REED COLLEGE



Portland, Oregon 97202

October 22, 2007

Document Control Desk US Nuclear Regulatory Commission Washington, DC 20555

Docket 50-288

REACTOR FACILITY

Enclosed is Reed College Reactor's Annual Report. Also enclosed is last year's report in case you didn't receive it.

Please feel free to contact me for additional information.

Regards,

Stephen G. Frantz Director, Reed College Reactor

, U20 RR

3203 SE Woodstock Blvd., Portland, OR 97202-8199

503-777-7222 Fax: 503-777-7274 reactor@reed.edu

REED RESEARCH REACTOR ANNUAL REPORT



September 1, 2006 -- August 31, 2007

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REED RESEARCH REACTOR ANNUAL REPORT



September 1, 2006 -- August 31, 2007

3203 Southeast Woodstock Blvd. Portland, Oregon 97202-8199 503-777-7222 Fax: 503-777-7274 http://reactor.reed.edu reactor@reed.edu

Stephen G. Frantz Director, Reed Research Reactor Program Director, Nuclear Science Consortium of the Willamette Valley

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OVERVIEW

This report covers the period from September 1, 2006 to August 31, 2007, and is intended to fulfill the reporting requirements of the U.S. Nuclear Regulatory Commission, the U.S. Department of Energy, and the Oregon Department of Energy including:

- U. S. NRC, License No. R-112, Docket 50-288
- Oregon Office of Energy Rule No. 345-030-010
- U. S. DOE Reactor Sharing Grant No. DE-FG07-02ID14387
- U. S. DOE Reactor Instrumentation Grant No. DE-FG07-04ID14573

We specifically wish to thank other funding sources including:

Portland General Electric

Concordia University

Reed College operates a TRIGA[®] Mark I reactor with zirconium hydride/uranium fuel elements in a circular grid array at the bottom of a 25-foot-deep tank of water and are surrounded by a graphite reflector. The fuel is enriched to 19.9% in uranium-235.

The Reed College Research Reactor has been a resource for research and educational projects in the Portland area since 1968. The main uses of the Reed Research Reactor are instruction and research, especially in the field of trace-element analysis. In addition to providing student research opportunities, the reactor staff works to educate the surrounding community on the principles of nuclear energy and radiation safety.

There were 2272 individual visits to the Reactor Facility during the year. Most were students in classes at Reed College or area universities, colleges, and high schools. Including tours and research conducted at the facility, the Reed Research Reactor contributed to the educational programs of 9 colleges and universities in addition to 15 pre-college groups. The reactor was operated 297 times on 119 days. The thermal energy produced was 38 megawatt-hours.

The reactor staff consists of a Director, an Associate Director, a Health Physicist, and Reed College undergraduate students who are licensed by the Nuclear Regulatory Commission as reactor operators or senior reactor operators. As this report is being written the licensed operating staff consists of 19 women and 23 men. During the reporting period, all 12 reactor operator candidates passed their NRC exams and all 9 senior reactor operator candidates passed their NRC exams.

There were no radiation exposures to individuals in excess of one percent of the limit during the year. There were no releases of liquid radioactive material from the facility and airborne releases were well within regulatory limits. There was one shipment of radioactive waste.

The Nuclear Regulatory Commission conducted their annual inspection during January 2007. There were no violations or concerns. There were no follow up items.

Reed Research Reactor Annual Report 2006-2007

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PEOPLE

Facility Staff

During the period September 1, 2006 to August 31, 2007, the facility staff consisted of:

Reactor Director:	Stephen Frantz (4/94 – Present)
Associate Director:	Vanessa Holfeltz (7/07 – Present
	Susan Beaver (7/06 – 6/07)
Reactor Supervisor:	Robin Bjorkquist (8/07 – Present)
	Craig Wagner (8/06 – 6/07)
Training Supervisor:	Tiffany Cook (8/07 – Present)
	Juliana Arrighi (8/06 – 6/07)
Requalification Supervisor:	Griffen Thoma (8/07 – Present)
Radiation Safety Officer:	Kathleen Fisher (1/03 – Present)
Health Physicist:	Becky Day (4/07 – Present)
	Marshall Parrott (8/91 – 10/06)

Susan Beaver

Tiffany Cook

Hilary Gray

Sarah Kemp

Grant Meadors

Elliot Naidus Alton Sartor

Kayce Spear

Gillian Woodruff

Steven Case with a sugar shell Michael Chaffin

Senior Reactor Operators (SRO):

Juliana Arrighi Rachel Bond Thomas Chartrand Stephen Frantz Cindy Joe Kristen Lavavej Marianna Mullens Joseph Parmalee Julia Schornack Craig Wagner

Reactor Operators (RO):

Constance Bailey Asher Davidson Rachel Fordyce Edward Griffith Kimberly Hartfield Matthew King Judith Levine Anna McGee Will Rosenbaum Jonah Simpson Daniel Wall Quincy Cardinale Allison Edgar Angela Frey Alex Gurfinkel Casey Hurstell Jordan Kohn Christine Lewis Alex Ragus Jacob Schwartzman Erin Smith Trevor Young

Fluffy Cass Michael Flashman Ryan Gersovitz Jeremy Harper Matthew Jemielita Reuven Lazarus Eric Lindsey Carl Rodriguez Emma Seward Sarah Spiegel

Robin Bjorkquist

Benjamin Fischer

Vanessa Holfeltz

Rebecca Schoenberg-Jones

Molly King

Tracy Mehoke Derek Oldridge

Griffen Thoma

Reed Research Reactor Annual Report 2006:2007. https://www.A. https://

The list of operators includes everyone who held a license at any time during the second reporting period. ROs who upgrade their licenses to SRO during the reporting period are listed under SRO. All staff members are Reed College undergraduate students except Mr. Frantz, Ms. Holfeltz, Ms. Beaver, Ms. Fisher, Ms. Day, and Dr. Parrott. 191009 (1910)

It is with sadness we note the passing of Dr. Marshall Parrott, who worked at the reactor for 16 years, and is greatly missed by all of us. I could a public of public a tomest end to obtain a alpha spectrometers, a where been are a gament prominent counters, ion charaber As this report is being written there are 9 women and 14 men with Reactor Operator licenses and 10 women and 9 men with Senior Reactor Operator licenses field the second in anoiear science and radiation de ections a workaud and shok monitors are in the r 10 Reactor Review Committee a survey state and survey at state the institution bingit A. mach Turship director for ansalva latevez and valling in main

The Reed Research Reactor has two oversight committees: the Radiation Safety Committee and the Reactor Operations Committee, Together they comprise the Reactor Review Committee. The Radiation Safety Committee is concerned with emergency preparedness, health physics, radiation safety, physical security, environmental impact. and the interface between the Reed Research Reactor, Reed College, and the surrounding community. The Reactor Operations Committee deals with the day, to-day operations of the reactor, reactor maintenance, reactor safety, operator training, and operator (10) (m. 1) regualification. The membership of the committees during the reporting period is shown of each sample receives the same neutron flux. Typically in escape are the rough in swoled when long brodiation times (generally greases and offer that its are required

Radiation Safety Committee, a billion 1 dear galialor a mi xult acutuen ierarali enuixorqa. Tom Meek , Chair (Radiation Protection Manager, Trojan Nuclear Power Plant) Norm Dyer (Neighborhogd Resident) and the dw (nimital & Resident) and the Norm Dyer (Neighborhogd Resident) and the dw (nimital birector, Portland General Electric) Kathleen Fisher (Director, Reed Environmental Health and Safety) <u>Moleve rolenstit piternon(i</u>

Reactor Operations Committee

Steve Reese - Chair (Radiation Center Director, Oregon) State University) pitane and on T Johnny Powell (Physics Faculty, Reed College) and boursorad at bus such and a grit -Daniel Gerrity (Chemistry Faculty, Reed College) of rotage and to no but it borrolacen

Juliet Brosing (Physics Faculty, Pacific University) Juliet Brosing (Physics Faculty, Pacific University) Juliet Brosing Seligence (International Seligence) (International Se Ex Officio (without vote) on Both Committees. rouser of of men violandal edi ni mereve Peter Steinberger, (Dean of the Faculty, Reed College) is the initial anison of the faculty, Reed College, Stephen Frantz (Director, Reed Research Reactor) Susan Beaver (Associate Director, Reed Research Reactor) Čraig Wagner (*Reactor Supervisor*) Juliana Arrighi (*Reactor Training Supervisor*) 16400

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regraduate studiests except Mr.	1.1 under SRO. All staff mernh minder Sec. C. soge in
Reactor Facility pears 1 and	Ms. Holto' Mar Seeven and Frederic A.

In addition to the reactor, the Reed College has a radiochemistry lab. The equipment available at the reactor facility includes high purity germanium gamma spectrometers, alpha spectrometers, a whole body counter, gas flow proportional counters, ion chambers, beta counters, Geiger Muller tubes, neutron detectors, alpha detectors, and thermo luminescent dosimeter readers. These instruments are used for experiments and training in nuclear science and radiation detector. Two hand and shoe monitors are in the control room. A liquid scintillation detector serves the campus radioisotope committee. The, reactor facility has several systems for performing irradiations, described below.

The Peed Research Returns two or artight to mnittees, the Radiation Safety is offee and the Reactor Operations Occupius **wilfford wilfs and will gaitaton** and the Reactor Operations of the Resolution Set in the els concerned with emergency

The rotating specimen rack ("lazy susar") is located in a well on top of the graphite reflector surrounding the dore. The rack consists of a circular array of 40 tubular receptacles, each of which can accommodate two irradiation tubes. Vials holding up to 17 ml (four drams) are used in this system. 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, researchers use the rotating rack when long irradiation times (generally greater than five minutes) are required. The approximate thermal neutron flux in a rotating rack position at full power is the 1.7 x10¹² m/cm² with a cadmium ratio of 6. The specimen rack can be used for gamma irradiations (approximately 8 Rad/min) when the reactor is shutdown: $\frac{1}{10^{12}}$ is the rotating tradiation in the reactor is shutdown.

Kerness, Fisher (Director, Reed E pitronnontal Health and Safery) Market System

The pneumatic transfer system ("rabbit") consists of an irradiation chamber in the outer F-ring of the core and 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.

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 laboratory next to the reactor and is then transferred pneumatically into the core-irradiation position. At the end of a predetermined time 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 $5x 10^{12}$ n/cm s when the reactor is at full power.

Reed Research Reactor Annual Report 2006-2007 Strong to Summission 25

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In-Core Facilities

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The central thimble is a water-filled irradiation chamber about 3 cm in diameter. It provides the highest available neutron flux, about $1 \times 10^{13} \text{ n/cm}^2$ s. Special sample holders are used in the central thimble to provide maximum flexibility in experiment design.

Such as provided in a prime in the second se

Foil-insertion holes, 0.8 cm in diameter, are drilled at various positions through the grider plates. These holes allow inserting special holders containing flux wires into the core, to diameter, and the core obtain neutron flux maps of the core.

In-Pool Facilities

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

An iridium gamma irradiator is also in the reactor pool for gamma only-irradiations and

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. Prompt gamma analysis and neutron radiography can be done. The flux above the beam exit is approximately 1×10^6 n/cm²s when the reactor is at full power.



Figure 1 Reed Research Places Visitors

Reactor Operations Saminer

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Restant

A total of 2272 individuals visited the Reed Research Reactor during the year, as derived from the visitor logi-Entry List B. Individuals who visited more than once are counted for each visit. Visitors include all individuals who are not listed as facility staff. The visitors included 59% who were in programs funded in part by the U.S. DOE Reactor Sharing program. A large percentage of these were students in classes at area colleges and schools as discussed below. A graph of the history of visitor attendance is shown in figure 1) and a list for the current year is included as Appendix A woll a color each be or odd by score xult option.





Reactor Operations Seminar

The Reed Research Reactor conducts an annual seminar series for students 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 continue with in-depth reactor operator training and subsequently apply for a reactor operator license. If successful, the individual may be hired to operate the reactor. In addition, existing reactor operators may take the NRC senior reactor operator exam to upgrade their licenses.

Reed Research Reactor Annual Report 2006-2007 Construction of Abattantic Constant Abat

During the reporting period, 12 out of 12 reactor operator candidates passed their NRC exams and 9 out of 9 senior reactor operator candidates passed their NRC exams. This year, for the first time, we put a limit on the number of reactor operator candidates.

Historically students who fail the NRC exam only fail one section and they are allowed to retake that section later. Figure 2 is a graph of the number of license application each year showing how many new RO and SRO licenses were awarded at Reed and how many failed to obtain a license. Following the large class in 2005 we began limiting the number of license candidates.



Figure 2 Reed Research Reactor License Exam Results t sourcovbA grimming end base source and source of the source

Nuclear Science Consortium

Marqineral Hope Village Saturdey Academy

In order to better use the resources of the Reed Research Reactor, several area colleges and universities established the Nuclear Science Consortium of the Willamette Valley in Fi 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.

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Colleges and Universities 30	ng a seguri 9 out of 9 sensor rate con or an an
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Mt. Hood Community College	telesson D ^H exemply methods (11)
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Portland Community College	a an ann ann an ann ann an ann ann ann
Portland State University	
Warner Pacific University	and the second s
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High Schools and Middle Schools	
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Forest Grove-High School	· · · · ·
Gilkey International Middle School	an a
Kennedy High School	
Eake Oswego Junior High, School	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
Merio Station High School	
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Special Groups	1022 1010 1010 1022 1022 1022 1022 1022
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Figure 3 is a graph showing the history of visi	ting groups: 1 ont bonations to the termination of termination of the termination of te
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Figure 3 Visiting Groups

Many reactor tours include hands-on use of facility equipment to conduct experiments in radiation science, health physics, and nuclear physics. A typical lab involves determining the background of a Geiger Muller scalar system and then determining the half-life of a sample of 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 use the reactor for projects. These are designed to enrich their educational program and prepare them for college. Some 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 Research Reactor continues to be used in independent science projects initiated by students from several Oregon and Washington State high schools.

Concordia University

The reactor provides training and experiments involving radiation, radioactive material, environmental sampling, and trace element analysis for the Environmental Remediation & Hazardous Material Management Program (ERHMM) and General Chemistry at Concordia University

Reed Research Reactor Annual Report 2006-2007: West and West Marshold and Page 16

Scaler Kits

Through the generosity of Portland General Electric, the reactor lends out kits containing a Geiger counter, a scaler, and some small exempt sources to local high schools for their use in their Advanced Placement Physics Classes.

Reed Classes

- Chemistry 271 students used neutron'activation analysis to determine chemical composition of an unknown compound.
- Chemistry 101 students determined the half-lives of an activated silver dime.

Industrial and Commercial Applications

The Reed Research Reactor is available for industrial or commercial concerns when it does not conflict with our educational goals. As in the past, the primary operations involved neutron activation analysis of materials or environmental samples. The facility also provides radiation protection training to interested parties and schools in the area.

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A spectral programs for gifted children use the reactor for projects. These are the spectral program set of the spectral program as i prepare them for college. Some of the a up. A to use the reactor target relation of the disadvantaged youth who are historically an interval a set of a science professions.

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REACTOR OPERATIONS

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During the year the reactor was taken critical 297 times on 119 days. The total energy produced was approximately 38 megawatt-hours. Operating history by month appears in table 1. A history of the data is shown in figure 4.

•			出来有不能,自己在这些情况。	
	Times Critical	Days Operated	MW-hours	
September	21	6	0.71	
October	58 anoist	tradi del 1 15 04	5.72	(0\ <u>1.</u> EV_
November	35	$(1, \dots, 1, \dots, 1, n) \in [1, 1, \dots, n]$	3.96	
December	$\cdot \qquad 12 - \frac{(3) \cdot t(y)}{\cdots}$	5 VIII - 10 - 5	1.94	
January		1910 - 19	3:55	- APREN
February	2001 State (C 24 1 - 1022	an , yllainsh i 05A	1.83	
March	25			
April	50 th	15 15	4.93	
May	28	. 12	2.31	
June		. 4	0.62	1994 - 1712 3
July	13	8	4.79	·
August	12	7	1.38	
Total	297	119	38.11	

Table 1 Operating History



Figure 4 Operations

Unplanned Reactor Shutdowns

SHOITAN 490 ACTOLS A

There were six inadvertent reactor shutdowns (scrams) as shown in table 2; they were all explained. The number of unplanned reactor shutdowns is consistent with the past as shown in figure 5.

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Date	Scram Type	Cause Of Scram	asy is 1.88 yea	т о 12063 was approxime и
9/19/06	Linear and Percent Power	Operator inattention	10.18 SHO-17.1	all Amstory of Ref Cl
1/15/07	z Linear	Månual adjustment of	inear channe	el
2/22/07	Linear and Percent Power	Faulty lab instructions		September Octoons
3/29/07	Percent Power	Loss of facility power	· · · · · · · · · · · · · · · · · · ·	1304:10V 091
3/29/07	Linear	Operator inattention		
7/26/07	Elinear	Accidentally pressed in	appropriate	range on Linear channel
	6.37	le 2 Umplonned Boosts	č'Shutdow	.icheM
	4 .93	ble z _e quiplanned Reaction	Sunnaowi	us tagA
	2.31	12	<u>72</u>	V2.W



Figure 5 Unplanned Shutdowns

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REACTOR MAINTENANCE HE MANNES OF STRUCT

Significant Maintenance

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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 that were not part of a regular schedule are listed in table 3.

	de ^{rkl} and rede ^{kt}
Date	Maintenance
9/8/06	Changed primary filter
9/25/06	Replaced APM display
10/12/06	CAM taken out of service due to min flow fail
10/16/06	Put APM and GSM on new blower in loft at log behiceb straige zerosite
10/18/06	Replaced ČAM flow sensor
10/20/06	Changed primary filter
12/20/06	Changed primary filter
12/20/06	Added carbon filter to primary make up water line
1/10/07	Fuel element dropped and retrieved
1/19/07	Changed demineralizer resin
1/29/07	Changed primary filter
2/1/07	Replaced shim rod motor
3/16/07	Replaced bottom part of console power on button
3/30/07	Installed Reactor On light
4/4/07	Changed primary filter
4/25/07	APM replaced with spare APM, due to punctured detector window
5/4/07	Original APM reinstalled with replaced detector from spare APM
7/23/07	Changed primary filter

Table 3 Significant Maintenance Operations

Safety Reviews Approved by Reactor Review Committee

Title: Adding Antimony-Beryllium Source

Date: November 1, 2006

Summary of Proposed Change:

This experiment will add an antimony-beryllium (SbBe) neutron source to the core as a special experiment. Although Routine Experiment #1 allows irradiation of both antimony and beryllium, when they are mixed they produce neutrons so a special experiment was deemed necessary. Ultimately this will replace the americiumberyllium (AmBe) neutron source currently used.

Reed Research Reactor Annual Report 2006-2007. A start hannel and and Page 20

The AmBe source is 40 years old and generates helium gas during its operation. Internal pressure could, someday, cause it to leak. It would be good to replace it.

The SbBe source does not generate helium gas. The antimony is activated by the neutrons in the reactor, and generates a high-energy gamma when it decays. This gamma has enough energy to cause the beryllium to emit a neutron. This is a regenerative neutron source. The antimony becomes radioactive at power and then emits gammas by decay (60.2 day half-life) even after the reactor is shutdown. The decay of the antimony with the beryllium produces source neutrons in the shutdown reactor. Here are the reactions:

$^{123}Sb + n \rightarrow ^{124}Sb$	
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$^{124}Sb \rightarrow ^{124}Te + \gamma E$ via and began C	3. 106
95 85 Augub M97. boolige/f	c λ
CAld taken out of $\gamma \rightarrow Be + \eta \rightarrow Be$ flow fail	L1266
s it turns out, we decided not to do this experiment, even though it was app	proved.
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Addec harbon finter to primerly make up water line	10/29/06
Fuel element du ppeut and rotrieve t	NG E
Changed dominant Lizer ream	
Changed primary filter	16-01
Rop'ered shim rod motor	70/1
Replaced bottom part of rensole power on bitton	10
Installed Reactor Cu light	
Ownged primary filter	
APM replaced with spare APM, due to punctured detector window.	108.
Griginal APM relastalled with replaced detector from spare APM	11 c
red'i yumine bene 10	1

Table 3 Signify a solution ance Operations

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1, 2006

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RADIATION PROTECTION

Inter (Still Mark and E8.15 ns. 1 and 21 yild) Personnel Dosimetry 10 20 00

O. F.S. R. CYSTR 2382033

<u>Cascies References</u> D

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During the period July 1, 2006 to June 30, 2007 personnel dosimeters were issued to 52 Reed students and staff, and to two contractors. Since dosimeters are changed on a concalendar quarter schedule, this period is the closest to the reporting period. Individuals were issued beta-gamma sensitive ring badges and whole-body badges. The Director and Associate Director were issued beta-gamma-neutron sensitive dosimetry.

. 13.1.

During the year the largest annual whole body dose was 20 mrem deep dose equivalent. The largest annual extremity dose was 110 mrem shallow dose equivalent. Both of these were staff members (not students). No one exceeded one percent of the federal limits.

Fixed Area Dosimetry

Radiation levels are continually monitored to provide an indication of the average radiation levels in the reactor bay and dose outside the facility. This year areas dosimeters were also placed in the sample counting room and the control room. All dosimeters monitor beta and gamma radiation. Two locations also measure neutron dose.

The deep dose equivalent radiation measured by fixed dosimeters during the period July 1, 2006 to June 30, 2007 are shown in table 4. Since dosimeters are changed on a calendar quarter schedule, this period is the closest to the reporting period.

	war in Nation	no Corde has	Carteria A	anseri G	Marchage Ct.	Acres	
Location	Height (m)	Radiation Detected	Jul 1 - Sep 30	Oct 1 - Dec 31	Jan 1 - Mar 31	Apr 1 - Jun 30	Total
East Wall	1.5	β, γ, n	19	20	25235	ian alse	W 08501
North Wall	1.6 der	ans β, γ as	27.	21	14 evr. efzevr.	4 Avitabath	. 66
West Wall	1.0	β , γ n	7	15	17	19	58
South Wall	1.6	β, γ	20	33	29	17	······································
North Wall	2,3	β, γ	14	16	22	17	69
North Outside	2.8	β, γ	8	15	19	22	64
Roof Outside		71.1. β, γ	, 0	antima 2			energy and a
East Outside	1.5	β, γ	0	0	0	0	
South Outside	0.4	β, γ	0	0	0	0	0
Counting Room	1.5	β, γ	0	. 0	., 63	32	95
Control Room	1.5	β, γ	24	28	38	22	$\underline{112}11$

Less on Fable 4 Area Radiation Dosimeters in montressing and the second se

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Gaseous Releases

ITOSA NOMAN

7.5

The only routine release of gaseous radioactivity is from ⁴¹Ar (1.83-hour half-life) and ¹⁶N (7.13-second half-life). These come from activation of pool water, and air in the pool water and in the irradiation facilities. For calendar year 2006, the average gaseous activity at the site boundary was $1.04 \times 10^{-10} \,\mu\text{Ci/ml}$, which would deliver a dose to a member of the public of approximately 0.52 mrems well below regulatory guidelines and constraints. Figure 6 shows the gaseous releases for each year. If simplify the site boundary is the gaseous releases for each year.

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Environmental Sampling

Soil samples taken from the area surrounding the facility showed no activity above background. Water samples taken from the facility's secondary cooling system showed no activity above background. The nearby canyon was sampled for activation products and tritium, but showed no activity above normal background.

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03/01/07 = 03/010000000000000000000000000000000000		Operations	1	Dead No. 180
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03/01/07 5	Chikey International Middle School	i Visha	.:) ?	DOB
03/01/07	a iDeed	Traidlag	2 0	Reed GLAD
03/02/07 174	a Sourceu D naintead	Training Observitions	0 5	Rection (1996)
03/04/07		Operations	1	Doga Net BO
03/04/07		Orbun Orbun	1	Desa (20) AG
03/05/07		bra Gr	10	KCCQ COMPU
03/05/07		D FOU L Traider	18	D-24000 M
03/05/07	n and a second sec	Training	2	D = SAN OCONO
03/06/07		Operations	2	D = TAVEY = SY
03/07/07		Training	2	Reed With the
03/07/07		Framing	4	
03/07/07 %		Character and Ch	2	
03/08/07		Operations	3	Keed Of PO
03/08/07	- Pacific University	S-FOUL	11	
03/08/07	Portland Community College	1 our	10	
03/08/07	0 SOUDReeds	Framing	4	Reed
03/14/07	2002 Reed	Weekly	3	Reed
03/15/07	United Fire	Maintenance	1	Reed
03/15/07	THO Reed	Operations	1	Reed
03/15/07	Barkeed	Training	4	Reed
03/15/07	C MIC Reed	Wipes	1	Reed
03/16/07	An an a Reed	Maintenance	1	Reed T+C
03/16/07	Community Hospital	Tour	1	US DOE 40
03/16/07	Kadlec Medical Center	loodes o Tour finees."	1	US DOE
03/16/07	Merlo Station High School	Tour	8	US DOE
03/16/07	Oregon Institute of Technology	Tour	6	US DOE
03/16/07	Successful School Transition	Tour	12	US DOE
03/16/07	Providence Hospital	Training	6	US DOE

Page 28

Dateinau	= Institution	Purpose	# Funding
03/16/07	2 2n Reed	Training	2 Reed
03/20/07	S viReed	Maintenance	3 Reed
03/20/07-A	approa Reed	Operations	2 Reed
03/21/07o 9	I g.rReed	Operations	2 Reed an ed
03/21/07	beeg ng	Operations	1 Reed The
03/21/07:5	David Douglas High Schoo	1 Tour	45 US DOE
03/21/07	S Reed O	Weekly	1 Reed
03/22/07 211	Reed Community Safety	Inspection the 2	1 Reed
03/22/07-7	Reed	Maintenance	3 Reed
03/22/07:55	i Reed	Province and Wipesterran	1 1 Reed of C
03/23/07:51	E mon Roed	on Operations?	1 Reed Corre
03/23/07-9	Reed .	Operations	1 Reed
03/23/07 9	T and Reed()	h Tour	4 Reed
03/26/07	i an Reed	Training	2 Reed
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03/27/07	- Reed	Weekly	1 Reed
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03/28/07.5	The Bead	Operations	7 Reed
03/28/083/		Operations	2 Recu
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03/20/07.5	Prod	Li annug Dimorthlur	2 Receive
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04/11/07e%	4 gaReedi	Maintenance	6 Reed
04/11/07 эЯ	{ VIReed	Maintenance	1 Reed
04/11/07 s S	i sonsReed in	Training	2 Reed
04/12/07:51	I Reed	RAD/Tour	21 Reed
04/12/07	k 2 Reed	Training	4 Reed
04/13/07/5.9	Reed	RAD Tour	26 Reed
04/13/07:07	Reeds M	Operations	2 Reed
04/13/07	Reed	Operations	1 Reed
04/13/07	Lane Middle School	much in Four start	6 US DOE
04/13/07	Reed	and in Training	3 Reed
04/15/07	Reed	RAD Tours	21 Reed
04/17/07	Reed	Maintenance	2 Reed
04/18/07	Reed	RAD Tour	20 Reed
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Date	Institution	Putpose	# Funding
04/18/075원	sort Reed	Maintenance	1 Reed
04/18/07° ²	Reed T	Training	4 Reed
04/19/07 ^{9,8}	Reed	Training	4 Reed
04/20/07 ^원	N: Reed	Training	2 Reed
04/22/07	S Reed	Training	1 Reed
04/23/07 20	Reed	and and the second rough reliable	. (3 gar-Reed all a
04/23/07 ^{3, 또}	S Chin an Reed? CE	Training	3 Reed
04/24/07 20	* S [©] Reed	ning darf bre Training gides	S Reed
04/25/07	2 ViReed	Training	13 Reed
04/26/07	Bath Reed	Tour	10 Reed 안전
04/26/07	Reed	Training	7 Reed
04/27/07 20	S a lineed	saine di LE D . Operations ideas	inchargeAReed\82\00
04/27/07		Tour	25 Reed 2010
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05/08/07		oriter Lashberghon	
05/08/07		Observions	
05/00/07	Encet Critical Sale	operations	
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05/17/07	Kecu Konnadiulliah Sahaa	Haming Vinchao Tambria?	
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05/25/07	Lake Oswego Jumor High 2	Schools is a production sector sector	
05/25/07	En Keed	a diamana aff tean a marina a diama	
05/24/07		Service of the servic	
05/29/07	Matheson Delbar Child service	Maintenance	07/26/BS-DA the liter
05/29/07	roiar Cryogenics	Constant de la Maine de La Constant	
05/29/07	AND THE DISA STATE	Taken and the second se	
05/29/07		1 OUF	
05/30/07		Maintenance	
05/30/07	····································	Internation States in Maintenances and the States	on the gran Keed sale Vice Of the Data Scherking
05/30/07			
05/30/07	Fortland Fire Bureau	Fraining	
06/02/07			
06/02/07		Uperations	
06/06/07	e Keed		
06/07/07	Reed	UPPE DEWIPES	
06/19/07	Reed ?	Maintenance	3 Reed Wall

Date Engli B Institution	Purpose	#	Funding
06/19/07	Maintenance	1	Reed
06/19/07=14 Electron Reed	RSO Class	1	Reed
06/19/07-9 Reed	RSO Class	11	Reed
06/19/07	RSO Class	14	Reed
06/20/07 H Reed	Maintenance	2	Reed
06/20/07 Apprenticeships Science and Engineering	Training	2	US DOE
06/21/07 E Reed	RSO Class Training	8	Reed
06/27/07 Apprenticeships Science and Engineering	Training	4	US DOE
06/27/07Reed	Weekly	2	Reed
06/28/07e (); Reed	Operations	1	Reed
$06/28/07_{3}$ s π Reed	Tour	4	Reed
06/28/07 Apprenticeships Science and Engineering	Training	2	US DOE
07/02/07-5 c Reed	Alumni Tour	2	Reed
07/02/07-5 Portland Packaging	Maintenance	1.	Reed
07/03/07 - Apprenticeships Science and Engineering	Training	4	US DOE
07/05/07-5	Maintenance	1	Reed and
07/05/07	Operations	1	Reed
07/05/07 Apprenticeships Science and Engineering	Training	6	US DOE
07/05/07 SApprenticeships Science and Engineering	Training	1	US DOE
07/06/07-SApprenticeships Science and Engineering	Training	1	US DOE
07/09/07 9 C Reed	Maintenance	6	Reed
07/09/07-9 1 anoiReed 0	Operations	1	Reed
07/00/07 CAnnenticeshing Science and Engineering	Training	5	USDOE
07/10/07 start and the second	Operations	2	Reed
07/10/07 0 Health Physics Society	Tour	34	US DOF
07/10/07. CAnnenticeshing Science and Engineering	Training	1	
07/11/07. Dortland Backaging	Maintenance	2	
$07/11/07_{0}$ (101 many Read C	Maintenance	2	Reed
07/11/02/03 200(AS994)	Training .	. 2	
07/11/07 Appropriationshing Science and Engineering	CEDE BE LEPONUE S ISOTO	: <u>~</u>	
$-07/11/07$, Apprentices mps segurice and Engineering $-07/12/07$, σ , Γ_{i} , P_{i} and	Operations	1	DOL
07/12/03071 (1) integration $07/12/07$ of 0 Department	Up <u>çi</u> ațions	1	Recu Reed -
$07/12/07$ Σ Solution for a second	hiyu Taur	1 21	
07/12/07 Annotationshing Science and Engineering	Training True Contract	1	
07/12/07/ Apprenticeships Science and Engineering	Chillianning	-1	
07/17/07 Apprenticeships Science and Engineering:	Recession Praintered I ranse	64 1	DSDOE
	Maintenance	1	
07/11/07/ Apprenticeships Science and Engineering	sterninger Huger	Sider.	US DOE
07/18/07 Apprenticeships Science and Engineering	Iraining	1	
07/19/04 Apprenticeships Science and Engineering	Iraining	2	US DOE
07/20/0#931 93r KRSAS	Research	1	Keed
07/20/04 Apprenticeships Science and Engineering	ic Iraining of	3	USDOE
07/23/07-3 Portland Water Bureau	Inspection	3	Reed
07/23/07.5 Reed	Maintenance	2	Reed
07/23/07/5/3 1 06/2 Reeds M	Operations	1	Reed CRAF
07/23/07 Apprenticeships Science and Engineering	Training	3	US DOE
07/24/07්රා Reed	Operations	1	Reed
07/24/07.5 Pigneer School	Fortlan uoT e Ecentri	13	US DOE
07/24/07 Apprenticeships Science and Engineering	Training	4	US DOE
07/25/07 (5) (cros) Reed (5)	Operations	· 1	Reed
07/25/07 Apprenticeships Science and Engineering	Training	6	US DOE
07/26/07 Apprenticeships Science and Engineering	Training	4	US DOE
07/27/07/201 (water Reed . M	Operations	1	Reed

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Date	Institution	Purpose	#	Funding
07/27/07	Apprenticeships Science and Engineering	Training	5	US DOE
07/30/07	Reed	Operations	• 1	Reed
07/30/07	Apprenticeships Science and Engineering	Training	3	US DOE
07/31/07	Reed	Operations	1	Reed
07/31/07	Reed	Operations	1	Reed
07/31/07	Oregon Institute of Technology	Tour	8	US DOE
07/31/07	Apprenticeships Science and Engineering	Training	2	US DOE
07/31/07	Apprenticeships Science and Engineering	Training	1	US DOE
08/01/07	Apprenticeships Science and Engineering	Training	5	US DOE
08/02/07	US Crane	Maintenance	1	Reed
08/02/07	Reed	Operations	1	Reed
08/02/07	Apprenticeships Science and Engineering	Training	· 1	US DOE
08/03/07	Reed	Operations	1	Reed
08/03/07	Apprenticeships Science and Engineering	Training	1	US DOE
08/04/07	Reed	Operations	1	Reed
08/06/07	Reed	Operations	1	Reed
08/06/07	Reed	Operations	2	Reed
08/06/07	Saturday Academy	Tour	14	US DOE
08/06/07	Apprenticeships Science and Engineering	Training	7	US DOE
08/07/07	Dynalectric	Maintenance	1	Reed
08/07/07	Reed	Maintenance	1	Reed
08/07/07	Reed	Operations	1	Reed
08/07/07	Apprenticeships Science and Engineering	Training	1	US DOE
08/08/07	Reed	Operations	1	Reed
08/08/07	Apprenticeships Science and Engineering	Training	4	US DOE
08/09/07	Saturday Academy	Tour	9	US DOE
08/09/07	Apprenticeships Science and Engineering	Training	4	US DOE
08/10/07	Reed	Operations	2	Reed
08/10/07	Apprenticeships Science and Engineering	Training	1	US DOE
08/13/07	Reed	Operations	2	Reed
08/13/07	Apprenticeships Science and Engineering	Training	2	US DOE
08/14/07	Dynalectric	Maintenance	5	Reed
08/14/07	Reed	Maintenance	. 1.	Reed
08/14/07	Marquie at Hope Village	Tour	10	US DOE
08/14/07	Apprenticeships Science and Engineering	Training	3	US DOE
08/15/07	Dynalectric	Maintenance	3	Reed
08/15/07	Apprenticeships Science and Engineering	Training	1	US DOE
08/15/07	Reed	Weekly	1	Reed
08/16/07	Apprenticeships Science and Engineering	Training	1	US DOE
08/20/07	United Fire	Maintenance	1	Reed
08/21/07	Reed	Maintenance	1	Reed
08/22/07	Reed	Tour	58	Reed
08/23/07	United Fire	Maintenance	- 2	Reed
08/23/07	Reed	Operations	2	Reed
08/23/07	Reed	Tour	53	Reed
08/24/07	Reed	Operations	2	Reed
08/24/07	Reed	Tour	13	Reed
08/29/07	Reed	Weekly	- 3	Reed
08/30/07	Reed	Wipes	2	Reed

REED RESEARCH REACTOR ANNUAL REPORT



September 1, 2005 -- August 31, 2006

REED RESEARCH REACTOR ANNUAL REPORT



September 1, 2005 -- August 31, 2006

3203 Southeast Woodstock Blvd. Portland, Oregon 97202-8199 503-777-7222 Fax: 503-777-7274 http://reactor.reed.edu reactor@reed.edu

Stephen G. Frantz Director, Reed Research Reactor Program Director, Nuclear Science Consortium of the Willamette Valley

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APPENDIX A - VISITOKS

OVERVIEW

This report covers the period from September 1, 2005 to August 31, 2006, and is intended to fulfill the reporting requirements of the U.S. Nuclear Regulatory Commission, the U.S. Department of Energy, and the Oregon Department of Energy including:

- U. S. Nuclear Regulatory Commission, License No. R-112 (Docket 50-288)
- Oregon Office of Energy Rule No. 345-030-010
- U. S. Department of Energy Reactor Sharing Grant No. DE-FG07-02ID14387
- U. S. Department of Energy Reactor Instrumentation Grant No. DE-FG07-04ID14573

We specifically wish to thank other funding sources including:

Portland General Electric

Concordia University

Reed College operates a Triga Mark I reactor with zirconium hydride/uranium fuel elements. The fuel elements are in a circular grid array at the bottom of a 25-foot-deep tank of water and are surrounded by a graphite reflector. The fuel is enriched to 19.9% in uranium-235.

The Reed College Research Reactor has been a resource for research and educational projects in the Portland area since its establishment in 1968. The main uses of the Reed Research Reactor are instruction and research, especially in the field of trace-element analysis. In addition to providing student research opportunities, the reactor staff works to educate the surrounding community on the principles of nuclear energy and radiation safety.

There were 2818 individual visits to the Reactor Facility during the year. Most were students in classes at Reed College or area universities, colleges, and high schools. Including tours and research conducted at the facility, the Reed Research Reactor contributed to the educational programs of 6 colleges and universities in addition to 12

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pre-college groups. The reactor was operated 340 times on 120 days. The thermal energy produced was 42 megawatt-hours.

The reactor staff consists of a Director, an Associate Director, a contract Health Physicist, and Reed College undergraduate students who are licensed by the Nuclear Regulatory Commission as reactor operators or senior reactor operators. As this report is being written the licensed operating staff consists of 21 women and 29 men. During the reporting period, all 16 reactor operator candidates passed their NRC exams and all 11 senior reactor operator candidates passed their NRC exams.

There were no radiation exposures to individuals in excess of one percent of the limit during the year. There were no releases of liquid radioactive material from the facility and airborne releases were well within regulatory limits. There was one shipment of radioactive waste.

The Nuclear Regulatory Commission conducted their annual inspection during November 2005. There were no violations or concerns. There were no follow up items.

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Facility Staff

During the period September 1, 2	2005 to Augus	t 31, 2006, the facility staff consisted of:
Reactor Director: 124. Active and	stephen F	rantz (4/94 – Present)
Associate Director:	Susan Bea	ver $(7/06 - Present)$
an a	Rachel Bá	rnett (5/03 – 6/06)
Reactor Supervisor:	🤊 Craig Wag	gner (8/06 - Present) back we also made
- 	Elliot Naid	lus (8/05 – 6/06)
Training Supervisor:	Juliana Ar	righi (6/06- Present)
	Jessica Gr	iffith (5/04- 6/06)
Radiation Safety Officer:	Kathleen I	Fisher (1/03 – Present)
, Contract Health Physicist:	Marshall H	Parrott (8/91 - Present)
Senior Reactor Operators (SRO).	•	
in the second second second second	Carl	Anderson 574 assession periods a lass
	Juliana	Arrighi
	Drew	Atwater
	Andre	Bach
genadu an ku ben a Bule nubersa	Rachel	Barnett
机内止 建氯化合物合物 经工资 网络	om Susan - de	bBeaverrey and 2001 and anoth
	Rachel	Bond
	Quincy	Cardinale
	David	de Regt
	Stephen	Frantz
	Hilary	Gray
•.	Ben	Greenspan
	Jessica	Griffith
	Jesse	Hallett
	Vanessa	Holfeltz
	Cindy	Joe
	Beverly	Lau
	Kristen	Lavavej
·	Grant	Meadors
	Tracy	Mehoke
	Marianna	Mullens
	Elliot	Naidus
	Derek	Oldridge
• •	Alton	Sartor
	Rebecca	Schoenberg-Jones
	Julia	Schornack
	Zach	Schultz
	Craig	Wagner
	Gillian	Woodruff

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Reactor Operators (RO):

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gelands and other to an except	Steven	Case 1 Although 2 And 3 Although 7
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 For the constraint of a particular state of the constraint of the const	Tom	Chartrand To the states of West and
reg film and end grade and the	Tiffany	Cook
en de la sectión de seguidad de la sectión de sec	Asher	Davidson and the second and case
化合物化 机塑料 化结构环境 建冷却来源于人	William	Draper of an and said the part of
a ingan gabijanan p	Allison	"Edgar. I arth at a fisse codus et
and the BR 1. S. S. P. M. S. S.	Ben	Fischeradementation and the second
	Michael	Flashman
	Ryan	Gersovitz
· · ·	Edward	Griffith to the state of the state of
and the set was shown in the set way for	Alex	Gurfinkel
· · · · · · · · · · · · · · · · · · ·	Jeremy	Harper
$X_{i} \in \{0, 1, 2\}, i \in \{1, 2\}, j \in \{1, 2$	Matthew	Jemielita
ા ગામ કે દીધુ કરી તેવકાર તે છે. આ ગામ	Sarah	Kemp
	Molly	King
	Matthew	King
n ja 1990 avenus area area area area area area area are	Jordan	Kohn
	Judith	Levine
	Christine	Lewis
	Eric	Lindsey
	Anna	McKee
	Joseph	Parmalee
	Alex	Ragus
•	Zoe	Rem
(marting)	Will What	Rosenbaum
.(<i>10</i> 7)	Jacob With	Schwartzman
ette Assector) –	Emma	Seward
	Griffen	Thoma
	David	Williams Manager and Andrews
	Trevor	Young and analyse disclosed and an

The list of operators includes everyone who held a license at any time during the reporting period. ROs who upgrade their licenses to SRO during the reporting period are listed under SRO. All staff members are Reed College undergraduate students except Mr. Frantz, Ms. Beaver, Ms. Barnett, Ms. Fisher, and Dr. Parrott.

As this report is being written there are 9 women and 20 men with Reactor Operator licenses and 12 women and 9 men with Senior Reactor Operator licenses.

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NAME /

Reactor Review Committee

11 1 12 14

1.04 M 1973

The Reed Research Reactor has two oversight committees: the Radiation Safety Committee and the Reactor Operations Committee. Together they comprise the Reactor Review Committee. The Radiation Safety Committee is concerned with emergency preparedness, health physics, radiation safety, physical security, environmental impact, and the interface between the Reed Research Reactor, Reed College, and the surrounding community. The Reactor Operations Committee deals with the day-to-day operations of the reactor, reactor maintenance, reactor, safety, operator training, and operator requalification. The membership of the committees during the reporting period is shown below: A LOFE

Na tanàng ang amin'ny salah salah

Radiation Safety Committee

11.1... Tom Meek - Chair (Radiation Protection Manager, Trojan Nuclear Power Plant) Martha Dibble (Neighborhood Resident) Wayne Lei (Environmental Director, Portland General Electric) Kathleen Fisher (Director, Reed Environmental Health and Safety)

Sec. 1

dense a U

Reactor Operations Committee

eactor Operations Committee Steve Reese - Chair (Radiation Center Director, Oregon State University) Johnny Powell (*Physics Faculty, Reed College*) Daniel Gerrity (Chemistry Faculty, Reed College) Juliet Brosing (*Physics Faculty, Pacific University*) Lily Cool (*Reed Alum*) 1.1.1 1 Carlo

Ex Officio (without vote) on Both Committees:

est could

Peter Steinberger (Dean of the Faculty, Reed College) Stephen Frantz (Director, Reed Research Reactor) Rachel Barnett (Associate Director, Reed Research Reactor) Marshall Parrott (Contract Health Physicist); Elliot Naidus (Reactor Supervisor) Nord 1 Jessica Griffith (Reactor Training Supervisor)

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FACILITIES

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In addition to the reactor, the Reed College has a radiochemistry lab. The equipment available at the reactor facility includes high purity germanium gamma spectrometers, alpha spectrometers, a whole body counter, gas flow proportional counters, ion chambers, beta counters, Geiger Müller tubes, neutron detectors, alpha detectors, and thermo luminescent dosimeter readers. These instruments are used for experiments and training in nuclear science and radiation detection. Two hand and shoe monitors are in the control room. A liquid scintillation detector serves the campus radioisotope committee. The reactor facility has several systems for performing irradiations, described below.

Rotating Specimen Rack Facility

The rotating specimen rack ("lazy susan") is located in a well on top of the graphite reflector surrounding the core. The rack consists of a circular array of 40 tubular receptacles, each of which can accommodate two irradiation tubes. Vials holding up to 17 ml (four drams) are used in this system. 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, researchers use the rotating rack when long irradiation times (generally greater than five minutes) are required. The approximate thermal neutron flux in a rotating rack position at full power is 1.7 x10¹² n/cm²s with a cadmium ratio of 6. The specimen rack can be used for gamma irradiations (approximately 8 Rad/min) when the reactor is shutdown.

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Pneumatic Transfer System

The pneumatic transfer system ("rabbit") consists of an irradiation chamber in the outer F-ring of the core and 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.

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 laboratory next to the reactor and is then transferred pneumatically into the core-irradiation position. At the end of a predetermined time 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 5×10^{12} n/cm²s when the reactor is at full power.

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In-Core Facilities

The central thimble is a water-filled irradiation chamber about 3 cm in diameter. It provides the highest available neutron flux, about $1 \times 10^{13} \text{ n/cm}^2 \text{s}$, Special sample holders are used in the central thimble to provide maximum flexibility in experiment design.

A fuel replacement source holder assembly can also be used as an irradiation facility. The chamber fits into a fuel-element position within the core itself. It holds only one specially positioned irradiation container 7.5 cm in length and 2.5 cm in diameter.

Foil-insertion holes, 0.8 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

. Noth the feature of the state of the

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

An iridium gamma irradiator is also in the reactor pool for gamma only irradiations. **Beam Facilities** (Sector of Clarific Levis 2000 900) for gamma only irradiations. **Beam Facilities** (Sector of Clarific Levis 2000 900) solution to the entry of the sector of the

Aner mathe Transfer System

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Reactor Visitors

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A total of 2818 individuals visited the Reed Research Reactor during the year, as derived from the visitor log - Entry List B. Individuals who visited more than once are counted for each visit. Visitors include all individuals who are not listed as facility staff. The visitors included 643 who were in programs funded in part by the U.S. DOE Reactor Sharing program. A large percentage of these were students in classes at area colleges and schools as discussed below. A graph of the history of visitor attendance is shown in Figure 1, and a list for the current year is included as Appendix A.



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Reactor Operations Seminar

The Reed Research Reactor conducts an annual seminar series for students from Reed and other area educational institutions. This non-credit course serves as an introduction to nuclear reactor theory, health physics, and reactor operation. <u>Some of the students</u> continue with in-depth reactor operator training and subsequently apply for a reactor operator license. If successful, the individual may be hired to operate the reactor. In addition, existing reactor operators may take the NRC senior reactor operator exam to upgrade their licenses.

During the reporting period, 16 out of 16 reactor operator candidates passed their NRC exams and 11 out of 11 senior reactor operator candidates passed their NRC exams. This year, for the first time, we put a limit on the number of reactor operator candidates.

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Historically students who fail the NRC exam only fail one section and they are allowed to retake that section later. Figure 2 is a graph of the number of license application each year showing how many new RO and SRO licenses were awarded at Reed and how many failed to obtain a license.



Nuclear Science Consortium

In order to better use the resources of the Reed Research Reactor, 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 partic	cipated in facility tours, experiments, and research
projects in the reporting period.	ก็ แต่สาร (ว่ามีสาวิวาทศณีรไก้สายและ โกระมี เปลี่กา
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COLLEGE TOURS/USERS	. Forther of the Wear of work and some from
• Concordia University	have a service and the service states of the service of the servic
• Lewis and Clark College	a de destra. This search donais a during t
Linfield College	1. Construction of the state of
 Pacific University 	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
 Portland Community College 	,
Warner Pacific College	and the second
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PRE-COLLEGE TOURS/USERS

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- E. R. M. Lewis Construction & Branch Harden. David/Douglas High School
- Lincoln High School
- New Urban High School
- Oregon Episcopal School
- **Rex Putnam High School**

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- Waldorf High School 12 . B. - • • 一般的 化加油 法保险控制 法地名法国法法特尔法
 - West Linn High School A SHE THE THE HERE HERE HERE

SPECIAL GROUPS

- American Chemical Society And the Children of the and the attended
- Advocates for Women in Science, Engineering, and Math
- and a state of the state 그의 그는 친구로 전에 같은 것이 많아? Saturdáy Academy 1995 and 1997 was appeared and the Strategy of the second
- Figure 3 is a graph showing the history of colleges, pre-college groups, and special groups.



Many reactor tours include hands on use of facility equipment to conduct experiments in radiation science, health physics, and nuclear physics. A typical lab involves determining the background of a Geiger Muller scalar system and then determining the half-life of a sample of 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. Contract Contractor and the

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

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<u>High School Student Projects</u>

The Reed Research Reactor continues to be used in independent science projects initiated by students from several Oregon and Washington State high schools.

Pacific University Modern Physics Lab

Each year the Modern Physics Lab at Pacific University spends lab sessions at the reactor. The students do several labs including basic health physics, sub-critical multiplication, and neutron activation analysis.

Concordia University

The reactor provides training and experiments involving radiation, radioactive material, environmental sampling, and trace element analysis for the Environmental Remediation & Hazardous Material Management Program (ERHMM) and General Chemistry at Concordia University

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Scaler Kits

Through the generosity of Portland General Electric, the reactor lends out kits containing a Geiger counter, a scaler, and some small exempt sources to local high schools for their use in their Advanced Placement Physics Classes.

Reed Classes/

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- Chemistry 271 students used neutron activation analysis to determine chemical composition of an unknown compound.
- Chemistry 101 students determined the half-lives of an activated silver dime.
- Two Reed students used the reactor as part of their thesis.

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Industrial and Commercial Applications' and the state of a state of and

The Reed Research Reactor is available for industrial or commercial concerns when it does not conflict with our educational goals. As in the past, the primary operations involved neutron activation analysis of materials or environmental samples. The facility also provides radiation protection training to interested parties and schools in the area.

REACTOR OPERATION States 124

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During the year the reactor was taken critical 340 times on 120 days. The total energy produced was approximately 42 megawatt-hours. Operating history by month appears in Table A. A history of the data is shown in Figure 4. AND STAN

Ċ,	"'ded" (* 135 - 54 1) Ta	ble A - Operating Hi	istory			
	Times Critical Days Operated MW-hrs					
di Sep.a		ter ush i du ern e 10 .et.	- state trace 1.92			
Oct.	49	11	1.38	et et al		
Nov.	28	4.4. 6 28 . 1. 11 J	·₂ to the j ∈ 6.86			
Dec.	23	8	3.91			
Jan.	23	40 million 13 11	2.33			
Feb.	26	11	4.62	n na farar e na seren an		
Mar.	250 30 AD 33		3.60			
Apr.	46	14	7.68			
May	31	10	4.22			
Jun.	5	4	0.46			
Jul.	18	, 5 8	2.94			
Aug.	19	/ \ 8	, 1.84			
Total	340	120	41.76			



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Unplanned Reactor Shutdowns SERVE MOTLER

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There were seven inadvertent reactor shutdowns (scrams) as shown in Table B; they were all explained. The number of unplanned reactor shutdowns is consistent with the past as shown in Figure 5. onse kan de la jua

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<u>1 - 22 - 16 576 - 1</u>	Table	B - Unplanned Reactor Shutdowns
Date	Scram Type	Cause Of Scram & el mais handland de second de se at 1
11/21/05	Loss of AC	Electrical power was lost to campus
11/921/05	Linear	Operator inattention
2/16/06	Linear	Linear channel was left in manual ranging
2/28/06	Percent Power	Accidentally pressed the Test button on the Percent Power
3/15/06	Linear	Operator inattention 3 .50
5/06/06	Linear and	Operator inattention 62 which
	Percent Power	3 1.1 2.544
5/06/06	Linear	Operator inattention 11 Acts



Security

There were significant security reviews of the facility, both internal and external. The physical security barriers and procedures were modified and improved.

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REACTOR MAINTENANCE

Significant 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 that were not part of a regular schedule are listed in Table D.

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 Table D - Significant Maintenance Operations

	Date	Maintenance
••	8/22/05	Installed Automatic Rod Control
	9/8/05	Changed primary filter
	9/26/05	Changed primary filter
	9/30/05	Placed iridium gamma source in the core
	10/21/05	Changed primary filter
	10/25/05	Moved APM and GSM from the loft to the hallway
	10/31/05	Changed primary filter
	10/31/05	Installed new grounding wires in the console
	11/7/05	Adjusted Log Channel test circuit to enable testing of source interlock
	<u>11/9/05 😳</u>	Changed primary filter is created as a sub-sector as a consequence of
$\{H_{i_1}^{i_1}\}$	1/6/96	Cleaned the Lazy Susan with mineral spirits
	1/16/06	Changed the primary demineralizer tanks resin
	1/22/06	Changed primary filter
	<u> </u>	Changed primary filters some from sor all a Ecological out of the
1	<u>- 4/10/06</u>	Replaced the air hoses on the pneumatic transfer system
en e	4/30/06	Changed primary, filter as a smooth before the second of Miller
3 14	////06	Changed primary filter
		Installed new digital RAMs and relocated the old ones
	, 8/ //06	Changed primary filter
	<u>8/15/06</u>	Replaced primary conductivity meter with a digital one
	· · · · · · · · · · · · · · · · · · ·	REPRESENCE SECONDERV WALEF THERE SHOLPOTTILLET

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Safety Reviews Approved by Reactor Review Committee

Title: New Emergency Implementation Procedures

Summary of Proposed Change:

The Emergency Implementation Procedures (EIPs) will be changed from a two-column format to a tabbed format.

The new format places all the steps on one sheet for the Emergency Coordinator (EC) to see at once. The information that used to be in the right hand column will be moved to a tab that has more details and pictures for any step that applies.

Advantages of the new format:

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- 1. All the steps are visible at once. No page turning is required until a condition is met.
- 2. Multiple copies of the flow sheet may be made for others to follow along.
- 3. Each action step is a separate tab that can be removed for implementation.
- 4. Since the actions steps don't have to fit in the right hand column, more details and the photographs can be included. The state at the back doubter the state of the state
- Mineral: Significant retraining will be required.² of a support of the support
 - 2. When a condition applies, the EC must open that tab rather than just go to the right hand column. The EC may go to the wrong tab. The tabs are lettered and color coordinated to minimize this.

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3. The EC may loose his/her place going back and forth between tabs. Check off boxes have been provided to the flow sheet to minimize this.

Title: Move the APM and GSM to the exit corridor (19) began by <u>JUN</u> Date: October 24, 2005

Summary of Proposed Change: State of a state of grant beliand

The proposed procedure change will move the Air Particulate Monitor (APM) and Gaseous Stack Monitor (GSM) from the loft to the exit corridor. The purpose is to put them in a more controlled environment and to facilitäte access:

We have had problems with the APM since installation; and now the GSM seems to be having problems. We have sent them back to Eberline repeated times, and they work perfectly there. We have installed power conditioners and replaced the cables. The only remaining suggestion is that the temperature environment in the loft may not be suitable for the detectors. Moving them to the exit corridor (the hallway) will alleviate this.

Also, having the APM and GSM in the hallway will allow operator to perform the weekly and bimonthly checklists without having to enter the loft. They no longer have keys to the loft so this has become a problem.

The APM and GSM will be in the hallway rather than the reactor room to minimize background radiation and to allow access if the reactor room cannot be entered.

The increased sampling line run will not be an issue due to the isokinetic sampling probe that was installed.

The APM and GSM will be mounted on the drywall in the hallway, with plastic tubing running up into the loft. This is the same as the old manner of mounting so no difficulties are anticipated. The reactor staff will perform the changes.

<u>Title</u>: Lazy Susan Cleaning

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<u>Date</u>: November 28, 2005

Summary of Proposed Change:

The proposed procedure will clean the lazy susan (LS) with the solvent mineral spirits (paint thinner).

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Three gallons of the solvent will be poured into the lazy susan. The LS will be rotating overnight to dissolve the oil. Then the contaminated solvent will be pumped into a shielded container. The waste will be handled as described below. The procedure is attached.

The LS is an air filled rack assembly that is isolated from the pool water, so there is no possible interaction between the solvent and the reactor water. Mineral spirits is compatible with metals, plastics, and the pool water if any were to get into the pool. The only significant activation product is sodium (15 hour half-life), although the LS oil will have long-lived cobalt and selenium isotopes. This method was used successfully at the Kansas State University Reactor in 2003.

The pump and tubing will be on absorbent paper and will be checked frequently for leaks. Radiation monitors will check for air contamination and for high radiation fields. Lab

coats, gloves, shoe covers, and goggles will be worn when transferring the solvent. Personal dosimetry is always worn in the reactor room. The container will be shielded and will not be positioned over the reactor pool. When Kansas State performed the procedure, the highest measured dose rate was 10 mR/hour.

The used solvent will be filtered to remove the radioactive particles. The solvent will then be stored for use in cleaning the LS in the future.

This procedure will be added to SOP-83 with lessons learned when completed.

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RADIATION PROTECTION

Personnel Dosimetry

During the period July 1, 2005 to June 30, 2006 personnel dosimeters were issued to 54 Reed students and staff, and to one contractor. Since dosimeters are changed on a calendar quarter schedule, this period is the closest to the reporting period. Individuals were issued beta-gamma sensitive ring badges and whole-body badges. The Director and Associate Director were issued beta-gamma-neutron sensitive dosimetry.

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During the year the largest annual whole body dose was 13 mrem deep dose equivalent. The largest annual extremity dose was 120 mrem shallow dose equivalent. Both of these were staff members (not students). No one exceeded one percent of the federal limits.

Fixed Area Dosimetry

Radiation levels are continually monitored to provide an indication of the average is radiation levels in the reactor bay and dose outside the facility. This year areas dosimeters were also placed in the sample counting room and the control room. All dosimeters monitor beta and gamma radiation. Two locations also measure neutron dose. Then

The deep dose equivalent radiation measured by fixed dosimeters during the period July 1, 2005 to June 30, 2006 are shown in Table E. Since dosimeters are changed on a calendar quarter schedule, this period is the closest to the reporting period.

Table E - Area Radiation Dosimeters (doses are in mrem per calendar quarter)

Location	Height	Radiation	Jul 1 -	Oct 1 -	Jan 1 -	Apr 1 -	Total
	(m)	Detected	Sep 30	Dec 31	Mar 31	Jun 30	
East Wall	1.5	β, γ, n	10	36	68	39	153
North Wall	1.6	β, γ	23	33	96	53	205
West Wall	1.0	β, γ n	28	70	57	21	176
South Wall	1.6	β, γ	10	30	31	21	92
North Wall	2.3	β, γ	5	28	34	23	90
North Outside	2.8	β, γ	0	16	35	23	74
Roof Outside	0.4	β, γ	0	0	0	0	0
East Outside	1.5	β, γ	. 0	0	0	0	0
South Outside	0.4	β, γ	0	0	0	0	· 0
Counting Room	1.5	β, γ	N/A	26	0	0	26
Control Room	1.5	β, γ	N/A	62	56	47	165

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Gaseous Releases

The only routine release of gaseous radioactivity is from ⁴¹Ar (1.83-hour half-life) and ¹⁶N (7.13-second half-life). These come from activation of pool water and air in the pool water and in the irradiation facilities. For calendar year 2005, the average gaseous activity at the site boundary was $4.94 \times 10^{-11} \mu$ Ci/ml, which would deliver a dose to a member of the public of approximately 0.25 mrem, well below regulatory guidelines and constraints. Figure 6 shows the gaseous releases for each year.



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

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Solid Waste Disposal

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There was one shipment of radioactive waste from the facility during this reporting period. Two drums were shipped to US Ecology in Richland, WA. The activity was 0.13 mCi and the volume was 18.45 ft³.

Environmental Sampling

Soil samples taken from the area surrounding the facility showed no activity above background. Water samples taken from the facility's secondary cooling system showed no activity above background. The nearby canyon was sampled for activation products and tritium, but showed no activity above normal background.

Reed Research Reactor Annual Report 2005-2006 Lands and an

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APPENDIX A - VISITORS

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hat sit minist	Dead	<u>Turpose</u> 110	under Funding
	Beed The state of the second s	Shutdown Shutdown	2 Reed
1 m 1 m 1 m 1 m 1 9/7/05	Reed	Startup vi da	1 Reed
9/7/05	Reed	Weekly	2. Reed
9/7/05	Reed	Tour	26 Reed
9/7/05	Reed	Shutdown	2 ^{°L} Reed
9/8/05	Reed	Maintenance	2 Reed
V1005.019/9/05	🖯 iReed 🖓 🖓 🖉 🖓 the Albert	Weekly 2 - i	3 Reed
9/11/0	5 Reed	Weekly	3 Reed
9/19/0	5 Reed	Startup	2 Reed
9/19/0	5 Reed	Tour	26 Reed
9/19/0.	5 Reed	Shutdown	2 Reed
9/20/0	5 Reed	Startup	3 Reed
9/20/0	5 Reed	Tour	50 Reed
9/20/0	5 United Fire	Maintenance	Reed
9/20/0.	b Keed	Operations	2 Reed
9/20/0	5 Desifie University	Snutdown	
9/20/0.	5 Pacific University	Stortup	9 USDUE 2 Reed
9/21/0	5 Peed	Weekly	2 Reed
9/21/0	5 OFG	Maintenance	2 Reéd
9/21/0	5 Reed	Tour	2 Reed
9/21/0	5 Reed	Shutdown	2 Reed
9/21/0	5 Reed	Training	10 Reed
9/22/0	5 Reed 17 miles of the second	- Startup	3 Reed
9/22/0	5 Reed	Tour	49 Reed
9/22/0	5 Reed	Maintenance	1 Reed
9/22/0	5. Reed .	Training	28 Reed
9/22/0	5 Reed	Shutdown	1 Reed
9/23/0	5 Reed	Startup	2 Reed
9/23/0	5 OEG	Maintenance	4 Reed
9/23/0	5 Reed	Maintenance	1Reed
9/23/0	5 Reed	Tour	28 Reed
1 9/23/0	Sor Reed & Laws Manager 1 1228	STraining THOM ST	124-100 Reed 900-04
9/23/0	5 Reed	Shutdown	1 Reed Story
9/26/0:	5 Reed	Maintenance	3 Reed
9/26/0	6 OEG	Maintenance	1 Reed
9/26/0:	5 Reed	Tour	Reed Shirt
9/26/0:	6 Reed	Bimonthly	4 Reed
9/2//0		Maintenance	
9/2//U	F Reed	Washing	5 Reed
0/27/0	Diverced and a second sec	Stortun	2 Peed
9/27/0	5 Reed	Training	1/ Reed
9/2//0	5 United Fire	Maintenance	1 Reed
9/29/0	5 Reed	Training	22 Reed
9/29/0	5 Reed	Shutdown	1 Reed
9/30/0	5 Reed	Startup	1 Reed
	5 Reed	Tour	19 Reed
9/30/0	5 Reed	Maintenance	-3 Reed
	5 Reed	Training	3 Reed
10/3/0	5 Reed	Startup	2 Reed
10/3/0	5 Reed	Shutdown	3 Reed
10/4/0	5 Reed	Startup	2 Reed
10/4/0	5 Reed	Maintenance	1 Reed

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	Date	Institution	Purpose	umber Funding
12	10/4/05	Reed 55411 a the	Shutdown	2 Reed
1. S.	10/5/05	Reed	Startup	2 Reed
: • 1	10/5/05	Reed	Weekly	4 Reed
,	10/5/05	Reed	Shutdown	5 Reed
•	10/6/05	Reed	Startup 🥵	2 Reed
	10/6/05	Reed	Training	2 Reed
1.1.2	10/6/05	Reed	Shutdown State	2 Reed
$\mathcal{C}_{r_{i}} \leq 1$	10/7/05	Reed	Startup	2 Reed
	10/7/05	Reed	Maintenance	1 Reed
	10/7/05	Reed and the second second	Training	1 Reed
	10/7/05	Reed	Shutdown	2 Reed
NO ESP.	10/10/05	US Crane and Hoist	Maintenance	1 Reed
	10/10/05	Reed	Startup	1 Reed
1931. H.	10/10/05	United Fire	Maintenance	1 Reed
<u>с</u>	10/10/05	Reed Part Parts	Shutdown	1 Reed
12:13:	10/11/05	Reed to dealer at the	Startup	3 Reed
15 	10/11/05	Lewis and Clark	Tour	3 US DOE
۰.	10/11/05	Pacific University	Tour	9 US DOE
in di Electronic	10/11/05	Reed	Shutdown	3 Reed
n de la composition de la comp	10/12/05	Reed	Startup	2 Reed
s an Al Feision	10/12/05	Reed State Hells	Weekly	2 Reed
الجنوع التين. مال د	10/12/05	FBI	lour	8 US DOE
	10/12/05		Iraining	14 Reed
577 - 57 F - 12	10/13/05		Startup	I Reed
n i zeri. Ni çi Qi	10/13/05	Keed	Training	
na san Na sa Sila	10/13/05	American Gnemical Society	10ur	24 US DUE
Here (A)	10/14/05	Deed state bits	Startup	1 Reed
	10/14/05	Reed represented	Training	4 Reeu
5 - C	10/14/05	Reed with some	Shuldown	2 Reeu
	10/17/05	Cleveland High School	Tour	
S. S.	10/17/05	Pred Putrist"	Tour	DOL DOL
	10/17/05	Reedanustant	Maintenance	CIVER Reed
55.20	10/17/05	NRC SHIGHT	Inspection	come Reed
1.200	10/17/05	Reed: 05//05/2001	Shutdown 200	32NE Reed
6-23	10/18/05	NRC and the	Inspection 1999	72 Reed
hee A	10/18/05	Reed Safrice?	Startup	2 Reed
losti.	10/18/05	Cleveland High School	Tour Cab	34 US DOE
5. J	10/18/05	Reed THE DURING	Shutdown	2 Reed
២ ភាព	10/19/05	Reed Statistic to be	Weekly	2 Reed
	10/19/05	NRC #URLAN	Inspection	2 Reed
in'd	10/19/Ö5	Reed	Weekly	71 Reed
505 ¹	10/19/05	Reed AMARA	Shutdown	1 Reed
1.1.1	10/21/05	Reed Statut	Training	2 Reed
	10/21/05	Reed H Change 2	Tour	7 Reed
i san ti	10/21/05	Reed	Maintenance	3 Reed
1997 (199	10/25/05	Reed	Training 👘 👘	5 Reed
	10/26/05	Reed and all	Maintenance	15 Reed
	10/26/05	Reed	Weekly	2 Reed
i nan s	10/26/05	United Fire	Maintenance 6	1 Reed
	10/28/05	Reed and a starting	Maintenance	4 Reed
	10/31/Ó5	Reed	Maintenance	2 Reed
۶	11/1/05	Reed	Startup	3 Reed
· · · ·	11/2/05	Reed	Tour	2 Reed
	11/2/05	CSLA	Tour	14 US DOE
ч. ^с .	11/2/05	Reed	Shutdown	1 Reed
•	11/2/05	Reed	Weekly	3 Reed
	11/2/05	Reed	Operations	2 Reed

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pre Starr 🔅 Date 👘	Institution	Purpose: All a	Number Funding
11/2/05	Reed	Training	12 Reed
11/3/05	Reed	Training	17 Reed
11/4/05	Reed	Tour	63 Reed
11/4/05	Reed	Shutdown (1 Reed
11/5/05	Reed an and	Startup	2 Reed
Line 11/5/00	Reed	Tour	20 Reed
11/5/05	Reed	Shutdown	2. Reed
11/8/05	Reed	Maintenance	L Reed
11/8/05	United Fire	Maintenance	-1 Reed
11/8/05	ECI Comera	Maintenance	1 Reed
11/0/05		Waakhy	2 . Peed
11/9/05	Deed	Weekiy page	2 Reed
. (<i>a</i>) 11/9/05	Recu Altrataria		Baad
5 CV 11/10/05	Reed		
11/10/05	Reed	Operations	
Full 11/10/05	Reed	Shutdown 5000	Reed
<u>, o⇒</u> ⊊ 11/11/05	Reed		2 Reed
HCC 2011/11/05	Reed	Startup	t A Reed
avid ≥_11/11/05	PNW	,Tour,	40 US DOE
11/11/05	Reed	. Tour how	5 Reed
<u></u> : 11/11/05	Reed Barrier	Operations b_{ij}	Reed 1311 Reed
Son (* 11/11/05	Reed	Shutdown 1000	Reed
11/14/05	Reed	- Startup	2 Reed
List 11/14/05	Reed	Operations Series	-4 Reed
hans 11/14/05	Reed	Shutdown	2 Reed
No. 3 11/14/05	Reed	Tour Same	4 Reed
11/15/05	Reed	Startuper Front	2 Reed
11/15/05	Reed	Operations Equal	-1 Line Reed
11/15/05	Reed a web	Shutdown Source	2 2 Reed
11/16/05	Reed	Operations have	3 Star Reed
11/16/05	Reed areas	Bimonthly being	T 70 ALA Reed
2.11/16/05	Reed and	Weeklyn 'mel	2 2 Reed
11/16/05	Reed and	Training	r altres Reed
S ^a 11/10/05	Reed	Maintenance	T The Los Reed
11/17/05	Reed Reed	Training	r the second second
11/17/05	Reed () () ()	Maintenance	S Reed
11/10/05	Reed myselfing	Startur	A Dia Hairia Reed
11/21/05		Startup (342)	
11/21/05	Reed h.	Training (204)	A 25.6 Reed
11/21/05	Reed The T	Operations	
11/21/05	Reed (prolightly)	Shutdown back	2 2 $3 $ Reed
11/22/05	Reed	Maintenance	Reed Reed
	Reed and stands	Startup	2 72 Reed
11/23/05	Reed	Tour	5 A Reed
i ⊲⊱ 11/23/Q5	Reed to a star of the	Weekly	Reed
11/23/05	Reed	Training (2005	2 Reed
11/23/05	Reed	Shutdown	Reed
11/30/05	Reed	Weekly	2 Reed
11/30/05	IB N/W	Maintenance	Reed Reed
11/30/05	Reed	Training	A3 Reed
12/1/05	Reed	Startup	2 Reed
12/1/05	Reed	Tour and your	4 Reed
12/1/05	United Fire	Maintenance	1. Reed
12/1/05	Reed	Operations	2 Reed
12/1/05	Reed	Training	11 Reed
12/1/05	Reed	Shutdown	3 Reed
12/1/05	PFR	Maintenance	4 Reed
10/0/05	Deed U/	Training	· A Reed
10/2/05	Dood	Training ; * ·	18 Dood
12/3/05	Reeu		10 Keeu
12/5/05	Reed	Operations	i keeu

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ڊ ¹	Date	Institution	Purpose at ANN	umber Funding
L. A	12/5/05	Reed memory and	Shutdown	2 Reed
	12/6/05	Reed	Operations	5 Reed
	12/6/05	Reed	Startup	1 Reed
,' '	12/6/05	United Fire	Maintenance	1 Reed
- 1 1	12/6/05	Reed	Shutdown	1 Reed
ta B	12/7/05	Reed	Operations	2 Reed
	12/7/05	Reed	Weekly	4. Reed
1. 11 2	12/7/05	Reed	Training	13 Reed
	12/8/05	Reed	Training	13 Reed
문 교	12/8/05	Reed and a	Operations 384.38	2 Reed
	12/9/05	Reed	Maintenance.	6 Reed
•	12/9/05	Reed	Training	4 Reed
•	12/10/05	Reed	Startup	2 Reed
، رو در د	12/10/05	Reed	Training	4 Reed
	12/10/05	Reed and had	Tour	10 Reed
	12/10/05	Reed	Shutdown	4 Reed
	12/13/05	Reed	Maintenance	2 Reed
,	12/13/05	Reed	Iraining	I Reed
· · ·	12/13/05	Reed	Snutdown	1 Reed
18.7	12/14/05	Reed Ref Call	Training 5	
ية مياني، المياني الم المالية	12/15/05	PFD Paod	Training	
	12/15/05	Reeu and sta	Operations	A Reed
	12/15/05	Reed to a final fi	Stortup	1 Reed
n an a'	12/16/05	United/Fire a 20	Maintenance	1 Reed
	12/18/05	PFR autor	Training	A Reed
19 19	12/18/05	Reed wat base to	Operations	1 Reed
5.11	1/3/06	West Linn High School	Tour	2 US DOE
Terral.	1/3/06	Reeducanonical	Maintenance	3 Reed
$(\gamma, \gamma) = \sum_{i=1}^{n} (\gamma_i - \gamma_i) \sum_{i=1}^{n} (\gamma_i - $	1/4/06	Reed animation	Maintenance	(5) Reed
15.1 X	1/4/06	Reed printing	Tourse steel.4	(1) Reed
	1/5/06	Reed youth it	Maintenance	5 Reed
1. m. (1)	1/6/06	Reed Strangan	Maintenance	4 Reed
41.17	1/9/06	Reed quarter	Maintenance 3	24 Reed
Net 🕚	1/9/06	Reedonnschliefe	Operations tested	28 Reed
ar 33	1/10/06	Reed white where	Maintenance and	90 C Reed
	1/10/06	Reed grande	Operations (1994)	31) Reed
	1/10/06	Reed HATTER	Training	11 Reed
$0 \pm i \lambda_{i}$	1/10/06	Reed (14)(applied by	Shutdown	1 Reed
	1/11/06	Reed 254 (0.53) 4	Training	19 Reed
	1/11/06		Operations	22 Reed
	1/11/00	Reed Constants	Weekly	4 Reed
an an an Anna Anna Anna Anna Anna Anna	1/11/00	Reed Association	Maintananaa	Quint Reed
4 1."	1/12/00	Reed	Operations	23 Reed
aya sar gan	1/12/06	Reed as a	Shutdown	A Reed
	1/12/06	Reed and shares	Training	5. Reed
· · · ·	1/13/06	Reed and a straight	Startun	3 Reed
	1/13/06	Reed	Maintenance	20 Reed
	1/13/06	Reed	Operations	·7 Reed
1. S. M.	1/13/06	Reed	Training	3 Reed
	1/13/06	Reed	Shutdown	1 Reed
· _ • `•	1/16/06	Reed	Startup	3 NEL Reed
	1/16/06	Reed . And the first	Maintenance	14 Reed
	1/16/06	Reed	Operations	12 Reed
. f	1/16/06	Reed	Training	2 Reed
• •	1/16/06	Reed	Shutdown	1 Reed
<i>v</i>	1/17/06	Reed	Training	22 Reed

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ja Botari -	Date	Institution	Purpose	Number]	Funding
125.22	1/18/06	United Fire	Maintenance	1	Reed
5 to 19	1/18/06	Reed	Training	10 s 1	Reed
1. 1.20	1/18/06	Reed	Maintenance	- 14	Reed
N. 1.	1/18/06	Reed	Startup 🗐 🖉 😳	5	Reed
1.1	1/18/06	Reed	Weekly	6	Reed
1.00	1/18/06	Reed	Shutdown 2002	2 :	Reed
1.993 T	19-Jan	Reed	Training	36	Reed
	1/20/06	Reed	Startup	6	Reed
55 S	1/20/06	Reed	Maintenance 2	5	Reed
22.31	1/20/06	Reed	Training	1 71 98 (1)	Reed
. Mather	1/20/06	Reed man the state	Shutdown 3023	2 ,	Reed
1.17	1/22/06	Reed gradual	Startup 6771	3	Reed
	1/22/06	Reed and the	Maintenance 🧃	2	Reed
14 5	1/22/06	Reed	Training See	9.71	Reed
· ber T	1/22/06	Reed	Shutdown 5	· 21 ·	Reed
by S	1/24/06	Reed	Maintenance	(二) PANTE C.	Reed
the state	1/25/06	Reed and the state	Maintenance	1 41 41 (1)	Reed
Fueto	1/25/06	Reed	Startup	11	Reed
07 3	1/25/06	Reed	Training	. 19	Reed
	1/25/06	Reed	Shutdown (hand)	2	Reed
200 10 10	1/25/06	Reed	Weekly	4	Reed
کر ٹی ہے ،	1/26/06	Reed 2 March 1	Maintenance	*15 3 (19)	Reed
1.54	1/26/06	Reed and a set	Tour 5.5	1.4.2.10:	Reed
He.	1/26/06	Reed	Training	12 10 AS	Reed
1.52	1/27/06	Reed	Maintenance	1 11 2021	Reed
61.423	1/27/06	Reed	Startup 617	2 6 Wat 2 .	Reed
bes S	1/27/06	Portland Waldorf High School	Tour buo.	1 2157: 21	US DOE
- Stat 80	1/27/06	Reed and a state	Verrision (toTs	7 4 0577.1	Reed
13.2	1/30/06	United Fire	Maintenance	2	Reed
6993	1/30/06	Portland Fire	Training best	4 4 0.24	Reed
1.1	1/30/06	Pinnacle Invest	Training beet	1 20\4.1	Reed
5005	1/31/06	Reed: come of lash	Training house	i 1: 1	Reed
19 Q.	1/31/06	Reedant to draw	Maintenance	3 9561	Reed
· :::	1/31/06	Reed: www.bille.	Startup beel	4 4 6.0	Reed
	2/1/06	Reed setteral angel?	Maintenance	1 10.00	Reed
	2/1/06	Reeduration in the se	Weekly bord	La overtis - F	Reed
	2/1/06	Reed ansate core	Startup and	$1 - dc_{V,T} + dc_{V,T}$	Reed
0005	2/2/06	Reed array of	Startup 5995	4 - 4	Reed
	2/2/06	Reed	Shutdown begi	3 3bartyi	Reed
	2/6/06	Reed and a second	Training bout	1 . 1	Reed
بالمقربين بالمساجر	2/8/06	Reed	Training 19-33	4. (j.)	Reed
1	2/8/06	Reed	Startup 1	4 11. ET	Reed
	2/8/06	Reed . Achieve .	Shutdown and	1.1.1	Reed
	2/9/06	Reedurescurter	Maintenance	a - 4 4211	Reed
	2/9/0.6	Reed the last off	Training	4	Reed
	2/9/06	Reed And And Pa	Startup 32.55	3.000	Reed
	2/9/06	Reed	Shutdown deast	3 0	Reed
1,5 %	2/10/06	Reed for a state of the second	Training 6.53	1 317 1	Reed
	2/10/06	Reed	Tour	4 11 1.1	Reed
	2/10/06	Reed	Shutdown Law	2	Reed
	2/11/06	Reed in the literature	Training	8	Reed
, · ·	2/11/06	Reed	Startup	4	Reed
·	2/13/06	Reed	Training :	2	Reed
	2/14/06	United Fire	Maintenance	÷ 1,	Reed
. /1	2/14/06	Reed	Training	2	Reed
	2/15/06	Reed and the	Training	3 > :	Reed
	2/15/06	Reed	Maintenance	a 4 , 1.	Reed
· , `,	2/15/06	Reed and a	Startup	1	Reed

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Date:	Institution (1)	Purpose	umber Funding
2/15/00	Reed 2400 the	Shutdown	1 Reed
2/15/0	6 Reed March and	Startup	1 Reed
2/16/0	Warner Pacific College	Tour	16 US DOE
2/16/0	Reed the second ge	Shutdown	1 Reed
2/10/0	Reed 1	Training	2 Reed
2/11/00	Reed State	Training	3 Reed
2/20/00	Reed 2	Shutdown	1 Reed
2/20/00	S Reed	Startup	3 Reed
2/21/0	S Rex Putnam High School	Tour	33 US DOE
2/21/0	6 Reed	Training	3 Reed
2/21/0	6 Reed	Shutdown	2 Reed
2/21/0	5 Reed	Startup	ALC: Reed
2/22/0	5 Reed	Weekly	3 Reed
2/22/0	5 Reed and the file	Maintenance	1 Reed
2/22/0	5 Saturday Academy	Tour (1993)	19 US DOE
2/22/0	6 Reed Mary	Tour	3 Reed
2/22/0	5 Reed and a	Shutdown 🚽 🔅	1 Reed
2/22/0	5 Reed Anthen	Training	3 Reed
2/24/0	6 Reed a stable	Training	4 Reed
2/27/0	5 Reed	Maintenance	2 Reed
2/27/0	5 Reed and the second	Training	4 Reed
່ມະ. 2/28/0	5 Reed 🐇 👘	Startup	1 Reed
2/28/0	5 United Fire	Maintenance	1 Reed
2/28/0	5 Reed and with the	Training	2 Reed
2/28/0	5 Reed	Shutdown	2 Reed
3/1/06	Reed Read and E	Tour	3 Reed
ડેલ્લ્સ્ 3/1/0€	Reed and Hause C	Maintenance	2 Reed
∋vu⊖ 3/1/0€	Reed Rootherpage	Weekly	3 Reed
3/1/06	Reed guinning	Training	3 Reed
Lond 3/2/06	Reed ADAMA	Training	4 Reed
3/3/06	Reed Guilling	Maintenance	2 Reed
00001 3/3/06	Reed Difful Official A	Training	A Reed
3/4/06	Reed envolution	Startup	4 Reed
1	Reed and and a	Iraining	4 Reed
3/6/06	Reed (1) and the	Training 0.1.1	
C 2010 3/6/06	Reed CHERTSAUCHER	Operations 6494	90 No Reed
		Training Loss	Z Reeu
3/7/06 10071-211-2/7/06		Maintenence	A So Reed
3/ //UC	Bood was to de	Wookh	2 Reed
3/8/00	Reed as a second	Training	1 Reed
a at 3/8/06	Reed	Operations	1 Reed
3/9/06	Reed 7	Training	6 Reed
3/10/0	S Reed HILLS	Training	5 Reed
3/11/0	5 Reed	Tour	2 Reed
3/11/0	6 Reed	Training	2^{12} Reed
3/11/0	5 Reed The offer	Training	Reed
3/14/0	5 United Fire	Maintenance	Reed
3/15/0	5 Reed	Startup 1 2	2) Reed
3/15/0	5 Reed	Bimonthly	3 Reed
3/15/0	5 Reed	Weekly all	d Reed
3/15/0	5 Reed	Operations	2 Reed
3/17/0	5 Reed	Maintenance	3 Reed
3/19/0	6 Reed	Training	6 Reed
3/19/0	5 Reed	Startup	define Reed
3/21/0	6 Reed	Startup	1 Reed
3/21/0	5 Reed	Training	3 Reed
3/21/0	5 New Urban High School	Tour	26 US DOE

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entre la	Date	Institution		Purpose	umber Funding	g
in in the second se Second second	3/21/06	Reed		Shutdown	1 Reed	
	3/22/06	State of Oregon		Inspection	2 Reed	
alette.	3/22/06	Portland Police Bureau		Inspection and the	1 Reed	
	3/22/06	Reed		Inspection	2 Reed	·
1.05	3/22/06	Saturday Academy		Tour	7 US DOE	Ξ
5 32	3/23/06	Reed		Startup	1 Reed	
1.11	3/23/06	Reed		Training man	3 Reed	
	3/23/06	Reed		Tour	8 Reed	
TENER	3/24/06	Reed	· ; ·.	Training	A Reed	
141 3	3/24/06	Reed		Tour	7 Reed	
1.15	3/25/06	Reed and the set		Training 1.1.1	5 Reed	
5 28	3/27/06	Reed		Training	1, Reed	
	3/28/06	Reed with the		Training	3 Reed	
h > 1	3/28/06	United Fire Park		Maintenance	2 Reed	
209C 21	3/28/06	Canberra		Maintenance	,2 Reed	
5.23	3/29/06	Reed		Weekly by 4	3 Reed	
	3/29/06	Reed an apple		Startup 5-53	2 Reed	
$b_{2,2}$	3/29/06	Reed		Training '2003	4 Reed	
9223	3/29/Q6	Reed		Shutdown	a Reed	
to barrow	3/30/06	Reed		Startup 1999	2 Reed	
î	3/30/06	Reed		Training Care	5 Reed	
1.54	3/30/06	Reed		Tour Grand	11 Reed	
i veli	3/30/06	Reed		Shutdown	1 Reed	
1.52	3/31/06	Reed and a		Training	5 Reed	
1.14	3/31/06	Reed		Tour 1999	10 Reed	
	3/31/06	Reed		Shutdown Dort	hand Reed	
1:20	3/31/06	Reed		Operations banfi	201 Reed	
1. 5-31	4/3/06	Reed Contraction		Operations heast	()\\`{} Reed	
~ 1	4/4/06	Reed		Training Doo.9	2 Reed	
i	4/5/06	Reed		Weekly boost	2 Reed	
	4/5/06	Reed: man rabbes		Startup 59%	300 Reed	
1.4	4/5/06	Reed and the		Maintenance 2015	2(11) Reed	
	4/5/0 6	Reed		Shutdown break	1. Reed	
	4/6/0 6	Reed and the or h		Training Cost	3 Reed	
$\{ i,j\}$	4/6/06	Reed 1920 17		Bimonthly 1000	h) 🔬 📜 Reed	
1 - S.	4/6/06	Reed DEPARTORNE		Maintenance	10.6% Reed	
3. 1	4/7/06	Reed		Training boos	20 Reed	
. 1995 <u>)</u>	4/7/06	Reed Black f		Shutdown 505	b), (7 Reed	
7, 19	4/10/06	Pacific University		Tour 555M	20 US DOE	ŝ
1.1.5	4/10/Q6	Reed /		Shutdown 5 25	1 Reed	
. 13 L.T.	4/10/06	Reed		Training tool	4 Reed	
	4/11/06	United Fire, 1964		Maintenance	10 Reed	
1:27	4/11/06	Concordia University		Tour Carl	20) GAL US DOE	i.
1	4/12/06	Reed		Startup	2 Reed	
4. g S	4/12/06	Reed		Training 200	d Reed	
·	4/12/06	Reed	•	Weekly margin	4 Reed	
l i d	4/13/06	Reed		Startup Confl	2 Reed	
	4/13/06	Reed		Training Strait	6 Reed	
1 t	4/13/06	RAD		Tour Date &	22 US DOE	ļ.
والحفاقي	4/13/06	Reed		Maintenance	2 Reed	
11. A.	4/13/06	Reed		Shutdown 👈 😛	4_{2} \sim Reed	
2 1	4/14/06	Reed		Startup 📜 😘	4 Reed	
e Vi	4/14/06	Reed		Operations -	1 Reed	
· '•;	4/14/06	RAD		Tour	22 US DOE	i.
••••••	4/14/06	Reed		Maintenance	4 Reed	
	4/14/06	Reed		Training 👔 😳	5 Reed	
21	4/14/06	Reed		Bimonthly 1998	1 Reed	
	4/14/06	Reed	· 1,67	Tour	1) Reed	

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	Date	Institution	Purpose 300 N	umber Funding
1895 T	4/15/06	Reed	Training	5 Reed
i i i	· 4/15/06	Reed	Operations	2 Reed
	4/15/06	Reed	Maintenance	1 Reed
fort I.	4/17/06	Reed	Startup	1 Reed
i. t	4/17/06	Reed	Tour	14 Reed
110 20	4/17/06	Reed when	Training	3 Reed
1 > 1	4/17/06	Reed	Shutdown	1 Reed
	4/18/06	Reed	Tour	2 Reed
	4/18/06	Reed and the line	Training	3 Reed
	4/19/06	PFB	Training	'1 Reed
北北省	4/19/06	Reed	Startup Startup	(1) Reed
Area a	4/20/06	Reed	Training	3 Reed
ar da'	4/20/06	United Fire	Maintenance	1 Reed
ta stasti T	4/20/06	Reed	Maintenance	3 Reed
1.C. 1.	4/21/06	Concordia University	Tour	18 US DOE
	4/21/06	Reed 9-11-44	Maintenance	3 Reed
i i i	4/21/06	Reed	Tour	1 Reed
1	4/21/06	Reed	Shutdown	'l Reed
	4/24/06	David Douglas High School	Tour	32 US DOE
06 22.5 1	4/24/06	Reed TRACE CALLS	Training	2 Reed
S. O.	4/25/06	Reed	Training	4 Reed
196, 1925. 1811 - 77	4/26/06	Reed	Startup	1 Reed
	4/26/06	American Nuclear Insurers	Inspection	1 Reed
1975 A.	4/26/06	David Douglas High School	Tour	25 US DOE
	4/26/06	Reed Advantage	Training - 52	3 Reed
a an Chine	4/26/06	Linfield College	Tour	8 US DOE
na a Sas. Marata	2 5/1/06	Reed Delay	lour	I Reed
an a	5/2/00		Startup	1 Reed
na ang san Ng Ng N	5/2/00	NRC 1939,473	Examinations	A Reed
fisher (5/2/00	DED amatemor. ⁽¹⁾	Training	A Reed
. #12-	5/2/00	Prod With The	Training	ZI Reed
nee fi	512100	NDC although	Framing	Reed
As est	5/2/06	Red Televine	Examinations 4	MERIC Reed
the off	5/3/06	United Fire as h	Mointenance	AND Reed
bseM	5/3/06	Reedbassorusly	Startun 6.39	
45.51	5/4/06	Reed Girada	Examinations 3	S Reed
122 1	5/4/06 5/4/06	NRCLOBRENA	Examinations 53	4 Reed
Reed	5/5/06	Reed (Coloude)	Examinations	Reed Reed
5.4	5/5/06	NRC 90/	Examinations	2 Reed
b sa≦	5/5/06	Reeductors	Startup 2119	2 Reed
la rest	5/5/06	Reed	Operations	A Reed
177. NA	5/6/06	Reed	Operations	2 Reed
i, 1,	5/6/06	Reed Harrist	Training	Reed
$\{r_i\}, \hat{\mathcal{H}}$	5/7/06	Reed a strate in the second second	Operations	2 Reed
$C \in \mathbb{N}$	5/9/06	NRC	Examinations	6 Reed
$t \rightarrow t$	5/10/06	NRC CALLER	Examinations	3 Reed
Lisi	5/10/06	Reed	Examinations	Reed
1.22.	5/10/06	Reed and an all a	Startup	(1745) Reed
$\{ 1, 2, 3, 1 \}$	5/11/06	Reed	Weekly	1 Reed
s r Li	5/11/06	Reed	Maintenance	3 Reed
i	5/12/06	Reed	Maintenance	1 Reed
§	5/16/06	Lincoln High School	Tour	21 US DOE
, d	5/17/06	Reed (The state	Weekly	1 Reed
the second	5/19/06	Reed	Tour	3 Reed
· · .:	5/23/06	Reed	Tour	6 Reed
122 B	5/26/06	United Fire	Maintenance	1 Reed
1. T	5/30/06	Portland Community College	Tour	12 US DOE

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y direction	Date	Institution	Purpose N	umber Funding
100	5/31/06	HVAC-RJ	Maintenance	1 Reed
1.991	6/1/06	Portland Community College	Tour	12 US DOE
	6/1/06	Reed	Tour	3 Reed
5 m (6/2/06	Reed	Tour	1 Reed
Jr138	6/5/06	United Fire	Maintenance	1 Reed
	6/5/06	Reed	Tour	2 Reed
25.	6/5/06	Reed	Weekly	2 Reed
* 1	6/20/06	RSO	Tour	14 US DOE
2 a 4	6/20/06	Reed	Maintenance	1 Reed
t suit	6/20/06	Reed	Weekly	.3 Reed
	6/22/06	RSO	Training	12 marsh Reed
	6/26/06	Reed	Training	5 Reed
	6/27/06	Reed	Training	7 Reed
1	6/28/06	DeTemple	Maintenance	2 Reed
	6/28/06	Reed	Maintenance	4 Reed
	6/28/06	Reed	Startup	3 Reed
	6/28/06	OCH	Tour	18 US DOE
ي د دور د دور	6/28/06	Reed	Training	2 Reed
2.571.01	7/7/06	DeTemple	Maintenance	2 Reed
1963.4	7/7/06	Reed manufactor	Maintenance	2 Reed
	7/8/06	Reed	Weekly	A Reed
	7/11/06	Reed	Startun berett	2 Reed
5 5	7/11/06	United Fire:	Maintenance	1 Reed
1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	7/11/06	Reed	Maintenance	Beed
	7/12/06	Reed	Weekly hours	5 Reed
the start	7/12/06	Reed	Startup: Medical	3 Reed
1557	7/12/06	Cascade Presbyterian	Tour	19 US DOE
Jag y	7/12/06	LJCDS	Tour	1.we = US DOE
3.5	7/13/06	Reed	Startup Osta	2 Reed
5.4	7/13/06	Saturday Academy	Tour base	23 US DOE
- 0 E	7/13/06	Reed	Operations	2 Reed
. 25 A	7/13/06	Cascade: Presbyterian	Tour boost	8 US DOE
Sec. 2.	7/17/06	Reed and a second	Bimonthly 237	2 Reed
5.15月	7/18/Q6	Reed as sector and the	Bimonthly 1999	6 Reed
1.12	7/19/06	Reed	Weekly H Logicia	2(A) Reed
	7/19/06	Reed Company and the second se	Maintenance, g	2 Reed
* 15 f	7/20/06	Reed Wasse 22:5	Startup Loss	2 Aust Reed
1 4 4	7/20/06	Reed	Maintenance	1 Reed
	7/20/06	Reed was more and the	Shutdown Lagest	$1_{\mathrm{G}} \neq \mathbb{R}$ Reed
	7/24/06	Reed Matter	Tour 🔿 🏤	1 Reed
	7/24/06	Reed	Maintenance 👾 🖣	2 Reed
1 E -	7/26/06	Reed a set of the set	Startup	3 Reed
1.6	7/26/06	Reed	Maintenance	3 Reed
$i = i^{\dagger}$	7/27/0,6	Reed	Startup tes st	40 Reed
• , '	7/27/06	Reed a set of the	Operations 5	2 Reed
	7/27/06	AWSEM	Tour	21 US DOE
~ 1	7/28/06	Reed	Startup (3.17	3 Reed
191 - E	7/28/06	Reed	Tour	2 Reed
	7/28/06	United Fire	Maintenance	Reed
• •	31-Jul	Reed	Maintenance	Z Reed
	1/31/06	Reed	Startup	2_r Reed
	8/1/06	Reed	Maintenance	Keed
	8/2/06	Reed Based	Maintenance	Z Reed
1.	8/3/06	Reed	Startup	2 Reed
	8/3/06	Portland Community College	Tour	IN US DOE
	8/3/00	Reed .	Operations	2 Keed
	8/4/06	Reed	Maintenance	1 Reed
	8///00	Reed	Maintenance	Z Keed

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Date	Institution	Purpose	Number	Funding
8/7/06	Reed	Startup	1	Reed
8/7/06	Reed	Tour	11	Reed
8/7/06	Reed	Shutdown	1	Reed
8/8/06	Reed	Startup	3	Reed
8/8/06	Reed	Maintenance	2	Reed
8/8/06	Reed	Tour	4	Reed
8/8/06	Reed	Shutdown	1	Reed
8/9/06	Reed	Weekly	2	Reed
8/9/06	Reed	Maintenance	1	Reed
8/9/06	Reed	Tour	2	Reed
8/10/06	Reed	Maintenance	2	Reed
8/10/06	DeTemple	Maintenance	2	Reed
8/10/06	Reed	Startup	. 1	Reed
8/10/06	Dynalectric	Maintenance	3	Reed
8/10/06	Reed	Maintenance	2 ·	Reed
8/11/06	Reed	Tour	2	Reed
8/14/06	Reed	Maintenance	3	Reed
8/15/06	DeTemple	Maintenance	1	Reed
8/15/06	Dynalectric	Maintenance	2	Reed
8/15/06	Reed	Maintenance	1	Reed
8/15/06	United Fire	Maintenance	1	Reed
8/16/06	Reed	Weekly	1	Reed
8/17/06	DeTemple	Maintenance	1	Reed
8/17/06	Reed	Startup	1	Reed
8/17/06	Reed	Tour	9	Reed
8/17/06	Reed	Maintenance	1	Reed
8/21/06	Reed	Tour	5	Reed
8/23/06	Reed	Startup	1	Reed
8/23/06	Reed	Tour	69	Reed
8/24/06	Reed	Tour	24	Reed
8/24/06	Reed	Shutdown	1	Reed
8/24/06	Reed	Maintenance	1	Reed
8/25/06	Reed	Startup	1	Reed
8/25/06	Reed	Tour	35	Reed
8/25/06	Reed	Shutdown	1	Reed
8/29/06	DeTemple	Maintenance	2	Reed
8/30/06	DeTemple	Maintenance	3	Reed
8/25/06	Reed	Maintenance	1	Reed