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License R-74
Docket 50-156

August 9, 2005

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Dear Sir:

Enclosed is a copy of the 2004-2005 Annual Report for the University of Wisconsin Nuclear Reactor Laboratory as required by our Technical Specifications.

Sincerely,

Robert J. Agasie
Reactor Director

Enc. (Annual Report)

cc: Region III Administrator
Compliance Inspector, Region II, Craig Bassett
Facility Project Manager, Patrick Isaac
Reactor Safety Committee, RSC 850

A020

THE UNIVERSITY OF WISCONSIN
NUCLEAR REACTOR LABORATORY

FISCAL YEAR 2004-2005 ANNUAL OPERATING REPORT

Prepared to meet reporting requirements of:
U. S. Department of Energy
SPECIAL MASTER TASK RESEARCH SUBCONTRACT NO. C96-175937
and
U. S. Nuclear Regulatory Commission
(Docket 50-156, License R-74)

Prepared by:

Robert J. Agasie
Department of Engineering Physics

EXECUTIVE SUMMARY OF REACTOR UTILIZATION

Teaching: Teaching usage of the reactor during the year included:

- 76 Nuclear Engineering & Engineering Physics students in laboratory and lecture courses.
- 14 students and staff from other UW-Madison departments used the facilities for formal instruction or research.
- 7 students and staff from 5 additional college-level educational organizations used the facilities for formal instruction or research.
- 616 students and instructors from 13 non-college level educational organizations used the facilities for formal instruction or research as part of the UW Nuclear Reactor Outreach Program.

Research: Neutrons from the reactor were used primarily for neutron activation and analysis.

- 343 samples were irradiated for departments at UW-Madison.
- 21 samples were irradiated for other educational institution research programs.
- 254.2 hours of neutron beam time were attributed to the study of neutron radiolysis in water at supercritical pressures and temperatures.

Industrial Use:

- One sample was irradiated for isotope production services.

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A. SUMMARY OF OPERATIONS

1. INSTRUCTIONAL USE -- UW-Madison Classes and Activities

Nuclear Engineering & Engineering Physics (NEEP) 231, "Survey of Nuclear Engineering" was offered in the spring semester with an enrollment of 30 students. The course is designed for freshmen students interested in nuclear engineering and consists of three lecture modules surveying fission, fusion and radiation science technologies. The fission module concludes with a reactor tour.

NEEP 427 was offered in the fall and spring semesters with a total enrollment of 28 students. Several NEEP 427 experiments use materials that are activated in the reactor. One experiment entitled "Radiation Survey" requires that students make measurements of radiation levels in and around the reactor laboratory.

Eighteen students were enrolled in NEEP 428 which was offered in the spring and summer semesters. Three experiments in NEEP 428 require exclusive use of the reactor. These experiments ("Critical Experiment", "Control Element Calibration", and "Pulsing") required a total of 18 hours of exclusive reactor use. Other NEEP 428 laboratory sessions use material that has been irradiated in the reactor ("Fast Neutron Flux Measurements by Threshold Foil Techniques" and "Resonance Absorption").

2. REACTOR SHARING PROGRAM

The University of Wisconsin Nuclear Reactor was again funded this year by the U.S. Department of Energy, Office of Nuclear Energy, Science and Technology to offer reactor services in accordance with the University Reactor Sharing Program. The purpose of the program is to make available university nuclear reactor facilities to non-reactor owning colleges, universities, and other educational institutions. User groups affiliated with the host institution (UW-Madison) are also eligible for assistance, up to 35% of the awarded funds. This year, the Reactor Laboratory provided $25,975 of reactor services free of charge to the user institutions under the University Reactor Sharing Program; of which, $20,000 was reimbursed by the U.S. Department of Energy. User institutions participation in this year's program are detailed below.

Participating Institution	Principal Investigator	Number of Faculty/ Students Involved

Argonne National Laboratory
D. Bartels 3/0
Reactor tour and demonstration of supercritical water test loop.

Beloit College
S. Ballou 1/0
Analyzed swipe tests to leak check radioactive sources and performed detector calibration.

Purdue University
P. Wilson 1/0
Reactor tour and demonstration of supercritical water test loop.

University of Minnesota - Duluth
G. Rapp 1/0
Gamma spectrographic analysis of material in support of returning NAA samples to the principle investigator.

University of Wisconsin - Madison
Department of Engineering Physics
T. Brigss 1/26
Reactor tour and lecture as part of the Energy Conversion Technologies course.

University of Wisconsin - Madison
Department of Engineering Physics
M. Swandby 0/19
Reactor tour and demonstration of supercritical water test loop in support of graduate research recruitment program.

University of Wisconsin - Madison
Department of Engineering Physics
T. Allen 3/46
Production of various activation foils as gamma emitting sources for the Instrumentation Laboratory.

University of Wisconsin - Madison
Department of Engineering Physics
J. Murphy 1/50
Reactor tour and lecture as part of the Introduction to Nuclear Engineering course.

Participating Institution	Principal Investigator	Number of Faculty/ Students Involved

University of Wisconsin - Madison
Department of Engineering Physics
J. Kulpin 1/0

Neutron calibration services provided to the Ion Beam Laboratory.

University of Wisconsin - Madison
Department of Engineering Physics
M. Anderson 2/2

NAA to measure trace elements in tubing to be inserted in the supercritical water test loop.

University of Wisconsin - Madison
Department of Medical Physics
B. Thomadsen 3/5

Calculations of yttrium activation for preliminary work in a program to determine whether the radioactive yttrium can be plated to stents in order to aid in preventing re-blocking of an artery after the stent is placed following angioplasty.

University of Wisconsin - Madison
Police Department
T. Kuschel 1/0

Reactor tour and lecture on radiation and radioactivity in the environment.

University of Wisconsin - Madison
Department of Soil Sciences
P. Helmke 4/1

NAA to determine Fe, K/Na ratios, and trace element concentrations of samples from a soil-stoneline-ironstone complex in Uganda.

University of Wisconsin-Whitewater
S. Sayhun 1/0

Analyzed swipe tests to leak check radioactive sources and performed detector calibration.

Non-College Groups:

Participating Institution	Number Instructor/Students Involved
Abundant Life Christian High School Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor.	1/36
American Society of Mechanical Engineers, UW-Madison Branch High school Day on Campus Engineering Society sponsored tours of College of Engineering facilities for area high school students. The tour included a discussion on nuclear energy in addition to a tour of the facility.	1/42
Boy Scouts of America Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor. Program included hands on demonstrations of radiation detection and shielding. Program co-sponsored by the UW student branch of the American Nuclear Society in support of the Scouts Atomic Energy Badge program.	5/404
Dodgeville High School Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor.	1/15
LaFollette High School Advanced Science and Engineering Class. Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor. Provided real time gamma spectroscopy activation analysis laboratory demonstration.	1/12
New Tier High School Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor. Provided real time gamma spectroscopy activation analysis laboratory demonstration.	1/6
O'Keeffe Middle School Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor.	1/42

Participating Institution Number Instructor/Students Involved

Nuclear Summer Science Seminar 1/10

Two, 1 week long seminars, on nuclear science for junior and senior high school advance physics and chemistry students from 9 area school districts. Students participated in lectures covering topics in atomic and nuclear structure, radioactivity, and shielding. Laboratory sessions included use of Geiger-Müeller and scintillation counters to experimentally investigate lectured topics. The final day was dedicated to lecture and demonstration of nuclear reactor physics utilizing the UW Nuclear Reactor.

Saturday Enrichment Program 1/17

A program sponsored by the Department of Education Outreach at the University of Wisconsin to allow local middle school students to explore math, science, and engineering. Reactor tour and nuclear energy discussion.

Society of Women Engineers
Engineering Careers for Tomorrow 1/21

Student engineering society promoting women's roles in engineering programs. Visit included a reactor tour and talks with high school students about career options in nuclear science and engineering.

Summer Science Institute 1/6

A high school program designed to provide experience in biological and physical research programs. Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor.

Tim Cullen Internship Program 0/3

Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor.

Waunakee High School 1/17

Reactor tour with a discussion on applications of nuclear energy and uses of the UW nuclear reactor.

USER SUMMARY:

Educational Institutions:	27
Students:	780
Faculty/Instructors:	39

3. SAMPLE IRRADIATIONS AND NEUTRON ACTIVATION ANALYSIS SERVICES

There were 365 individual samples irradiated during the year. Of these samples, 119 were irradiated for 15 minutes or less. Samples accumulated 120.5 irradiation space hours and 300.7 sample hours. Many samples were irradiated and then counted at the Reactor Laboratory as part of our neutron activation analysis service. In the listing below the notation (NAA) indicates that the samples were processed by our neutron activation analysis service.

Engineering Physics Department, UW-Madison
UW Nuclear Reactor Laboratory
6 samples, 4.75 sample hours
Production of calibration sources for required reactor measurements and development of methods for instrumental neutron activation analysis. UW support.

Engineering Physics Department, UW-Madison
Graduate Research Project
6 samples, 3.9 sample hours
Irradiation of activation salts for measuring the spacial flux distribution of beam port number 2. Supported by DOE Reactor Sharing Program.

Engineering Physics Department, UW-Madison
Instrumentation Laboratory
120 samples, 118.7 sample hours
Irradiation of foil sources for radiation detector experiments, including absolute counting for neutron flux measurements and activation of samples for neutron activation analysis experiment. Supported by DOE Reactor Sharing Program.

Engineering Physics Department, UW-Madison
NEEP 428
77 samples, 97.3 sample hours
Irradiation of foils for resonance absorption measurements and fast neutron flux measurements. UW support.

Department of Soil Sciences, UW-Madison (NAA)

134 samples, 67 sample hours

Professors J. Norman, V. Holliday, K. McSweeny, and P. Helmke and 1 graduate student used NAA to determine Fe, K/Na ratios, and trace element concentrations of samples from a soil-stoneline-ironstone complex in Uganda. This information determines the degree and type of weathering, geochemistry and hydrology which control formation of these types of complexes throughout much of the tropics. Supported by the DOE Reactor Sharing Program.

New Tier High School Program (NAA)

13 samples, 3.25 sample hours

Activation foils provided for real time gamma spectroscopy activation analysis laboratory demonstration as part of a reactor tour and discussion on applications of nuclear energy and uses of the UW nuclear reactor. Supported by DOE Reactor Sharing Program.

Nuclear Science Summer Seminar (NAA)

8 samples, 2.0 sample hours

Neutron Activation Analysis services were provided as part of a week long seminar on nuclear science. Supported by DOE Reactor Sharing Program.

NWT Corporation

1 samples, 3.8 sample hours

Irradiation of sodium to produce ^{24}Na for use as a radioactive tracer in moisture carry over tests performed at a regional utility's nuclear generating station. Industrial support.

4. OTHER MAJOR EDUCATIONAL AND RESEARCH USE

The reactor Laboratory is continuing collaboration with Argonne National Laboratory and the Notre Dame Radiation Laboratory on the study of neutron radiolysis in water at supercritical pressures and temperatures. This project is supported by the U.S. Department of Energy NERI (Nuclear Energy Research Initiative) grant. In order to investigate this radiolysis, a water loop has been designed, assembled and inserted into beam port 2 of the UW nuclear reactor. This loop is designed to pressurize water to 25 MPa (3600 psi) and heat it to 500 C (932 F). The water is then transported near the core of the reactor and returned to be analyzed.

Upgrades to the experiment apparatus have been made over the past year including a 3 inch removable lead shield near the core of the reactor to shield gammas which has increased the neutron to gamma ratio to 2.8.

Experiments to determine the critical hydrogen concentration (CHC), the concentration of hydrogen gas in water necessary to prevent formation of stable corrosive species such as H_2O_2 and O_2, have been run at supercritical temperatures and pressures. Results have found that while operating with a high neutron to gamma ratio evidence of CHC behavior is seen, but the concentration of formed species never approaches zero. This is most likely due to the high concentration of high average LET (linear energy transfer) radiation such as fast neutrons. Previous data taken before the installation of the lead shield showed a more definite trend that all hydrogen peroxide and oxygen formation was prevented at some point during the experiment.

5. CHANGES IN PERSONNEL, FACILITY AND PROCEDURES

Any changes reportable under 10 CFR 50.59 are indicated in section E of this report.

Additional upgrades to the facility, not reportable pursuant to 10 CFR 50.59, were completed during the year as described below.

A 530 square foot mezzanine was installed in the north bay of the reactor confinement room. The mezzanine was constructed of ½ inch thick steel plate placed on existing steel structural frame work. The existing structural frame work was installed during original construction for offices, but was never completed. The steel plate was installed to create an open air mezzanine for storage.

Personnel changes during the year were as follows:

Reactor operator Athi Varuttamaseni OP-70179-1, was removed from licensed status. Mr. Varuttamaseni's license was terminated July 26, 2004, upon graduating and resigning his position with the university.

Senior reactor operator Stephen M. Matusewic, SOP-03769-6, was removed from licensed status. Mr. Matusewic's license was terminated October 22, 2004, upon retiring from the university.

Michelle M. Blanchard, was appointed as Reactor Supervisor effective October 22, 2004 upon the retirement of the incumbent supervisor, Stephen M. Matusewic.

Professor Paul P.H. Wilson was appointed to the Reactor Safety Committee upon the resignation of Reactor Safety Committee Member Douglass L. Henderson.

6. RESULTS OF SURVEILLANCE TESTS AND INSPECTIONS

The program of inspection and testing of reactor components continues, satisfactorily meeting procedural acceptance criteria. Inspection of underwater components during the annual maintenance showed no deterioration or wear.

The pool leak surveillance program continues to monitor the pool evaporation rate, the pool make-up volume, and pool water radioactivity. Analysis continues to show ^{3}H to be the only radionuclide present with an average concentration of $9.8 \times 10^{-5} \mu Ci/ml$, which is 9.8% of the 10 CFR Part 20, Appendix B, Table 2, column 2, maximum allowable water effluent release concentration. The pool leak had ceased during the year, but was observed to commence leaking in October 2004. The leak has since ceased again. Monthly totals of pool water loss to the environment and ^{3}H concentrations are summarized in Table 3, at the end of this report.

B. OPERATING STATISTICS AND FUEL EXPOSURE

Operating Period	Critical Hrs	MW Hrs	Runs	Pulses
Fiscal Year 2004-2005	522.14	460.61	109	21
FLIP Core	16,720.86	13,962.41	4,771	1,000
TRIGA	23,985.85	18,950.59	6,761	2,311

Core I23-R10 was operated throughout the year. The excess reactivity of this core was determined to be 4.272%ρ.

C. EMERGENCY SHUTDOWNS AND INADVERTENT SCRAMS

There were seven automatic scrams or unintentional shutdowns during the year. Each is described below in chronological sequence.

July 20, 2004; Rely and electronic SCRAM from picoammeter number 2. While attempting to increase reactor power from 300 W to 1000 kW, an operator failed to up range the picoammeter to the next higher range prior to withdrawing a control blade. Reactor power was already at 100% indicated power on the 300 W range, when the operator inserted the positive reactivity. Sufficient reactivity was inserted into the reactor resulting in reactor scram from a neutron high flux trip of 125% on the 300 W range.

On August 17, 2004, October 7, 2004, November 11 and 16, 2004, February 18, 2005 and March 1, 2005 a relay SCRAM or unintentional drop of a control element from the Fuel Temperature Safety Channel occurred. In every event, true fuel temperature did not approach the limiting safety system setting (LSSS), as observed on the installed console recorder. Because it was known that the true fuel temperature did not reach the LSSS, the fuel temperature safety channel was investigated for intermittent opening of the thermocouple signal leads. On August 17, one thermocouple connection on a terminal board was found to be damaged and was repaired. On October 7, the input to the fuel temperature safety channel was loose and subsequently tightened. On November 11 the connections at the instrumented fuel element weather head were inspected and deemed to be poor and subsequently repaired. On November 16, in an attempt to rule out a thermocouple intermittent open in the instrumented fuel element, the input to the fuel temperature safety channel was replaced by another thermocouple in that same fuel element. On February 18, the input to the fuel temperature safety channel was replaced by the third thermocouple in the same fuel element. On March 1st, after having repaired all connections, verified operability of each thermocouple in the instrumented fuel element, the fuel safety temperature safety channel, 19M1 was replaced with the installed spare, 19M2. No further spurious SCRAMs were observed. This led to the conclusion that the trip relay in 19M1 was experiencing intermittent failure.

D. MAINTENANCE

The Preventive Maintenance Program continues to maintain equipment and systems in good condition. Routine regeneration of the demineralizer resins were performed on July 9, 2004 and December 14, 2004.

Corrective maintenance was performed on the following systems:

The ball check valve of the thermal column exhaust line was replaced on July 1, 2004 following observation of a crack in the existing ball check valve.

On November 6, 2004, the tensioning spring of the fission chamber drive was replaced after the existing spring no longer maintained tension and the drive chain slipped from the drive sprocket.

As described in section C of this report, On March 1, 2005, the installed fuel temperature safety channel, 19M1, was replaced with the installed spare, 19M2, to eliminate spurious reactor SCRAMS as a result of a failing relay in 19M1.

In May 2005, in response to drifts in the gain of the Log Count Rate Monitor, an investigation revealed the pre amplifier low gain TRA-1000 chip was bad. The chip was replaced.

On June 10, 2005, the GM tube in the thermal column area radiation monitor was replaced following observation of the detector indication pegging high twice; a symptom known to indicate incipient failure of the GM tube.

E. CHANGES IN THE FACILITY OR PROCEDURES REPORTABLE UNDER 10 CFR 50.59

There were no changes in the facility or procedures reportable pursuant to 10 CFR 50.59.

F. RADIOACTIVE WASTE DISPOSAL

1. SOLID WASTE

All solid waste was transferred to the University Broad Scope license for ultimate disposal in accordance with radioactive materials license number WI 25-1323-01. The amount and activity are detailed below.

Date	Isotope	Activity (mCi)
07/30/2004	Co-60	7.4E-4
	Mn-54	4.7E-5
	Zn-65	4.9E-4
	Total:	1.2E-3
Volume:	2.7 cubic feet	
Constituents:	contaminated steel pipe	

Date	Isotope	Activity (mCi)
09/07/2004	Co-60	4.5E-2
	Eu-152	1.0E-3
	Mn-54	1.7E-2
	Zn-65	4.9E-2
	Total:	7.1E-2
Volume:	1.94 cubic feet	
Constituents:	cellulose and nylon filters	

2. LIQUID WASTE RELEASED TO THE SANITARY SEWER

Liquid waste discharges from the facility during the year are detailed in Table 1.

3. PARTICULATE AND GASEOUS ACTIVITY RELEASED TO THE ATMOSPHERE

Table 2 presents information on stack discharges during the year.

4. LIQUID ACTIVITY RELEASED TO THE ENVIRONMENT

Table 3 presents information on the pool leak effluent described in section A.6 of this report to the environment during the year.

G. SUMMARY OF RADIATION EXPOSURE OF PERSONNEL (01/01/04 - 12/31/04)

The personnel radiation monitoring program at the University of Wisconsin for the past calendar year used Global Dosimetry brand TLD monitors for whole body exposure while extremity dose was monitored using TLD ring badges processed by the University of Wisconsin Radiation Calibration Laboratory. No personnel received any significant radiation exposure for the above period. The highest annual doses recorded were 41 mrem to the whole body and 135 mrem to the extremities.

The highest dose received by a member of the public visiting the reactor lab was 1.494 mrem, as measured by Siemens brand Electronic Personal Dosimeters.

Monthly radiation surveys continue to demonstrate acceptable radiation dose rates within the reactor laboratory and no contamination.

H. RESULTS OF ENVIRONMENTAL SURVEYS (01/15/04 - 01/14/05)

The environmental monitoring program at the University of Wisconsin uses Landauer Luxel brand area monitors located in areas surrounding the reactor laboratory. Table 4 indicates the dose a person would have received if continuously present in the indicated area for the entire 2004 calendar year.

In the 3rd quarter of 2004 TLD #33 reported a quarterly dose of 379 mrem. TLD #33 is located outside Room 10E of the Reactor Lab basement. This area is unrestricted but not normally occupied.

Hypersensitive surveys of the room and outside walls were performed and continuous monitoring with electronic dosimeters for 12 weeks was conducted. The results of the surveys and monitoring revealed a dose rate of 0.017 mrem/hr or a quarterly dose of 36 mrem. Additional environmental monitors in the area have revealed an average dose rate of approximately 20 mrem/quarter. Subsequent quarterly values for TLD #33, show a dose rate of approximately 18 mrem/quarter.

While it is not clear why such a high reading was observed by TLD #33, protective measures have been taken to reduce dose rates in and around Room 10E including additional shielding and limiting access to the area. A dose reconstruction analysis shows that the dose to any person spending 2 hours a week in that area (very conservative) is less than 20 mrem for the entire 3 months.

I. Publications

The following are theses, publications and presentations based on reactor use:

Edwards, E. Radiation Chemical Yields of Water in Neutron and Gamma Radiation. 2005 ANS Annual Meeting. San Deigo, CA. June 7, 2005.

Edwards, E., Bartels, D., Olson, L., Wilson, P., Anderson, M., Humrickhouse, P. Radiation Chemical Yields of Water in Neutron and Gamma Radiation. Transactions of the American Nuclear Society. V 92, pp. 125. San Deigo, CA. 2005.

Humrickhouse, P. Gamma Shield Design for the Supercritical Water Neutron Radiolysis Experiment. 2005 ANS Annual Meeting. San Deigo, CA. June 7, 2005.

Humrickhouse, P., Wilson, P., Edwards, E., Anderson, M. and Bartels, D. Gamma Shield Design for the Supercritical Water Neutron Radiolysis Experiment. Transactions of the American Nuclear Society. V 92, pp 161. San Diego, CA. 2005.

Law, R. A Diachronic Examination of Lithic Exchange Networks During the Urban Transformation of Harappa. *South Asian Archaeology*. Proceedings of the 17th International Conference fo the European Association of South Asian Archaeologists. Bonn, Germanay. 2005.

Wilson, P. Operational Benchmarks for the Computational Modeling of the UWNR. TRTR Annual Meeting. October 15, 2004.

TABLE 1
LIQUID RADIOACTIVE WASTE DISCHARGED TO SEWER

Release Date:	07/01/2004	05/24/2005	06/22/2005
Gallons Released:	1350	1450	1950
Total µCi:	23.36	2.00	6.16
Sum of Fraction of MPC w/o dilution:	0.092	0.012	0.018
Sum of Fraction of MPC w/ daily dilution:	0.005	0.001	0.001

Isotope	MPC (µCi/ml)	Released	Released	Released	
Co-60	3.00E-05	6.21	2.00	3.78	µCi
		1.22E-6	3.64E-07	5.10E-07	µCi/ml
		4.05E-02	1.21E-02	1.70E-02	Fraction of MPC
Mn-54	3.00E-04	4.78	-	2.38	µCi
		9.35E-07	-	3.20E-07	µCi/ml
		3.12E-03	-	1.07E-03	Fraction of MPC
Zn-65	5.00E-05	12.37	-	-	µCi
		2.42E-06	-	-	µCi/ml
		4.84E-02	-	-	Fraction of MPC

Total volume of water released to the sanitary sewer (gallons)	=	4750
Total quantity of radioactive material released to the sanitary sewer(µCi)	=	31.52
Average daily sewage flow for dilution (gallons)	=	2.37E+04
Maximum fraction of MONTHLY release limit with DAILY dilution	=	0.005
Maximum fraction of MONTHLY release limit with MONTHLY dilution	=	0.0003

TABLE 2
EFFLUENT FROM STACK

1. Particulate Activity

There was no discharge of particulate activity above background levels.

2. Gaseous Activity - All Argon-41

Month	Activity Discharged (Curies)	Maximum Concentration µCi/ml x 1E-6	Average Concentration µCi/ml x 1E-6
July 2004	0.0699	1.80	0.0390
August	0.0499	1.50	0.0278
September	0.0453	1.30	0.0261
October	0.0516	1.50	0.0288
November	0.0588	1.50	0.0339
December	0.0130	1.50	0.0073
January 2005	0.0251	2.00	0.0142
February	0.0330	2.80	0.0204
March	0.0153	1.10	0.0085
April	0.0086	0.09	0.0050
May	0.0376	1.10	0.0210
June	0.0057	0.90	0.0033
	Total	Maximum	Average
	0.4138	2.80	0.0196

Using Gifford's model, as described in the appendix to the "Safety Analysis Report for the University of Wisconsin Nuclear Reactor", a concentration of 8E-6 µCi/ml at the stack discharge would result in a maximum air concentration of 1E-8 µCi/ml at any point downwind.

TABLE 3
EFFLUENT FROM POOL

Liquid Release to the Environment - All Activity ^{3}H

Month	Water Released (Gallons)	Monthly Concentration (µCi/ml)	Activity Released (mCi)	Fraction of MPC
July 2003	0	-	0.000	-
August	0	-	0.000	-
September	0	-	0.000	-
October	295	1.11E-4	0.124	0.111
November	336	8.38E-5	0.107	0.084
December	308	1.28E-4	0.150	0.128
January 2004	0	-	0.000	-
February	0	-	0.000	-
March	0	-	0.000	-
April	0	-	0.000	-
May	0	-	0.000	-
June	0	-	0.000	-
	Total	Average	Total	Average
	939	1.08E-4	0.380	0.108

TABLE 4
ANNUAL DOSE DATA -- Environmental Monitors
(01/15/04 - 01/14/05)

Location	Annual Dose mrem
Highest Dose Inside Reactor Laboratory	353.0
Dose Inside Reactor Laboratory Stack	28.0
Highest Dose Outside Reactor Laboratory (Reactor Lab Basement: See section H of this report for more information)	416.0
Highest Dose in Occupied Non-restricted Area (East wing hallway of Mechanical Engineering Building)	39.0
Average Dose in all Non-restricted Areas (28 Monitor Points)	26.3