L. Mitchell | 11 | Tour, Half-life Exp., INAA demo. | USDOE |
| 11/29/89 | NEA Labs | | B. Tansy | 0 | Irrad. (7 hours) | NEA |
| 12/1/89 | Reed | Chem 315 | D. Gerrity | 5 | Tour; trace elemts. in Al foil | --- |
| 12/4/89 | Reed | Admissions--Seattle students | | 6 | Tour and demonstration | --- |
| 12/6/89 | NEA Labs | | B. Tansy | 0 | Irrad. (7 hours) | NEA |
| 12/11/89 | NEA Labs | | B. Tansy | 0 | Irrad. (7 hours) | NEA |
| 1/5/90 | Portland State | Geology | M. Beeson | 1 | irrad. for Masters Thesis, B. Lira | USDOE |
| 1/16/90 | Reed TAG | Nuc. Science | D. Love | 3 | Tour | USDOE |
| 1/24/90 | Portland State | Geology | M. Cummings | - | Geology of Owyhee gold region | PSU |
| 1/29-30/90 | Nyssa H.S. | Independent | M. Omberg | 1 | Science project, Jennifer Yruegas | USDOE |
| 1/31/90 | OMSI | HS students | B. Hanshumaker | 17 | Tour; INAA demo; half-life | USDOE |
| 1/31/90 | Mt. Hood C. C. | Occupational Safety & Health | B. Woodhull | 18 | Tour & demo | USDOE |
| 2/1/90 | Warner Pacific | Chemistry | D. Canoy | 1 | Tour; Se in tissue | USDOE |

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|---------|------------------------|-------------|-------------|-------------------------------|--|---------------|
| 2/6/90 | Nyssa H.S. | Independent | M. Ohberg | 1 | Irrad. for B. Schulthies | USDOE |
| 2/6/90 | Oregon Epis. School | Independent | B. Lamb | 1 | Irrad. for C. Smith | USDOE |
| 2/6/90 | Gold Beach H.S. | Independent | J. Kuper | 1 | Irrad. for M. Howard | USDOE |
| 2/13/90 | Lawrence Berkeley Labs | Geology | F. Asaro | - | Irrad. of samples | U.C. Berkeley |
| 2/13/90 | Reed | Chem 110 | A. Glasfeld | 9 | Tour, demo, half-life including Ag dime (optional lab) | --- |
| 2/15/90 | Reed | Chem 110 | A. Glasfeld | 4 | Tour, demo, half-life including Ag dime (optional lab) | --- |
| 2/16/90 | Reed | Chem 110 | A. Glasfeld | 9 | Tour, demo, half-life including Ag dime (optional lab) | --- |
| 2/23/90 | Nyssa H.S. | Science | M. Ohberg | 22 | Tour, demo, neutron activity analysis | USDOE |
| 2/23/90 | Portland State | Geology | M. Cummings | 1 | Owyhee research | USDOE |
| 2/27/90 | Portland State | Geology | M. Cummings | 1 | Fassio, thesis res., OR bauxite depo. | USDOE |
| 2/27/90 | Reed | Chemistry | M. Pollock | - | Irrad., gold ore for symp. demo 3/3 | --- |
| 3/3/90 | Reed | Chemistry | M. Pollock | 12 | Half-life exp.; Deter. of gold in ore sample | Dow Chemical |
| 3/20/90 | PSU | Geology | M. Cummings | 1 | Fassio thesis res.; autoradiography | USDOE |
| 3/29/90 | Gold Beach H.S. | Independent | J. Kuper | 1 | Irrad. for M. Howard research; zeolite | USDOE |
| 3/29/90 | Pacific | Physics | Brosing | 1 | Tour for research student | --- |
| 4/3/90 | Portland State/USC | Geology | M. Cummings | | Joint project with USC; irradiation of samples | USDOE |
| 4/10/90 | Boy Scouts | --- | K. Wetzel | 4 | Tour, demo | USDOE |
| 4/18/90 | Portland State | Geology | M. Beeson | 1 | Thesis research, Karen Boelling | USDOE |
| 4/21/90 | Saturday Science Symp. | | | 50 | H.S. students; Lecture on natural vs man-made radioactivity; labs on identification of natural radiation sources | --- |

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|---------|--|------------|-----------------|-------------------------------|---|---------|
| 4/26/90 | Portland State | Geology | M. Beeson | 9 | Adv. geochem. proj. irradi. | USDOE |
| 4/27/90 | Reed | Thesis | B. Reynolds | 1 | Bruce Stephenson; Radiation effects on organic dyes | — |
| 5/2/90 | Gaston H.S. | Chemistry | G. Gorchels | 21 | Tour; half-life experiment | USDOE |
| 5/2/90 | Portland State | Geology | M. Beeson | 9 | Adv. geochem. proj. irradi. | USDOE |
| 5/7/90 | Portland State | Geology | M. Beeson | 2 | Tour | — |
| 5/7/90 | Warner Pacific | Chemistry | D. Canoy | 5 | Analytical Chem lab on Neutron Activation Analysis | USDOE |
| 5/10/90 | Lewis & Clark | Chem/Phys. | T. Bennett | 9 | Tour, demo, Ba half-life, Ag-dime | USDOE |
| 5/21/90 | Portland State (with Stanford & Idaho Geologic Survey) | Geology | M. Cummings | 4 | irradi. | USDOE |
| 5/22/90 | Oregon Museum of Science and Industry | | B. Hanschumaker | 5 | Irradi. of Soil Samples from new museum site | USDOE |
| 5/23/90 | Portland State | Geology | M. Beeson | 9 | Tour, demo, advanced geochem class | USDOE |
| 5/25/90 | Northwest Hazardous Materials Managers | | C. Savage | 26 | Tour, Demo | — |
| 5/31/90 | International Materials Management Assoc. | | | 8 | Tour, Demo | — |
| 6/12/90 | Reed Security Office | | B. Curtin | 7 | Tour | — |
| 6/13/90 | Portland State | Geology | M. Beeson | 1 | K. Boelling Thesis | USDOE |
| 6/22/90 | Oregon Graduate Institute, Apprenticeship in Science & Engineering (ASE) | | W. Lamb | 1 | K. Ducusin irradi. of oil samples | USDOE |
| 7/3/90 | CGI | ASE | W. Lamb | 1 | Second oil irradi. | USDOE |
| 7/10/90 | Oregon State Fire Marshalls office | | | 3 | Tour | — |
| 7/19/90 | U. of Oregon | Chemistry | D. Johnson | 1 | C. Grant graduate research irrads. | USDOE |
| 7/20/90 | U. of Oregon | Chemistry | D. Johnson | 1 | C. Grant graduate research irrads. | USDOE |
| 7/24/90 | Lewis & Clark | Geology | M. Pollock | 4 | Tour, Demo, half life lab | USDOE |

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| DATE | Institution | Group | Faculty | Students (or participants) | Activities | Funding |
|---------|-------------|-------------|-------------|-------------------------------|---|---------|
| 7/25/90 | Reed | Chemistry | A. Glasfeld | 1 | Development of lab for C110, Introductory Chem Class | — |
| 7/26/90 | OGI | ASE | W. Lamb | 1 | Flux measurements | USDOE |
| 7/27/90 | | | | | Tour | |
| 7/30/90 | OGI | ASE | W. Lamb | 1 | Flux measurements, hair sample irrad. | USDOE |
| 7/31/90 | OHSU | Dentistry | O. Downey | 1 | Metals in gum tissue, pilot study | USDOE |
| 8/2/90 | OGI | ASE | W. Lamb | 1 | Flux measurements | USDOE |
| 8/7/90 | OGI | ASE | W. Lamb | 1 | Osteoporosis correlation to hair composition | USDOE |
| 8/21/90 | Reed | Orientation | | 10 | Tour, Demo | — |
| 8/22/90 | Reed | Orientation | | 13 | Tour, Demo | — |
| 8/22/90 | NEA Labs | | B. Tansy | 0 | Irrad. (3 hours) | NEA |
| 8/23/90 | Reed | Orientation | | 5 | Tour, Demo | — |
| 8/28/90 | NEA Labs | | B. Tansy | 0 | Irrad. (3 hours) | NEA |

NUCLEAR REGULATORY COMMISSION
 SHARED INFORMATION NETWORK
 OPERATIONS OFFICERS SUPPORT SYSTEM
 EVENT NOTIFICATION - RESEARCH FACILITIES

EVENT NUMBER: 22311

FACILITY:
 UNIT NO:
 REGION: 5
 DOCKET NO: 050-00288 -- --
 LICENSE TYPE:
 STATE: OR
 EMERGENCY: UNU Unusual Event
 LICENSE NO: R-112
 LICENSEE:
 REPORT REQUIRED BY: AEC 50.72 (a)(1)(i)

EVENT DATE: 11/23/
 EVENT TIME: 15:15
 NOTIFY DATE: 11/23/
 NOTIFY TIME: 22:57
 CALLER: MICHEA
 OPS OFFICER: THOMAS
 NOTIFIED: RDO S
 EO J
 R5 W
 FEMA L

| UNIT | SCRAM CD | RX CRITL | INIT PWR | INIT RX MODE | CURR PWR | CURR RX |
|------|----------|----------|----------|--------------|----------|---------|
| | N | N | 000 | | 000 | |

DESCRIPTION TEXT

MICHAEL POLLACK OF REED COLLEGE, CALLED TO REPORT THAT THEY DECLARED AN UNUSUAL EVENT AT 1515 PST WHEN THE GAS STACK MONITOR ALARMED AT THEIR TRIGA REACTOR FACILITY. THE REACTOR WAS BEING OPERATED AT THE LICENSED LIMIT OF 250 KW THERMAL AT THE TIME. AN IRRADIATION EXPERIMENT WAS IN PROGRESS IN WHICH THE REACTOR HAD BEEN OPERATING FOR ABOUT 5 HOURS. REED COLLEGE'S LICENSE NUMBER IS R112 AND DOCKET NUMBER IS 050-00288. THE COLLEGE IS LOCATED IN PORTLAND, OREGON. THE LICENSEE'S EMERGENCY PLAN REQUIRES DECLARING AN UNUSUAL EVENT WHEN ANY MONITORS ALARM DURING OPERATION. THE LEVELS ARE WELL BELOW THE ALERT LEVEL (100 TIMES AN ALARM SETPOINT). THE GAS STACK MONITOR, THE PARTICULATE MONITOR AND THE CONTINUOUS AIR MONITOR ARE ALARMING. THE PARTICULATE MONITOR IS READING ABOUT 2.5 TIMES THE ALARM SETPOINT, THE GAS STACK MONITOR IS READING 3 TIMES THE ALARM SETPOINT AND THE AIR MONITOR IS READING 15 TIMES THE ALARM SETPOINT. AN AIR SAMPLE INDICATES RB-88 IS PRESENT LEADING THE LICENSEE TO BELIEVE THAT THERE IS FUEL LEAKAGE. THE REACTOR WAS SHUT DOWN AND THE REACTOR ROOM WAS EVACUATED AND ISOLATED. APPROXIMATELY 100 CFM IS BEING VENTED FROM THE REACTOR ROOM THROUGH FILTERS. THE LICENSEE ESTIMATES THAT 15 MICRO-CURIES / MINUTE IS BEING RELEASED. THE LICENSEE DOES NOT HAVE OUTSIDE MONITORING EQUIPMENT. THE LICENSEE HAS NOTIFIED THE OREGON STATE HEALTH DIVISION, THE OREGON DEPARTMENT OF ENERGY AND COLLEGE OFFICIALS. THE OREGON STATE HEALTH DIVISION HAS BEEN REQUESTED TO PROVIDE MONITORING ASSISTANCE. THE HOO SET UP A BRIDGE CONFERENCE CALL BETWEEN THE MR. POLLACK, RICHARDS (R5DO), WENSLAWSKI (REGION 5), ROE (NRR-EO), MICHAELS (NRR), AND RAHZVI (GENERAL ATOMIC).
 ***UPDATE 11/24/91 @ 0800 EST *** COMMISSIONERS ASSISTANTS BRIEFING
 AEOD ZECH; COMM ASSTS DOOLITTLE, TRIMBLE, KARMAN & VIETTI-COOK;
 EDO SHANKLIN, SNIEZEK & TAYLOR; EO ROE; NRR MICHAELS; PA FOUCHARD & GAGNER;

c/14

NUCLEAR REGULATORY COMMISSION
SHARED INFORMATION NETWORK
OPERATIONS OFFICERS SUPPORT SYSTEM
EVENT NOTIFICATION - RESEARCH FACILITIES

EVENT NUMBER: 22311

REG 5 COOK, FAULKENBERRY, RICHARDS & WENSLAWSKI; SP KAMMERER

***UPDATE 11/24/91 @ 1030 EST *** CONFERENCE CALL

DISCUSSION OF CURRENT STATUS OF RECOVERY EFFORTS LICENSEE (POLLACK) AND
REGION 5 (FAULKENBERRY, WENSLAWSKI & RICHARDS)

***UPDATE 11/24/91 @ 1500 EST *** CONFERENCE CALL

PRELIMINARY BRIEFING OF SITE TEAM

LICENSEE (POLLACK), REGION 5 (FAULKENBERRY, REESE, WENSLAWSKI)

***UPDATE 11/24/91 @ 1700 EST *** COMMISSIONERS ASSISTANTS' BRIEFING

BOBBY FAULKENBERRY - REGION 5, BRIEFER

AEOD (ZECH, WEISS), EO (ROE), PA (FOUCHARD, GAGNER),

REGION 5 (FAULKENBERRY, WENSLAWSKI, REESE), NRR (MICHEALS, MIRAGLIA, WEISS)

EDO (SNIEZEK, SHANKLIN)

***UPDATE 11/24/91 @ 1843 EST *** BY POLLACK TAKEN BY T ANDREWS

LICENSEE TERMINATED UNUSUAL EVENT AT 1530 PST WHEN RADIATION LEVELS IN THE
REACTOR ROOM RETURNED TO ACCEPTABLE LEVELS. THE LICENSEE WILL BE NOTIFYING
STATE AND LOCAL OFFICIALS AT A PRESS CONFERENCE SCHEDULED FOR 1600 PST.

HOO NOTIFIED R5DO (RICHARDS), EO (ROE), FEMA (HIRST)

REED COLLEGE
FUEL LEAKAGE
NOVEMBER 23, 1991

PROBLEM

RADIATION MONITORS IN REACTOR ROOM ALARMED INDICATING A RELEASE OF RADIATION.

CAUSE

RADIATION RELEASE BELIEVED TO BE CAUSE BY PIN HOLE LEAK OR CRACK IN FUEL ROD CLADDING .

SAFETY SIGNIFICANCE

POTENTIAL TO CONTAMINATE REACTOR ROOM PERSONNEL.

DISCUSSION

- THE 250 KW (THERMAL) TRIGA REACTOR WAS BEING USED TO CONDUCT A SIX HOURS IRRADIATION EXPERIMENT.
- FIVE HOURS INTO THE EXPERIMENT THE GAS STACK MONITOR, THE PARTICULATE MONITOR AND THE CONTINUOUS AIR MONITOR ALARMED.
- SET POINTS AND READING FOR THE MONITORS ARE:

| <u>MONITOR</u> | <u>SET POINT</u> (COUNTS/MIN) | <u>READING</u> (COUNTS/MIN) |
|----------------|----------------------------------|--------------------------------|
| GAS STACK | 90 | 300 |
| PARTICULATE | 40,000 | 20,000 |
| CONTINUOUS AIR | 3,600 | 50,000 |

- REACTOR WAS SHUTDOWN AND REACTOR ROOM EVACUATED.
- REACTOR ROOM WAS VENTED THROUGH HEPA FILTERS AT 100 CFM RELEASING ABOUT 15 MICRO-CURIES/MIN. LICENSEE ESTIMATED THAT TOTAL RELEASE WAS ABOUT 68 MILLI-CURIES DUE TO NOBLE GASES (Kr) AND RUBIDIUM.
- LICENSEE HAS NO OUTSIDE MONITORING EQUIPMENT.
- NO PERSONNEL WERE CONTAMINATED OR RECEIVED MEASURABLE EXPOSURES.

FOLLOWUP

- OREGON STATE HEALTH DIVISION SURVEY AREA OUTSIDE REACTOR ROOM AND DID NOT DETECT ANY RADIATION ABOVE BACKGROUND.
- LICENSEE SAMPLE ONE LITER OF POOL WATER AND FOUND SLIGHT TRACES OF NOBLE GASES. NO IODINE OR RUBIDIUM FOUND.
- LICENSEE IS PLANNING TO DEVELOP PROCEDURES TO DETERMINE HOW TO LOCATE LEAKING FUEL ELEMENT.
- REGION IS PREPARING A CONFIRMATORY ACTION LETTER.
- THERE HAS BEEN CONSIDERABLE MEDIA INTEREST IN THIS EVENT. LICENSEE HAS ISSUED NEWS RELEASE AND HAS HELD PRESS CONFERENCE.

CONTACT: T. GREENE
REFERENCE: 10 CFR 50.72 #22311

AIT: NO
SIGEVENT: NO

C/115

METRO

Leak forces Reed reactor shutdown

— An NRC official says public safety is not threatened by the small amount of the isotope krypton 88 that escaped

By NAOMI KAUFMAN PRICE
of The Oregonian staff

A pinhole leak in a fuel rod released a small amount of radioactive gas from Reed College's nuclear reactor, forcing its shutdown, officials reported Sunday.

Alarms went off at 2:15 p.m. Saturday. The two operators — both Reed students — quickly shut down the 83-year-old small research reactor and evacuated the control room as a precaution. The reactor room is

separate from the control room, and officials said neither student was exposed to any radiation.

A "very, very limited amount" of the isotope krypton 88 escaped outside the building before the exhaust fan automatically shut off, said Michael Pollock, acting director of the Reed reactor.

"Our assessment indicates no threat to public safety," said Greg Cook, a spokesman for the U.S. Nuclear Regulatory Commission.

None of the inert gas was detectable a short time later when the Oregon State Health Division took measurements, officials reported. Krypton 88 has a half life of 2.8 hours. That means half of it decays in that time; half of the rest decays in the next 2.8 hours, and so on, until it's all decayed.

The NRC was contacted Saturday and flew in an inspection team Sunday from San Francisco.

The 28-inch-long fuel rods will be inspected. "There's no way to know yet which element has the leak," Cook said. He termed it a pinhole leak.

Pollock and NRC officials said all but three of the 60 fuel elements have been used

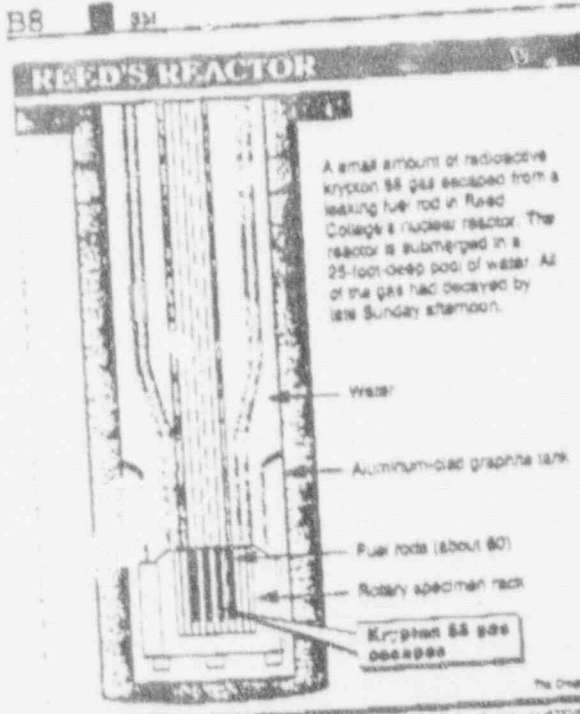
since the reactor began operation. They said, however, that they couldn't say yet whether age caused the stainless steel-zirconium alloy rod to leak.

Pollock said the age of the reactor is of continuing concern. But he said Cook said fuel rods elsewhere have developed leaks and Cook said, "It can happen — a new element. When it does occur, the amount released is relatively small."

The radiation within the reactor room was down to normal levels by late Sunday afternoon. In any case, the level never

Please turn to REACTOR, Page 6B

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/11
/12



Right: Michael Pollock, acting director of the Reed College nuclear reactor, holds a medal of the unit as he explains how a fuel cell in the reactor, above, could have caused a radioactive gas leak.



Reactor: NRC files inspection team to college

Continued from Page B1
exceeded one-tenth of a millirem — and Cook said a person would be exposed to about 3 millirems of radiation during a cross-country airplane flight.
The reactor won't be restarted until after an investigation and evaluation with General Atomic, the builder of the Triga Mark I water-cooled reactor. The restart probably will occur early next year.
The reactor's fuel rod assembly is about the size of a washing machine, contained in a 25-foot-deep, 15-by-20-foot oval pool of water. A cylindrical array of fuel rods is encased by a sample rack.
The purpose of the reactor is to make radioactive samples of various materials, from human hair to small

rocks. The process is called neutron activation.
The various elements in the sample then will give off varying amounts of radiation. These elements — gold, for example — can be measured in minute quantities.
The Reed reactor pales in comparison with commercial ones. Its output is 150,000 watts, compared with about 88 million watts from a typical commercial reactor.
Reed is the only undergraduate college in the country with its own reactor. It is used mainly for research — a Nyssa High School student's project that is analyzing a mineral that is a potential waste filter will be among those affected by the shutdown, Pollock said.
Jim Rees, one of the two NRC

investigators, said he wasn't concerned that both operators were students and no staff member was present. The operators had to pass the same certification requirements as those at commercial reactors, he said.
Their qualifications, Cook added, are "every bit as adequate as the operators of the Trojan reactor. No individual operator error was involved."
No alarms went off outside the reactor area, which is at the northwest end of Reed's chemistry building.
Reed is located in a Southeast Portland residential neighborhood. Harriet Watson, college spokeswoman, said neighborhood associations

and students were informed of the incident.
Lloyd Marbet, an anti-nuclear activist, said after a Reed news conference Sunday afternoon that the age of the reactor concerned him.
Both student operators were classified as senior reactor operators with more than a year's experience. "They are not novice operators by any means," Pollock said. He and the NRC officials said both young people performed well.
The incident was categorized as an "unusual event," a low level emergency requiring operators to leave the area. The status was lifted Sunday afternoon after the krypton 88 decayed below detectable levels.
Reed will bear the cost of the NRC's investigation, Cook said.

C/16

EUGENE PEACEWORKS
454 WILLAMETTE ST.
EUGENE, OR. 97401

(503) - 343-8548

JANUARY 16, 1992

FREEDOM OF INFORMATION ACT REQUEST

FREEDOM OF INFORMATION
ACT REQUEST

To: Office Of Chairperson
Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, Maryland 20852

FOIA - 92-35

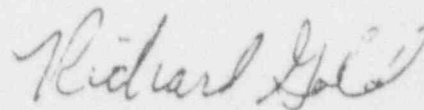
Rec'd 1-23-92

Re: FOIA Request concerning experimental Nuclear Facility at Reed College
Portland, Oregon.

Dear NRC,

I am a volunteer member of *Eugene PeaceWorks* a non-profit public organization whose members are interested and concerned about the spread of Nuclear technology and waste in our state. We are currently organizing a public forum in Eugene and will continue to organize other public forums on the state of the Nuclear industry in Oregon. One of our members found an interesting recent (December 1991) article in our local paper, *the Register-Guard*, about a Nuclear accident at an Experimental Nuclear Facility at *Reed College*, Portland, Oregon. Could you send copies of any and all documents you have regarding this facility within 10 (ten) days. Would you also send a description (including map with location if available)? We will share this information with the public and make ourselves available for interviews with local news agencies concerning this issue of critical importance to all Oregonians. We will also donate this material to our local public library.

Sincerely,



Richard Gold

9210280113