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February 5, 2001

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

Re: Facility License R-56, Docket No. 50-83

In compliance with our Technical Specifications reporting requirements, enclosed is one copy of the 1997-98 University of Florida Training Reactor Annual Progress Report.

This document is intended to comply with the requirements of Section 6.6.1 of the UFTR Technical Specifications.

Please advise if further information is needed.

Sincerely,

William G. Vernetson
Director of Nuclear Facilities

WGV/dms
Enclosure

Copy: J. Wolf

Sworn and subscribed this 5th day of February 2001

Elizabeth F Bruce
Notary Public

Elizabeth F. Bruce
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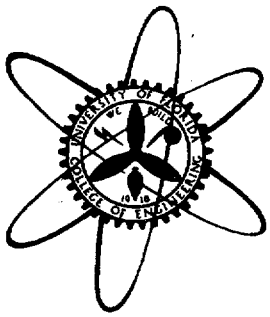
Report: DOE/NE/38152-2

UNIVERSITY OF FLORIDA TRAINING REACTOR ANNUAL PROGRESS REPORT

SEPTEMBER 1, 1997 – AUGUST 31, 1998



Submitted by
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February 1999

U.S. Department of Energy
Award #DE-FG02-96NE38152

UNIVERSITY OF FLORIDA
TRAINING REACTOR
ANNUAL PROGRESS REPORT

SEPTEMBER 1, 1997 – AUGUST 31, 1998

Submitted By
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Gainesville, Florida

February 1999

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1997-98 ANNUAL REPORT

I. INTRODUCTION

A. Overall Utilization

The University of Florida Training Reactor's overall utilization for the past reporting year (September 1997 through August 1998) continued to be at historically high levels of quality usage, limited only by unavailability of the reactor or necessary personnel. The diversity of users and usages was among the best in the history of the facility, especially considering that availability this year was reduced to 58.29% primarily due to a four-month outage at year's end to investigate a core reactivity anomaly. Unlike in years prior to 1990-91, this availability accounts for lost availability for administrative reasons as well as for repair and maintenance related reasons. Otherwise, availability for this year would be near 60.0%.

The University of Florida Training Reactor (UFTR) continues to experience a high rate of utilization in a broad spectrum of areas with total utilization continuing near the highest levels recorded in the early 1970's and most usage indicators moving upscale with quality usage occurring whenever system and operator availability permits. This broad-based utilization has been supported by a variety of usages including research and educational utilization by users within the University of Florida as well as by other researchers and educators around the State of Florida through the support of the Department of Energy (DOE) Reactor Sharing Program and several externally supported usages. A number of science fair projects were also accommodated. Less effort than usual has also been devoted to facility enhancement except when necessary; a key ingredient accounting for this situation has been the lack of a full-time Reactor Manager/SRO in place for the entire year as an interim acting manager has been in place since losing the full-time reactor manager as of March 28, 1997 along with one part-time Senior Reactor Operator (SRO). Personnel associated with the UFTR are listed in Section II; this does not include NAA Laboratory personnel except where also involved with UFTR operations. The loss of all experienced NAA laboratory personnel at the beginning of the previous reporting year has continued to present a challenge throughout the reporting year for research usage of the facility. Facility operations for all usage's especially external users under the DOE Reactor Sharing grant are delineated in Section III indicating the diversity of usage.

The yearly total energy generation of 11.615 Megawatt-hours for the 1997-98 reporting year represents a decrease of 31.29% from the previous reporting year. However, although this value ranks last in energy generation in the last ten years, it would still rank about the midpoint in the first 14 years of UFTR operational history licensed at 100 kW during which time energy generation has averaged somewhat over 22 Megawatt-hours per year. The decrease in energy generation this year is significant and was primarily due to the lack of any mega-projects requiring lengthy irradiations as the number of projects was comparable with the previous year with a number of extensive research operations completed or in progress at year's end awaiting recovery from the outage as well as the forced outage time increasing significantly from the previous year from over 102 days to over 131 days, almost all at year's end for investigating the reactivity anomaly. The planned unavailability was reduced somewhat from just under 17 days to just over 13 days with the major contribution due to performing and upgrading the annual nuclear instrumentation calibration checks.

The run time, time when the reactor is running at any power level, has decreased by a about 37% from the previous year. This decrease is again attributed to decreased numbers of lengthy irradiations in favor of educational usages and the lack of any single mega-project but primarily the forced outage time over the last four months. On a positive note, this decrease coupled with a much smaller decrease in experiment time (6.5%) is still indicative of the large amounts of time used to run classes and other educational activities as well as research projects, especially for institutions using the facility under the Reactor Sharing Program either for classes or training, where reactor operation is only part of the educational research or training activity, as well as for University of Florida classes. The extended low power usage for education, as well as for neutron transmission and radiography analyses contributes significantly to total reactor operation time but in a limited way to total energy generation during the year.

Additional significant time and resource commitments were made for efforts related to conversion of the UFTR from high enriched uranium (HEU) to low enriched uranium (LEU). A total of 1200 SPERT fuel pins were transferred for shipment to Oak Ridge National Laboratory (ORNL) on May 17, 1990; subsequently, the "storage only" license was revised and the fuel moved to a new location in the Nuclear Research Field Building involving considerable upgrade of the new facility as well as commitments of time for assuring decontamination and security requirements were met. This year weekly facility checks and continued efforts to request permission to ship the fuel to a secure Department of Energy facility along with preliminary review of final fuel drawings following completion of renewal with receipt of the new SNM-1050 license for storage only in June 1995 involved over 70 hours of experiment time this year including some time to address security alarms and the effects of building experiments on the fuel storage facility plus one visit by two NRC representatives to perform an SNM-1050 license inspection.

With the one extended outage this year, periodic failures and repairs related to surveillances and the need for modifications caused lost availability at the highest rate in the last eleven years. Because there was only one large outage during this year with no others of significant length, the total time spent on maintenance activities is much larger but still barely manageable; as noted previously, the primary forced outage was for addressing the anomalous loss of reactivity resulting in a lengthy forced outage (122¼ days) extending through the end of the reporting year with the reactor defueled and partially disassembled at year's end. With the largest outage accounting for over 122¼ days forced down time, no other forced outage was significant in length, though some of the other over 9 days forced outage time did cause lost facility usage and hence negatively affected energy generation and run time. Because of unscheduled shutdowns due to repeated failures in the blade position indicator system circuits in previous years, a new system utilizing light emitting diodes was implemented in June 1994 with the result there was no outage time from this source during the 1994-95, the 1995-96, or the 1996-97 reporting years. There was also no forced outage time from the compensated ionization chamber (CIC) or uncompensated ionization chamber (UIC) which were the subject of over 72 days forced outage time in the previous 1996-97 reporting year.

As indicated above, the total run time for the facility was decreased about 37% from the previous year. With the resignation of the full-time interim Reactor Manager as of March 27, 1997, availability of operating personnel was limited for most of the year as there was only an acting part-time reactor manager for the entire year with two SRO-trainees unable to be licensed at year's end

due to the outage to investigate the reactivity anomaly. The availability of operating personnel for the upcoming year will be just as limited initially as it takes time to reassemble the core and then prepare the trainees for license examinations with several possible new personnel identified at the end of the reporting year. Overall, the indication is toward considerable low power usage and continued high utilization of the reactor subject to availability of the reactor and licensed operators.

Analysis of facility utilization shows that the diverse usage and good but decreased energy generation continuing from the previous five years are attributable to continuing supportive conditions as in the last year. As noted previously, the continuing refurbishment of the Neutron Activation Analysis Laboratory has impacted favorably on all areas of utilization from research projects using neutron activation analysis (NAA) to training and educational uses for students at all levels. With successful implementation of an improved remote sample-handling "rabbit" facility, efforts to advertise availability and encourage usage of the UFTR (especially for research) have proceeded in a favorable light, though always less quickly than hoped. Implementation of the standard rabbit capsule size with larger carrying capacity has further supported use of the facility. The additional implementation of two state-of-the-art PC-based spectrum analysis systems with complete ORTEC software packages for spectrum analysis and data reduction has been a key factor supporting reactor utilization during the last ten reporting years for education and training uses as well as research projects, several of which constitute large ongoing but promising seed projects to support proposals. Indeed, the 1987-88 reporting year was the first full year for availability of the PC-based ORTEC analyzers with standardized rabbit system capsule size. The NAA Laboratory had also been outfitted with its own independent sample and standards drying facility during the 1987-88 reporting year and in the 1988-89 year saw implementation of a 4.5 digit electronic balance to provide two complete lab sample preparation facilities. In addition to continuing efforts to provide proper switching and computer control software for the automatic sample changer first installed in the 1989-90 year, the previous year saw implementation of the new ORTEC OMNIGAM software and spectrum analysis package to speed up as well as simplify spectrum analysis. During the 1991-92 reporting year, additional computer storage capacity and a new monitor were added along with a new spectroscopy system and multichannel buffer. In addition, an integral shield was added for one detector and a desiccator station was added for storage of standards and processed samples, as every effort is being made to supply accurate and reliable trace element analysis for a wide range of projects from high school students working on science fair projects to doctoral students using trace element analysis for their research.

During the 1992-93 reporting year, an entire new spectroscopy system was obtained and implemented to include an integral shield and detector as well as the computer-based analyzer system with University of Florida funding to provide three complete systems. The result of these various improvements has been an easier, more reliable and faster turnaround of samples submitted to be irradiated for neutron activation analysis with a resultant increase in interest by potential users. The implementation of these facilities has given UFTR management the capability to promote it among University of Florida users and among researchers at other universities and colleges around the State of Florida. As the availability of this high technology facility becomes better advertised through its users, its usage continues to increase, limited realistically by the unavailability of full-time personnel committed to the analytical laboratory facility. Staffing is clearly a key limiting factor in the total throughput as well as the rate of processing of samples for trace element analysis

after irradiation in the UFTR. Though this situation was improved at the end of the 1992-93 reporting year with the hiring of a recent graduate to work in the NAA Laboratory and expand programs, the situation again reverted to a limitation when insufficient funding was available to keep this person in spring 1994. Nevertheless, during the 1993-94 reporting year, a new nimbin and sodium iodide spectroscopy system was added to the analytical laboratory along with a freeze dryer for sample preparation. In addition, one HPGe detector was completely refurbished at ORTEC and all the floor tile in the laboratory area was replaced to restore appearances.

Despite the lack of a DOE Instrumentation Grant, a number of NAA Laboratory improvements were implemented during the 1994-95 reporting year. First, two HPGe detectors were sent off for refurbishment with one returned. Several donated scaler-based counting systems were set up for use in half-life measurement demonstrations and laboratory exercises for visiting students. In addition, the poster display on trace element analysis of cannabis sativa samples to support a legal case presented at the New Orleans American Nuclear Society meeting in July 1994 was mounted on the NAA Laboratory hallway wall to enhance facility tours. Finally, the rabbit system was subjected to a major overhaul and modification to replace old tubing, to upgrade the exhaust fan for increased flow out of the shield box for the receiver station, and to replace and upgrade the HEPA filter system to assure long-term availability.

During the 1995-96 reporting year, one of the NAA Laboratory computers and the upstairs office (secretary) computer were upgraded. The upstairs computer can now run Windows compatible software such as WordPerfect 6.1 for Windows and Quattro Pro for Windows. The NAA Laboratory could then perform sample analyses at a much faster rate.

During the 1996-97 reporting year, a new Pentium NAA laboratory computer was obtained along with the latest ORTEC software packages for collecting and analyzing gamma spectra as well as a complete library of gamma ray energies to be used for reference purposes. It has been proposed to replace another computer in the upcoming year.

During the 1997-98 reporting year, additional software was obtained for the NAA Laboratory to include ORTEC's Nuclide Navigator library consisting of all the essential information on radioactive decay, neutron activation, etc., for all the isotopes. The facility also received a complimentary copy of the Gammavision Report Writer which is to be used to facilitate reporting the results of NAA spectrum analyses. During September 1997, it became apparent that HPGe Detector #2 was failed. Efforts at in-house repair, including the electronics shop, were unsuccessful so the detector was packaged up and sent to ORTEC for diagnosis and repair with the detector checked to be okay and returned. It was finally determined that the equipment failure came from the 92X spectrum master which was shipped to EG&G ORTEC for repair in mid-January and subsequently returned to the NAA Laboratory and returned to operation by the end of February 1998 so all three of the HPGe detectors were determined to be in working order and could be utilized for gamma spectroscopy analyses at the end of February 1998. Subsequently, a vacuum leak was discovered in Detector #2 so the detector was shipped to EG&G ORTEC. The HPGe detector was finally returned on June 10, 1998 with ORTEC having certified the detector and the electronics supporting the detector. This particular detector must simply be configured differently than the other detectors currently being used in the NAA Laboratory so it was then reconnected to the high voltage

supply and powered back up on July 7, 1998 following a long period of cooling. The detector was then hooked up to the spectrum analyzer and computer and it was subsequently calibrated for energy and efficiency. On June 13, 1998, a Dell Dimension XPS 300 MHz Pentium-II computer was ordered. The computer was delivered on August 20, 1998 and assembled that same day. The computer included 64 MB RAM, 8.4 GB EIDE Ultra ATA Hard Drive, 32X Max Variable CD-ROM, Altec ACS90 Speakers and a Dell 1200HS Color Monitor with 17.9 viewable image. The system includes Windows 98 and other various programs. An internal 100MB Iomega Zip Drive was also included. An HP DeskJet 722C printer was also purchased with the computer along with an HP SCANJET 5100CSE Scanner, all implemented in August 1998 to provide more computer versatility in the NAA Laboratory.

In addition to support from the College of Engineering through the Nuclear and Radiological Engineering Department, the primary catalyst for maintaining facility usage continues to be the Department of Energy's Reactor Sharing Program. This 1997-98 reporting year was the fourteenth consecutive year in which the UFTR was supported as part of DOE's Reactor Sharing Program, though at a further reduced support level.

This program is designed to increase the availability of university reactor facilities such as the UFTR for non-reactor-owning educational (user) institutions ranging from high schools to colleges and universities. Basically, this grant provides funds against which reactor operating costs may be charged when the facilities are utilized by regionally affiliated user institutions for student instruction/training or for student or faculty research that is not supported by outside funding. In all, as noted in Table III-1, forty different outside academic institutions and entities ranging from high schools to universities around the State of Florida and the Southeast made use of this program to utilize the UFTR for research (primarily via neutron activation analysis to determine trace element composition), for reactor facility demonstrations, experiments and course work related to various aspects of operation. Further usages include training of students in various community college programs such as nuclear medicine technology, natural sciences and radiation protection technology and for research and training programs for community college and high school students for which a number of senior level science fair projects are still in progress. Again this year, several of these projects received local and regional awards with a number of these outstanding students from previous years now attending upper division programs in the College of Engineering here at the University of Florida. Indeed, one of the emphases in recent years has been to pre-college institutional use of the UFTR under the Reactor Sharing Program.

At year's end, several unsupported research projects were still awaiting availability of the UFTR under the Reactor Sharing Program as UFTR usage attributable to this DOE-sponsored program continues to grow. Despite considerable cost-sharing by the University of Florida, all of the reactor sharing funds allocated by the Department of Energy for this reporting year were fully utilized. Indeed, the funds were all utilized by the eleventh month. This program had been increasing as it had been renewed with 8%, 11% and 7% increases for three years and then a 22% reduction for the 1994-95 reporting year. With nearly a 23.7% increase for the 1995-96 reporting year, further significant expansion of this usage was enthusiastically undertaken. Despite a decrease of 20% for the 1996-97 reporting year, broad-based usage of the Reactor Sharing Program had continued. However with a further decrease of over 8% down to $22,000 for the 1997-98 reporting

year, further significant expansion was severely limited. Nevertheless, with the grant renewed for an over 45% increase to $32,000 for the 1998-99 reporting year and in expectation of even better future availability of funds, there is great optimism for the Reactor Sharing Program and its effects. Reactor Sharing users have always been and will continue to be accommodated as much as possible during this next reporting year since the UFTR is the only such facility in the State of Florida and one of only three now operating in the southeast.

Reactor use by University of Florida courses and laboratories continues at the substantial level established in the last several years. Course and department usages within the University range from the Environmental Engineering Sciences Department in its Health Physics and other courses to the Physics Department at the undergraduate level to the Chemistry Department in a graduate level radiochemistry laboratory course and the Geology Department in a graduate level isotope course. Another new and frequent user is the freshman Introduction to Engineering course for introducing new prospective engineering students to various areas of engineering. Of course, the biggest single user department remains the Nuclear and Radiological Engineering Department (previously the Nuclear Engineering Sciences Department, but renamed in the previous reporting year) which uses the reactor facility for both graduate and undergraduate laboratories, research projects and class demonstrations and exercises. An expanded usage in recent years is for senior level design projects of which there were several again this year, each directed to provide some improvement in the physical facility, in the reactor experimental capabilities or in NAA Laboratory operations. In the 1996-97 reporting year, a group of four students completed a major project to characterize the trace metals in sediments around Lake Alice on the University of Florida campus. Another student completed a project to quantify trace elements in roadway runoff sediments. This year saw several radiochemistry projects completed as well as one started on automation of the k_0-standardization method of neutron activation analysis and another completed on trace metals around coal-fired power plants among others. The existence of an operating facility for such design projects is a unique educational opportunity for engineering students who get immediate feedback on the viability of their design work.

Last year saw work concluded on elemental analysis of zeolites for the Chemistry Department, and several other small projects such as trace element analysis of silicon nitride samples. Projects this year included stoichiometric measurements of Al/Na ratios in various compounds. Other continued research projects this year included transmission studies on utility spent fuel pool absorber coupons for Holtec International, Inc., copper activation for the Nuclear Medicine Department, NAA of rare earth materials for isotope identification for the Armed Forces Radiobiology Research Institute and several projects for trace element analysis on sediments for Reactor Sharing users at other schools. Additional new experiments are planned for the upcoming year to include sediment analyses for researchers at Savannah State University and continuation of trace element analysis of surface canal water samples for a researcher in Civil Engineering at the University of Miami interrupted by the outage. External users for courses include Central Florida Community College for its radiation protection technology courses as well as Santa Fe and Hillsborough Community Colleges for their nuclear medicine technology courses plus physics and other science courses at St. Petersburg Community College, St. Johns River Community College, Valencia Community College, Pensacola Junior College and Santa Fe Community College. There has also been interest expressed by researchers in the Materials Science and Engineering and the Nuclear and Radiological

Engineering Departments on campus along with a small business in the Gainesville area in using the UFTR for a seed project to support boron neutron capture therapy (BNCT)-related research into neutron absorbing and penetration characteristics for various materials and chemicals.

With many continuing usages already scheduled along with the state-of-the-art analysis instrumentation and support equipment in the NAA Laboratory, plus renewal of the Reactor Sharing Program support at a significantly increased level, facility utilization and energy generation for the upcoming year should show continued growth in quality and diversity, dependent upon reactor return to normal operations. The latter augmentation is particularly possible because the UFTR utilization under the DOE Reactor Sharing Program has spread publicity on the availability of the UFTR so that a number of investigators on the University of Florida campus and elsewhere around the state continue to indicate interest in using the reactor facility and its experimental systems. Several other statewide users are in the process of preparing proposals hopefully to provide funded usage of the UFTR within the next year. Large previous usages for groups at Florida State University, another at the University of Wisconsin at Eau Clair/Southeast Missouri State University and another at the University of Miami brought to an intermediate conclusion last year are primarily to demonstrate capabilities to support proposals seeking external support as an outgrowth of the DOE Reactor Sharing Program support while some usages such as those conducted in the 1994-95 reporting year for the Florida Institute of Technology are partially supported already. Therefore, expectations of continued growth in quantity as well as diversity of reactor facility usage dependent on availability, a continued upgrading of facility capabilities and staff expertise are quite realistic.

In addition, the DOE University Reactor Instrumentation Program has been instrumental in providing support for much needed instrumentation such as the console two-pen recorder and a backup reactor safety channel in previous years. During the 1991-92 year it supported acquisition of a high speed chart recorder to facilitate certain UFTR console surveillances and thereby reduce personnel time commitments as well as a portable neutron survey meter essential to support neutron transmission and radiography as well as other experiments but the acquisition of an electronic maintenance tool kit was the key item of support as it has facilitated much facility maintenance. The electronic maintenance tool kit along with the NAA Laboratory items such as the integral shield have greatly facilitated facility response to potential users by improving reactor availability and laboratory results.

During the 1992-93 reporting year, the grant was used to obtain a new multipoint temperature recorder for the reactor, a new telescoping high dose rate instrument and a microR survey meter. The new area radiation monitoring system bought on this grant is on a delayed schedule for implementation along with the temperature recorder since currently installed instrumentation has operated without significant problems during this year. Both the temperature recorder and the area radiation monitoring system will require considerable effort to be implemented in the next year as this effort has been delayed by the lack of failures in these systems during the latest reporting year.

During the 1993-94 reporting year, this grant supported obtaining such items as the new freeze dryer for the NAA Laboratory as well as a boroscope and lead blankets to reduce dose commitment in outages along with an ultrasonic flow meter to allow improvements in the annual nuclear instrumentation calibration. Unfortunately, the instrumentation Grant was not renewed for the

1994-95, 1995-96 or the 1996-97 reporting years, nor for the next year, though the AMS[4] air particulate detector bought under the grant for the 1992-93 year was finally officially implemented in August 1995 following incorporation of several facility installed features so this source of outage time has been eliminated. It is hoped that such DOE Instrumentation Grants will be re-instituted for use in the 1998-99 reporting year; indications from DOE are that this will be the case which is another positive indicator.

B. Facility Improvements

For facility enhancement, the neutron radiography facility was available during the last seven years. Attempts at further optimization have not been successful during the last three reporting years primarily due to forced outages. A major effort was devoted to installing a semi-permanent shield structure and a movable table for positioning objects and the film cassette for applications of neutron radiography in the 1988-89 reporting year. As a result these improvements have not only reduced the radiation levels associated with radiography but have also reduced the time and effort required to implement the radiography facility as one of the UFTR experimental capabilities. The neutron radiography facility continues to provide a strong base for growth and diversification of usage during this year and should continue to do so during the upcoming year as the facility is further optimized to attract more users, not only for demonstrations and evaluations of radiography system parameters for laboratory and other exercises but also for research and service usage. One external company has already utilized the facility for many hours of usage on a number of occasions and has been pleased with the results, especially with radiography performed using a graded thickness boraflex standard to demonstrate and document the sensitivity of the facility. One other possible university user is interested in using neutron radiography for research on layered materials. The facility will be well used in the new NRE Department undergraduate curriculum laboratory courses emphasizing uses of radiation for non-destructive testing.

Plans have also been formulated for installation of a prompt gamma analysis facility at the UFTR to complement the NAA Laboratory capabilities. This is a multiyear enhancement project; some work to date has included characterization studies on a suitable beam port to complement a preliminary design of the facility performed as a summer research project by a high school student several years ago. During the upcoming year funds will again be solicited to support equipment purchases for this facility with installation and initial implementation possible by late in the next reporting year provided the necessary funding and a student to work on it are obtained. There is already one researcher at the University of South Florida (Tampa) and one industrial firm who would use such a facility as well as one researcher in the Materials Science and Engineering Department on our campus. Indeed, several users have gone to other facilities for such usage during the last few reporting years. This facility too could be a major asset in the newly revised undergraduate curriculum within the Nuclear and Radiological Engineering Department emphasizing nondestructive testing and imaging techniques.

Another area of enhancement receiving considerable attention in recent years has been a series of measurements to characterize all experimental facility irradiation parameters from neutron flux and spectrum characteristics and gamma dose levels and spectrum characteristics to ratios of neutron and gamma field dose parameters. One small student class research project (CHS-5110L) was

completed in this area during the 1995-96 reporting year; another was completed during this reporting year. As indicated above, some of this work has supported the preliminary efforts for design of a prompt gamma analysis facility. It had been hoped that a master's level student would be able to bring this program to fruition during the last year, though data to date has been sufficient to support continued plasma kinetics research for the space power reactor program at the University of Florida and for research on radiation effects on dielectric materials for a researcher at Florida State University. Further work is needed to support interests expressed by several users in performing radiation damage studies on electronic components, including one group at the University of Florida. This work is also needed to support the planned UFTR HEU-to-LEU fuel conversion and some of the data will certainly be needed to support any BNCT-related work.

Other significant facility enhancements implemented during the 1993-94 year resulted from the DOE Instrumentation Grant to include the boroscope, the lead blankets and the ultrasonic flow meter as well as a freeze dryer for the analytical laboratory. Another enhancement has been in the NAA Laboratory facility for the installation of an automatic sample changer, developed as part of a senior project. At the end of the 1989-90 reporting year, the device was completed but would only change a single sample. During the last five years, the timing circuit and computer software system have been in the process of being modified and redesigned to provide a fully automated sample changer to allow counting multiple samples without technician attention. This improvement promises to improve laboratory throughput and assure the laboratory remains competitive with other facilities but is not yet ready for implementation at year's end as the facility depends on the NRE Department electronics engineer support group for this work. As part of the same effort to maintain competitiveness, the next generation software package for the PC-based analyzers as well as additional computer MCB modules were obtained and implemented during the 1990-91 year to improve the speed with which analysis is performed. Enhancements in the NAA Laboratory facility during the 1991-92 reporting year included a new spectroscopy system and the external multi-channel buffer to speed data processing. Finally, the implementation of a low background integral lead shield has greatly improved sample counting efficiency as well as reduced counting time and improved element sensitivity. During the 1992-93 reporting year the biggest enhancement in the NAA Laboratory was the acquisition of a complete new spectroscopy system to include the detector and integral shield assembly as well as the computer-based analyzer to give two such systems. During the 1993-94 year, the biggest improvements were the freeze dryer and the new tile floor for appearances. During the 1994-95 year, the biggest improvement was the overhaul and modifications to upgrade the rabbit system. Technically, however, the ongoing work to implement a full-scale quality assurance program for laboratory data begun in the 1993-94 year was continued with good progress during the year and is the most significant laboratory improvement for the long term, though the loss of one long time and one newer NAA Laboratory worker, the second except for occasional consulting work, severely restricted NAA Laboratory improvements during the 1995-96 reporting year with the work progressing very slowly during the last two reporting years. The upgrading of one of the NAA Laboratory computer systems plus upgrading of the upstairs (secretary) computer system promises to promote the processing of samples in the laboratory as a new NAA Laboratory worker was being sought to supplement the one remaining part-time worker. Replacements were identified and training conducted early in the 1996-97 reporting year but these workers were lost late in the 1996-97 year with new personnel in place again for the 1997-98 reporting year but again requiring still further training.

Laboratory upgrades during the 1996-97 reporting year included continued work on the Quality Assurance Program as one project neared completion by a student now employed by the Department of Energy. In addition a complete new Pentium II based computer system was implemented late in the reporting year along with newly released ORTEC software for performing gamma spectroscopy along with a complete library of gamma ray energies and other software to modernize laboratory analysis and generation of reports. Finally, the facility obtained fourteen (14) new self-reading dosimeters with a self-powered charger to allow dosimeters to be assigned to all visitors in most classes visiting the facility to facilitate the hands-on educational experience.

Laboratory upgrades during the 1997-98 reporting year included overhauling one of the high germanium detectors as well as shipping the 92X spectrum master to ORTEC for repair. In addition, a complete Dell XPS 300 MHz Pentium-II computer with 64 MB RAM, 8.4 GB EIDE ultra ATA Hard Drive, 32X Max Variable CD-ROM, Altec ACS90 speakers and a Dell 1200 HS color monitor with 17.9 inch viewable image was acquired for the NAA Laboratory along with support software and an internal 100 MB Iomega Zip Drive. An HP Deskjet 722C printer was also implemented with the computer along with an HP SCANJET 5.00 CSE Scanner to provide more computer versatility for project support.

All of these improvements increase laboratory throughput while enabling facility staff to spend more time addressing experiment design as well as student and faculty training. These improvements will further enhance the reputation of the facility and our effectiveness in serving users of the facility, not only for University of Florida students and researchers but also students and faculty from other educational institutions as part of the Reactor Sharing Program as well as for occasional industry users.

C. Staffing Considerations

After the loss of the full time SRO/Reactor Manager and the Acting Reactor Manager for all but consulting purposes in the 1990-91 year, two new part-time student SROs were licensed early in the 1991-92 reporting year. As a result, staffing conditions during the 1992-93 year were generally supportive of the considerable broad-based increases in facility usage for education and training of students as well as research by faculty at the University of Florida and other schools. Nevertheless, all staff personnel had been part-time employees, which always necessitates detailed planning for some usages of the facility. Near the end of the 1992-93 reporting year, one of the new SROs was appointed as a full-time Reactor Manager and a new student part-time SRO-trainee hired in the previous year was near to being licensed to further alleviate personnel problems. This full-time SRO/Reactor Manager was available for the full year with the new SRO licensed and certified in February 1994. One long time part-time RO fully retired and relinquished his license in June 1994. For the 1994-95 reporting year, the full-time Reactor Manager was maintained for the full year as were two part-time SROs, though one had a much reduced work schedule. With the part-time personnel availability combined with careful planning of activities, impact on facility operations by availability of licensed operators was minimized during the 1994-95 reporting year resulting in the relatively high usage numbers for that year.

For the 1995-96 reporting year, the full-time Reactor Manager was available until his resignation effective August 9, 1996 to go to medical school. Unfortunately, his efforts to complete his Master's degree plus family illness during the 1995-96 year restricted his availability somewhat as one new part-time SRO-trainee was hired in January 1996 and was nearing completion of his training at the end of the 1995-96 reporting year. Operations staffing was considerably improved midway through the 1996-97 reporting year with the hiring of one part-time SRO to be the interim full-time Reactor Manager upon his graduation in early December 1996. Overall, personnel availability was acceptable during that year though the biggest limitation was trained personnel for the NAA Laboratory. The new- hire operator trainee was finally licensed and certified in March 1997. Unfortunately, with the loss of the interim full time manager, as of March 28, 1997, the situation reverted to that present at the beginning of the 1996-97 reporting year. It was hoped to hire several part-time personnel as operator trainees in the 1997-98 reporting year to alleviate the restrictions on operators.

During the current reporting year, one new ex-Navy part-time SRO-trainee was hired in October 1997 and another in April 1998. The first was nearly ready to sit for his license by year's end but neither was able to get the necessary reactor operations with the extended outage at year's end, though both have been valuable, reliable staff additions which are expected to be licensed soon after ending the outage in the next reporting year. As the new NAA Laboratory personnel are trained, the availability of both types of personnel should improve in the next reporting year.

D. Administrative Commitment of Resources

Activities in response to NRC regulations as well as various efforts to maintain facility compliance and responsiveness occupied significant facility management and staff time during the reporting year. Previously, in a health physics/emergency response emphasized inspection in May 1996 by two inspectors, the facility was cited for one violation for failure to submit annual reports to meet Technical Specification time limitations and an inspection follow-up item was opened concerning updating the Emergency Plan agreement letters. NRC Inspection Report No. 50-83/96-01 dated June 21, 1996 and the facility's reply to the notice of violation dated July 19, 1996 were contained in Appendix E of the 1995-96 annual report along with documentation of NRC acceptance of the reply.

As a result of the Notice of Violation, UFTR management also submitted a request for Technical Specification Amendment 21 allowing two additional months for submission of a routine annual report covering the activities of the reactor facility during the previous calendar year. The request was submitted by letter dated August 2, 1996 as contained in Appendix A of the 1995-96 report with no response from NRC by the end of the reporting year on August 31, 1996. In a letter dated October 10, 1996, the NRC issued license Tech Specification Amendment 21 which was implemented in October 1996. The NRC letter with attachments approving the Amendment 21 including the Safety Evaluation Report is contained in Appendix A of the 1996-97 report.

Though there was no visit by NRC resident inspectors from Crystal River in the 1996-97 reporting year, the facility did receive one NRC inspection during the 1996-97 reporting year. During an operations/ health physics-emphasized inspection in June/July 1997, the facility was cited

for no violations in a report dated September 9, 1997 and received on September 15, 1997. The violation concerning annual report submissions and the follow-up item on Emergency Plan Agreement Letters were able to be closed out with this June/July 1997 inspection per NRC Inspection Report 50-83/97-201 which was contained in Appendix H of the 1996-97 report. In addition, the facility did receive one non-cited, facility-identified violation for failure to have licensed operators undergo physical examinations within the required two year interval. To implement corrective action for the non-cited violation, the semiannual check of the requalification training program records (S-12 Surveillance) was amended to include an additional check of the status of physical examinations for all operators which involved some time in the current reporting year.

During the 1997-98 reporting year, there was again one special health physics and respiratory protection NRC inspection on August 13-14, 1998 in response to implementation of Revision 2 of the UFTR Respiratory Protection Program. This inspection was in connection with the core disassembly to address the outage relative to the reactivity anomaly with the NRC approving the changes in the Respiratory Protection Program. No violations or other concerns were noted with considerable administrative effort expended to prepare and implement the revised Respiratory Protection Program for core work during the outage.

During the 1996-97 reporting year, the facility also submitted a request for Technical Specification Amendment Number 22 to delete references to submitting reports to NRC Region II since all NRC inspection and licensing functions for non-power reactors are now controlled and directed from the Non-power Reactor Directorate at NRC Headquarters. In addition, Amendment 22 requests updating the Technical Specifications to reflect the name change of the Nuclear Engineering Sciences Department to the Nuclear and Radiological Engineering Department which is a name change only for the same entity remaining in the UFTR administrative structure. The request for Amendment 22 was submitted by letter dating August 21, 1997 as contained in Appendix B of the 1996-97 report with no response from NRC by the end of the reporting year on August 31, 1997. This amendment was finally approved with a letter dated December 3, 1997 and received on December 8, 1997 of this reporting year with the Tech Spec Amendment 22 then inserted in the document manuals and implemented in December 1997.

Revision 14 of the UFTR Physical Security Plan was developed during this reporting year and submitted to NRC via a cover letter dated October 7, 1997. Other than acknowledging receipt, no response has been received from NRC concerning this submission by the end of the 1997-98 reporting year.

The total time devoted to NRC communications was similar or even higher than most previous years especially with the need to keep NRC informed of activities to address the reactivity anomaly during the 1997-98 reporting year. Some time had been spent to submit Revision 10 to the UFTR Safety Analysis Report in March 1997 and to develop and submit an extensive Revision 10 to the Emergency Plan which was submitted in April 1997 but only approved based on the facility submittal by NRC letter dated August 22, 1997. Since the approval was not received until August 28, 1997, Emergency Plan Revision 10 was finally implemented early in the reporting year as copies of the FAR and the Emergency Plan were placed in standard binders to facilitate

documentation of changes and completeness. The Emergency Plan Revision 10 was supplied to all copy holders with a memorandum dated October 17, 1997 directing insertion. A renewal of the Operator Requalification and Recertification Training Program with several minor changes was also submitted in May 1997 and approved by the NRC in a letter dated July 9, 1997 so no submission was necessary this year. In addition, the SNM-1050 Spent Fuel License (Storage Only) had previously been renewed on June 8, 1995 for five years after a submittal in the previous year was updated in May 1995 following a visit by NRC NMSS licensing representatives to check out the SPERT fuel (SNM-1050) storage facility so there was no work in this area except to answer questions on occasion and to accompany two NRC inspectors for an SNM-1050 license inspection in February 1998 with no violations noted.

Though no new Standard Operating Procedures (SOPs) were generated during the year, considerable administrative efforts were involved in developing procedure revisions in response to staff review of procedures, with two revisions of SOP-0.7 (Control of NRC 10 CAR 50 Written Communications Requirements) and SOP-F.8 (UFTR Safeguards Reporting Requirements) implemented during this reporting year. However, considerable effort was also expended in making eight minor changes (temporary change notices) to a total of four different procedures to correct minor errors or update changes to assure consistency in the procedure manual especially based on periodic procedure reviews as well as the Biennial Evaluation of the UFTR Standard Operating Procedures (B-4 Surveillance) completed near the end of the 1995-96 reporting year.

Some additional time was spent updating the estimated cost of decommissioning to meet the new requirements of 10 CAR 50.33 and 50.75 first promulgated in the 1990-91 reporting year. As required, the updated cost was produced and documented in a memorandum dated September 3, 1997 to the UFTR Decommissioning Information File showing the estimated decommissioning cost had been increased to $2.493 million as of June 1997 with a new update as of June 1998 still pending as the 1997-98 year ended. These special responses to and communications with NRC were in addition to the usual information supplied periodically via telephone calls, these include the quarterly safeguards reports, the updated HEU to LEU Conversion Proposal submitted in March 1998 to meet the requirements of 10 CAR 50.64(c)(2), as well as the responses to several NRC advisories. In general, these various submittals and communications with NRC resulted in a commitment of as much time in the 1997-98 reporting year as in most previous years.

Other regulatory agencies also affected the UFTR in the reporting year as there was an inspection by the fire marshal. Considerable time was also spent to follow-up the annual facility audit by the Reactor Safety Review Subcommittee and to respond to the annual laboratory safety survey by the University Environmental Health and Safety Division.

During the 1996-97 reporting year and again in the 1997-98 reporting year, some effort was spent in following up the decision made not to utilize the pin type SPERT fuel for conversion of the UFTR from HEU to LEU fuel. Efforts continued to arrange shipment of this unneeded fuel to a secure DOE facility like Oak Ridge National Laboratory without success as the Department of Energy apparently has no room for the SPERT fuel. Since it will be necessary to remove the remainder of the SPERT fuel to another facility eventually, the hope was that it could be accomplished in this past year. Since it was not, the hope is now to do so in the next reporting year

although the QA Program was renewed in October 1992 effective for five years. In addition, with the previous completion of static neutronics calculations and production of a Master's project, as well as near completion of thermal hydraulics analysis as a 14-plate fuel bundle of standard silicide fuel plates was selected as the final design for the LEU core, the thermal hydraulic analysis was essentially completed during the 1992-93 year. Some calculations remain as does documentation of proper evaluation of selected fuel design as well as generation of a final report. Another extension for the submittal of the safety analysis to NRC was noted in the proposal submitted in March 1996 to NRC. One other area requiring considerable time was for partial review of the final fuel drawings and other EG&G Idaho design documents. The unique difficulties involved in trying to check the UFTR core and sub-core connections and dimensions due to the unstacking of shielding and the removal of fuel requirement may necessitate making a complete dummy core. Finally, two years ago, on May 31, 1994, the submission was made for storage-only renewal of the SNM-1050 license which involved considerable effort to prepare; even more effort was required during the 1994-95 reporting year before the storage-only license renewal was approved on June 8, 1995 for five years as contained in Appendix F of the 1994-95 annual report. As discussed in more detail in Chapter III, some progress was made in completing the HEU to LEU analysis during the latter half of this reporting year by a visiting professor from the SOREQ Institute. It is hoped to complete this work in the next reporting year.

The level of administrative work dedicated to regulatory and licensing activities is expected to remain at a similar or even higher level during the next reporting year. The continuous efforts to update the UFTR SAR and the Emergency Plan will continue as will review and evaluation of SOPs and other facility documents. Hopefully, the revision to the Security Plan will be approved early in the next reporting year so it can be implemented. Of course, considerable facility management effort will be devoted to performing calculations and preparing the license amendment package for HEU-to-LEU conversion during the upcoming year, though the safety analysis submittal may have to be delayed to the following reporting year. It is planned to continue using the visiting professor in this next year to produce the amendment package. In addition, it is likely that shipment of the remaining fuel from the SNM-1050 SPERT facility, as well as shipment of waste from the UFTR will involve considerable administrative effort. The net result is that administrative efforts directed at compliance with NRC requirements will not likely be reduced but may even be increased during the next reporting year though directed to somewhat different areas in some cases.

The considerable test, maintenance and surveillance activities required by the facility license, Technical Specifications and other regulatory requirements also contributed significantly to usage and personnel commitments. Details on these surveillance and maintenance usages are presented in Section V of this report, while any associated modifications or evaluations of potential unreviewed safety questions are tabulated in Section IV. This contribution has been considerably increased even from the high level of the last reporting year with one four-month outage related to addressing the reactivity anomaly and core disassembly which continues through the end of the reporting year accounting for over 122 outage days and despite elimination of some previously recurring problems such as console two-pen recorder and blade position indicating system failures. The total outage time spent on maintenance activities is significant and larger than in any recent year, essentially entirely attributable to the reactivity anomaly. This and some other outages were lengthened in part because of unavailability of personnel to address the failure on a full time basis.

There was also considerable "planned" unavailability throughout the year primarily for completing the annual calibration check of the nuclear instrumentation (A-2 Surveillance) in March 1998 (10¾ days). It should be noted that there was no outage time due to failure of the blade position indicating (BPI) system following implementation of a modification to install light emitting diodes for the BPI circuits in the 1993-94 year and none for the UIC or CIC nuclear instrumentation detector system repaired in the 1996-97 reporting year. There was also significant time spent on corrective and much preventive maintenance and surveillances with most problems not recurring to demonstrate effective corrective action for most failures.

E. Facility Summary Overview

The reactor and associated facilities continue to maintain a high in-state visibility and strong industry relationships. With the DOE Reactor Sharing Program to support UFTR-related research by faculty and students at other academic institutions as well as training for various high school, community college and university programs around the state, the reactor facility is also maintaining high in-state visibility with other educational institutions. This situation is particularly true among high school and community college science departments where reactor sharing supported usage has increased significantly in the last few years with even larger increases in size and diversity of usages expected during the upcoming year. The interactions of several small externally supported research programs as a result of the Reactor Sharing work is further proof of its effectiveness as is the continued generation of proposals to obtain external funding based on results of research obtained under Reactor Sharing support.

A delineation of projects continues to be quite extensive. Although several projects could be listed without having associated reactor use, all had some level of staff and/or facility involvement during the year. The same is true of the list of publications and reports associated with the UFTR though this listing is not included in this report and was never intended to be all inclusive but generally delineated the diversity and quantity of facility usage, including a number of publications in respected journals and transactions.

With the sustained statewide interest, the facility is being included in several proposals to provide for funded usage of the UFTR and the NAA Laboratory. Several such usages occurred during each of the past twelve reporting years (1986-1998). The Reactor Sharing Program began in late 1983 and is directly responsible for the generation of a number of these proposals. As more of these proposals are submitted and funded, further increases in UFTR usage can be expected. In any case, on-campus research and service usage of the UFTR is also increasing because of the visibility generated via the Reactor Sharing Program. Each year more faculty utilize the reactor for a significant class-related usage or a research project. Continuity of Reactor Sharing Program funds but at a much increased level to $32,000 for the next year after an increase for 1995-96 reporting year and then a decrease in 1996-97 and 1997-98 provides a challenge to the facility to increase external usage especially since the full-time permanent Reactor Manager resigned near the end of the year on August 9, 1996 to enter medical school and a full-time interim Reactor Manager hired in December 1996 resigned on March 28, 1997. In general, the level of interest in the facility is high though expanded on-campus usage for funded research is a continuing objective. Nevertheless, the

role of the facility in attracting quality high school students to seek careers in science and engineering at the University of Florida should not be ignored.

Finally, it is hoped that more direct industry training will be accomplished in the upcoming year. The last such usage was ten years ago and none is scheduled for next year; the lack of utility interest in training programs other than operations usage for SRO certification makes it unlikely significant growth will occur in this area. With the rabbit system and the associated NAA and neutron radiography facilities plus the DOE Reactor Sharing Program and expectations for increased DOE Instrumentation Program funding and possible research funding from other agencies, expansion and diversification in facility usage are realistic expectations and could be significant, especially if an increased number of licensed Senior Reactor Operators can be realized during the next reporting year as the facility recovers from the current outage. Implementation of a prompt gamma facility is perhaps two years away but it too could make a significant impact on usage as several individuals would like to use such a facility. Some interest in using beam time for research related to boron neutron capture therapy has been expressed by several on-campus researchers and by one off-campus company so this is a real growth possibility also.

The expectations for the 1998-99 reporting year are positive. Significant opportunities for expanded education and research usages are apparent. The possibilities for continued growth in existing and new program areas are a challenge that must be addressed vigorously in light of the continuing outage for the reactivity anomaly, having no permanent Reactor Manager and the need to continue training part-time graduate student expertise in the NAA Laboratory. Nevertheless, with sufficient support, there is no limit to possibilities for growth in facility usage.

II. UNIVERSITY OF FLORIDA PERSONNEL ASSOCIATED WITH THE REACTOR

A. Personnel Employed by the UFTR

W. G. Vernetson	-	Associate Engineer and Director of Nuclear Facilities and Senior Reactor Operator (September 1997 - August 1998)
J. Powers	-	Student Senior Reactor Operator and Acting Reactor Manager (1/2 time) (September 1997 - August 1998)
J. Wolf	-	Student Senior Reactor Operator (1/3 time) (September 1997 - December 1997)
	-	Student Senior Reactor Operator (1/20 time) (January 1998 - August 1998)
R. Salazar	-	Student Technician and Senior Reactor Operator Trainee (1/2 time) (October 1997 - August 1998)
G. Macdonald	-	Technician and Senior Reactor Operator Trainee (3 /4 time) (April 1998 - August 1998)
S. Iverstine[1]	-	Student Radiation Control Technician (1/4 time) (September 1997 - October 1997)
B. Uhlmer[2]	-	Student Technician/Radiation Control Technician (1/40 time) (September 1997 - August 1998)
J. Hamilton	-	Student Technician/Radiation Control Technician Trainee (1/20 time) (January 1998 - August 1998)
D. Seifert	-	Secretary (3/4 time) (September 1997 - August 1998)

[1]As of November 1997, S. Iverstine worked mostly in the NAA Laboratory but remained qualified and occasionally served as a radiation control technician throughout the year

[2]B. Uhlmer worked in the NAA Laboratory but remained qualified and occasionally served as a radiation control technician throughout the year.

B. Radiation Control Office

D. L. Munroe[3]	-	Radiation Control Officer (September 1997 - August 1998)
C. Guincho	-	Radiation Control Technician (September 1997 - December 1997)
J. Parker	-	Radiation Control Technician (April 1998 - August 1998)
B. Beck[4]	-	Nuclear Technician (August 1997 - November 1997)

Basic routine health physics is performed by UFTR staff; however, assistance from the Radiation Control Office is required for operations where a significant dose (Level I RWP) is expected or possible and where certain experiments are inserted or removed from the reactor ports. These personnel are also required for certain operations where high contamination levels may be expected such as fuel inspection activities or core area maintenance activities. They also periodically review routine UFTR radiation control records and operations and assist in performance of certain radiation safety and control related surveillances. As a result, a number of radiation control office personnel are noted and though employed 1/3, 1/2 or full time, only a small fraction of their work effort supports UFTR activities. Several others with only infrequent contact at the UFTR are not listed though they are available for backup purposes, especially when entry into the core area is required.

C. Reactor Safety Review Subcommittee (RSRS)

M. J. Ohanian	-	RSRS Chairman (Associate Dean for Research and Administration, College of Engineering, and Professor, Department of Nuclear and Radiological Engineering)
W. G. Vernetson	-	Member (Director of Nuclear Facilities)

[3]The specified alternates for the Radiation Control Officer position are Ms. K. Hintenlang and Mr. G. Rawls.

[4]B. Beck had relatively low involvement with UFTR activities in his role as a nuclear technician for the Radiation Control Office.

Reactor Safety Review Subcommittee (RSRS) (continued)

J. S. Tulenko	-	Member (Chairman, Department of Nuclear and Radiological Engineering)
W. E. Bolch	-	Member-at-Large (Professor, Environmental Engineering Sciences)
D. L. Munroe	-	Member (Radiation Control Officer)

D. Line Responsibility for UFTR Administration

J. V. Lombardi	-	President, University of Florida
W. M. Phillips	-	Dean, College of Engineering
J. S. Tulenko	-	Chairman, Department of Nuclear and Radiological Engineering
W. G. Vernetson	-	Director of Nuclear Facilities (September 1997 – August 1998)
J. Powers	-	Acting Reactor Manager (September 1997 – August 1998)

E. Line Responsibility for the Radiation Control Office

J. V. Lombardi	-	President, University of Florida
G. Schaffer	-	Vice President, Administrative Affairs
W. S. Properzio	-	Director, Environmental Health and Safety
D. L. Munroe	-	Radiation Control Officer

III. FACILITY OPERATION

The UFTR continues to experience a high rate of utilization as total utilization continues at or near the highest levels recorded in the early 1970's in most areas when the reactor is available; with so much unavailability this year, some indicators are up, some down for the year but with good results considering reduced availability of licensed operations staff during the reporting year as well as a relatively high forced outage rate. This continuation of a high rate of UFTR facility usage has been supported by a variety of usages ranging from research and educational utilization by users within the University of Florida to research, educational and training utilization by users around the State of Florida through the support of the Department of Energy Reactor Sharing Program with over half of the costs of this latter usage not covered by Reactor Sharing. Again this year, several externally supported usages have also continued to impact reactor utilization and support the continued diversification of facility activities and capabilities, especially through the hiring of part-time laboratory assistants for support work in the analytical laboratory and to provide funding for facility improvements. For the third year in a row, however, there was no Department of Energy Instrumentation Grant to provide support for instrumentation upgrades during the year.

As noted over the last thirteen years, the continuing refurbishment of the Neutron Activation Analysis Laboratory has impacted favorably on all areas of utilization from research projects using NAA to training and educational uses for students at all levels especially for student design-related projects. With successful implementation of an improved remote sample-handling "rabbit" facility, efforts to advertise availability and encourage usage of the UFTR (especially for research) have proceeded in a favorable light though always less quickly than hoped over the last twelve years. Implementation of the standard rabbit capsule size with larger carrying capacity, the subsequent additional implementation of two state-of-the-art PC-based spectrum analyzer systems with complete ORTEC software packages for spectrum analysis and data reduction, the installation of an independent sample and standards drying facility as well as improved shielding around the pneumatic sample insertion (rabbit) system are all improvements that have been key factors in supporting facility usage by assuring an easier and faster turnaround of samples submitted to be irradiated for Neutron Activation Analysis.

The experimental neutron radiography facility was also upgraded during the 1988-89 reporting year. With installation of a semi-permanent shielding cavity as well as design and implementation of a movable table to position objects to be radiographed along with movable shielding blocks, the UFTR neutron radiography facility reached a level of mature application with much reduced installation time and more reliable results. Not only has it been used for several demonstrations, exercises and experiments for university classes, as well as for visitors from other educational institutions (Reactor Sharing) and for two senior projects to document implementation, but, perhaps more significantly, it has been used extensively for one externally funded user with reasonably consistent results over the past few years. Further improvements were implemented in the radiography facility during the 1990-91 reporting year to improve the beam quality in an attempt to reduce the exposure times needed for various types of radiography with further improvements planned to improve beam quality, reduce installation time and standardize exposure time during the upcoming year. This work was at a much reduced level in the last five years due to the need for

funding to support the effort as well as efforts to train new personnel in radiography techniques which were completed during the 1994-95 reporting year as a number of good quality radiographs were obtained.

During the 1989-90 reporting year, a senior project was completed to design an automatic sample changer for the NAA Laboratory. This device had been partially implemented but its timing circuit would only allow it to insert a single sample. During the 1992-93 reporting year, plans were finally implemented to redesign the timing circuit to provide a fully automated sample changer to eliminate technician time to change samples overnight, thereby greatly increasing the sample throughput in the analytical laboratory. This redesign is only partially complete at year's end as the effort has been refocused to complete software development for the attached computer system and to redesign the segmented shield for this detector to assure samples are properly counted and the data stored for later analysis. This effort was nearly complete in the 1995-96 reporting year but with no work effort during this reporting year some work remains to be completed on the timing circuit to make the software and the sample changer compatible.

During the 1990-91 reporting year, the new ORTEC software package (OMNIGAM) was implemented in the NAA Laboratory. This software package enabled the laboratory to produce efficient and accurate reports on trace element analysis of many different sample matrices.

During the 1991-92 reporting year, further NAA Laboratory improvements were made. First, additional storage capacity was obtained for the laboratory computers to improve the speed with which analysis is performed along with a new monitor to replace a failed one. A 92X Spectrum Master spectroscopy system was obtained to provide computer-controlled gamma spectroscopy with user friendly, yet sophisticated capabilities. A model 919 Spectrum Master multichannel buffer was also obtained for high performance data acquisition in nuclear spectroscopy applications. It interfaces with a personal computer and up to four (4) HPGe detectors for data processing, giving the laboratory the capacity for future expansion. An analysis upgrade package was also obtained. The SyncMaster 3 is a key multifaceted analysis upgrade package to provide extensive graphics capabilities, high resolution, easy-to-read commands, and the ability to alternate back and forth between programs during analysis. The most important was an integral shield for one of the PC-based detector-analyzer systems to improve the sensitivity that can be reached in analyzing samples by reducing interferences from external radiation sources, lowering detection limits and reducing counting time. In addition, a desiccator station was obtained for the NAA Laboratory as a donation from another researcher to increase the capacity to store both standards and samples with the added assurance of preventing moisture intrusion. All of these improvements were designed to increase laboratory throughput while enabling laboratory workers to address experiment design, improve student laboratory experiences and generally assure better results with optimal effort.

Several other significant items were also obtained in the 1991-92 year to include an electronic maintenance repair tool kit which has saved hundreds of hours of maintenance effort over the past three years as well as a high speed chart recorder to facilitate time allocated to several surveillances. Acquisition of a portable neutron-sensitive survey meter has also reduced delays when the previously borrowed instrument was not available.

During the 1992-93 reporting year, a new area radiation monitoring system as well as a new multipoint temperature recorder were obtained under a DOE Reactor Instrumentation Grant. Both are still in the process of being prepared for installation at year's end though on a delayed schedule since previous repairs on these systems have resulted in near zero outage time attributed to these systems in the 1994-95 through 1996-97 reporting years. In addition, a new telescoping high dose rate survey instrument as well as a MicroR low level survey instrument were obtained under the same DOE grant, the first to replace a frequently failing teletector, the second to provide in-house environmental survey capability. Other acquisitions and facility improvements in the 1992-93 reporting year included asbestos removal and installation of a new main air handler in the reactor building, installation of a touchtone telephone in the Emergency Support Center plus the delivery and implementation of a complete new detector system in the NAA Laboratory including an HPGe detector, integral shield, PC-based analyzer and complete software package. This acquisition gives the NAA Laboratory three detector systems, though one is in need of replacement. Finally, a staff computer for use by the Reactor Manager was obtained to simplify report generation.

Additional improvements during the 1993-94 year included development and implementation of a spill kit for addressing radiological contamination incidents to include training, partial implementation of a used whole body counter for the UFTR Bioassay program developed in draft form as well as acquisition of a new nimbin and implementation of a NaI well detector for spectral analysis training and demonstrations in the analytical laboratory as well as reinstallation of a HPGe detector following rework at ORTEC. Old asbestos-based tile was removed from the entire NAA Laboratory facility and replaced with new tile as part of the University's continuing effort to preserve facilities. Equipment acquired and implemented through another DOE Instrumentation Grant included a boroscope to reduce dose for UFTR fuel and control blade inspections, lead blankets to limit dose rates at key points around the facility and a freeze dryer for processing samples in the NAA Laboratory without losing volatile trace elements. Finally an ultrasonic flow meter was also acquired with plans to implement it as part of the UFTR Nuclear Instrumentation Calibration Check and Calorimetric Heat Balance in the next reporting year, though this has not yet occurred.

Although there was no DOE Nuclear Instrumentation Grant for the 1994-95 reporting year, a number of significant facility improvements and upgrades were implemented during the reporting year. Implementation of the new AMS^4 air particulate detector obtained through DOE support in the previous year was finalized near year's end after attaching a computer printer, establishing DAC levels and incorporating its operation into facility procedures. Other significant upgrades and improvements included obtaining and implementing several simple, scaler-based GM counting systems for use with classroom and tour groups in performing half-life measurements which have been supporting a popular classroom/laboratory experimental exercise in measuring half-lives for nearly three years. In addition, two HPGe detectors were returned to ORTEC for refurbishment and have been operating well subsequently. The poster session display board depicting the research project involving trace element analysis of cannabis sativa samples to support a legal case was mounted in the laboratory access area to provide a unique source of discussions with visitor groups at all levels. Finally, following several tube failures the rabbit system was subjected to a major overhaul and modification to replace old tubing, to upgrade the exhaust fan for increased flow and to upgrade the HEPA filter system to assure long-term implementation of this experimental facility.

During the 1995-96 reporting year, one of the NAA Laboratory computers and the upstairs office (secretary) computer were upgraded. The upstairs computer will now run common windows compatible software such as WordPerfect 6.1 for Windows and Quattro Pro 6.0 for Windows.

During the 1996-97 reporting year, additional facility upgrades were implemented. First, the NAA Laboratory hardware used for neutron activation analysis was upgraded in July 1997. A Gateway 2000 G-5 200 computer was purchased. This computer has a 3.7GB hard drive and a 200-MHz pentium processor. The software installed includes Windows 95, Microsoft Office 97, Microsoft Bookshelf, and McAfee Virus Scan. Software was also ordered from EG&G ORTEC to update the older software being used in the laboratory. New Gammavision software, the software used to determine and analyze NAA spectra, was also purchased. This software allows for more accurate and efficient analysis, and increases the proficiency and throughput of the lab. Software that includes a complete chart of all of the elements and each isotope was also installed on the computer. This nuclide library allows for quick access to all of the radionuclide half-lives, the energy of the gamma rays emitted by each, the neutron cross sections for each and the naturally occurring abundance. The computer was received on July 18 with the software received on August 11, 1997. Both the computer and the software are operational at the end of the 1996-97 reporting year. All of the upgrades will lead to a smoother running laboratory and better overall performance for production of trace element analysis. The larger monitor is especially useful for demonstrations for class and group presentations in the NAA Laboratory.

In addition, the facility was supplied with fourteen 0-200 mR self-reading pocket dosimeters (SRPDs) plus a hand-held self-powered charger in June 1997. All fourteen SRPDs were checked for calibration in June and are now in use at the facility making it possible to give nearly every class visitor a personal dosimeter for more interactive utilization of the facility.

During September 1997, additional software was obtained for the NAA Laboratory to include ORTEC's Nuclide Navigator library consisting of all the essential information on radioactive decay, neutron activation, etc., for all the isotopes. During October 1997, the facility received a complimentary copy of the Gammavision Report Writer which is to be used to facilitate reporting the results of NAA spectrum analyses. During September, it also became apparent that HPGe Detector #2 was failed. Efforts at in-house repair, including the electronics shop, were unsuccessful so the detector was packaged up on October 10 and sent to ORTEC for diagnosis and repair. The detector was checked to be okay and returned on November 4, 1997. It was cooled down on November 13 and checked on November 14 but it was still inoperable. Dan Ekdahl then reviewed his plan for determining any other reasons why the signal from the detector is not reaching the computer as work continued in this area at the end of November with the thought that there may be a realignment software problem involved. In the month of December, the work on the high purity germanium detectors was continued. It was determined that the equipment failure came from the 92X spectrum master. This piece of equipment was shipped to EG&G ORTEC for repair in mid-January. It was repaired by February 6, 1998 and subsequently returned to the NAA Laboratory and returned to operation by the end of February 1998 so all three of the HPGe detectors were determined to be in working order and could be utilized for gamma spectroscopy analyses at the end of February 1998. Near the end of March, it was discovered that the computer

was not receiving a signal from HPGe Detector #2 previously sent to ORTEC for repair. At the end of March 1998, work was under way to determine the source of this problem.

During April 1998, the effort continued to determine the reason for the failure of the HPGe Detector #2. All of the components that operate along with the detector were tested and it was determined that the detector was giving off too much heat verified by the observed increased rate at which liquid nitrogen was being used up in the dewar. The cause of this problem was determined to be a vacuum leak in the detector. This particular problem could not be fixed in-house, so the detector was shipped to EG&G ORTEC. The HPGe detector was finally returned on June 10, 1998 with ORTEC having determined there is nothing wrong with the detector or the electronics supporting the detector. According to the ORTEC technician, this particular detector must be configured differently than the other detectors currently being used in the NAA Laboratory. This HPGe detector was then reconnected to the high voltage supply and powered back up on July 7, 1998 following a long period of cooling. The detector was then hooked up to the spectrum analyzer and computer and it was determined that the detector is working. The detector was then calibrated for energy and efficiency. The weekly QA calibration checks were not done on this detector for the remainder of the month due to the fact that the detectors are being used very infrequently at this time of the year due to the reactor unavailability.

On June 13, 1998, a Dell Dimension XPS 300 MHz Pentium II computer was ordered. The computer was delivered on August 20, 1998 and assembled that same day. The computer included 64 MB RAM, 8.4 GB EIDE Ultra ATA Hard Drive, 32X Max Variable CD-ROM, Altec ACS90 Speakers and a Dell 1200HS Color Monitor with 17.9 viewable image. The system includes Windows 98 and other various programs. An internal 100MB Iomega Zip Drive was also included. An HP DeskJet 722C printer was also purchased with the computer along with an HP SCANJET 5100CSE Scanner, all implemented in August 1998.

With the continued support of the DOE Reactor Sharing Program in the 1994-95 reporting year (at a significant 24% reduced level from the 1993-94 grant year), there was continued significant usage by a wide variety of users from a broad spectrum of schools for educational as well as research purposes; again, several proposals for separate research funding were in progress. Despite the large reduction in funding, significant and even increased usage in some areas was undertaken under Reactor Sharing. During the 1994-95 reporting year, there was also continued reactor usage for both educational and research programs sponsored by the University of Florida but spurred by Reactor Sharing users. In 1992-93 one relatively large funded project from the Endodontics Department in the Dental School completed utilizing the reactor and NAA Laboratory to examine mercury content of laboratory rat brain and kidney tissues following bone implantation of mercury amalgam. Another smaller project in the pharmacology department continues to use the UFTR to generate radioactive copper-64 for calibration of its positron-emission tomography (PET) scanner. Indeed, a second scanner obtained in late 1996 has resulted in more frequent need for copper-64, especially for research purposes. New funded projects for the 1993-94 year included activation analysis to determine the role of citrates containing metabolite in the genesis of renal calculi for a researcher at Shands Hospital, trace element analysis of cannabis sativa plant tissues to support a criminal prosecution in Polk County, Florida, plus trace element analysis of NiA1 alloys for materials science researchers serving as expert witnesses at the University of Florida.

In the 1994-95 reporting year, research on benchmarking and implementing a Quality Assurance Program in the NAA Laboratory proceeded at a good pace. Other new research programs included NAA on rare earth materials (Dy_2O_3, Dy and In_2O_3) for isotope identification in tracing weapons effects for the Armed Forces Radiobiology Research Institute. Other projects included continuing analysis of zeolite and then carbonaceous supports for the Chemistry Department as well as a number of new Reactor Sharing projects including analysis of Gulf of Mexico sediments for Dr. John Trefry at the Florida Institute of Technology and NAA on geological quartz for Dr. Roy Odom's group at Florida State University for an EPR Dating project. The research area shows several other projects with proposals awaiting funding and/or demonstration of feasibility using UFTR facilities including one at the University of Miami to look at surface water contaminants. Many other projects were undertaken to determine feasibility. There were also several commercial research irradiations and related projects in that year with one utilizing the radiography facility and beam transmission facilities for over 40 hours.

In the 1995-96 reporting year, the benchmarking and implementation of a Quality Assurance Program continued, though at a slow pace due to loss of lab personnel and the need to train new personnel. The University of Miami project to look at surface water contaminants was finally begun. In addition, several projects were undertaken for the Chemistry Department including continuing analysis of zeolite plus other new seed projects to look at filtered particulates from a controlled salt water environment, analysis of prepolymer precursor material for tin content and trace element analysis of silicon nitride samples. A large student project was also begun to perform trace element analysis of Lake Alice sediments. Again, there was one commercial research project to utilize the beam transmission facilities for over 25 hours and the production of copper-64 for the hospital positron-emission tomography (PET) scanners continued periodically. When combined with the computational analysis capabilities for NAA, it had been hoped more such usages would be forthcoming during this last year to complement UFTR research and educational utilization activities whether supported by the University of Florida, Reactor Sharing or externally funded sources.

In the 1996-97 reporting year, loss of NAA Laboratory personnel and the need to train new personnel limited efforts in implementation of a Quality Assurance Program though some work was accomplished by visits of a part-time student working on a project. This work will serve as a good basis for the NAA Laboratory QA Program as work continued in this area during the 1997-98 reporting year.

Again, several seed projects were undertaken for the Chemistry Department as some trace analysis was performed on silicon nitride samples and on zeolite samples. A funded project was conducted for the Armed Forces Radiobiology Research Institute (AFRRI) reactor facility in the 1996-97 year to determine detection limits for dysprosium and other rare earth metals and look at trace elements in wood and lead samples. Another project was conducted to look at prehistoric manganese secretions for assessment of the Cactus Hill Archeological Site in Virginia. The individual involved in these efforts now lives in Florida and visited the facility this year (1997-98) to investigate the possibility of similar work. Some discussions were held for possibly conducting some tests using UFTR beams for BNCT-related research, but this is only in the discussion stages as yet. Again, there was one commercial research project to utilize the beam transmission facilities for over a dozen hours and the production of copper-64 for the Shands hospital positron-emission

tomography (PET) scanners continued but at a reduced rate (over 6 usage hours) as they acquired a new machine and conducted research on it periodically. There was also some seed project trace analysis of CeO_2 to support the MOX program at Los Alamos as a funded program may be possible. When combined with the computational analysis capabilities for NAA, it is still hoped more such usages will be forthcoming during this next year to complement UFTR research and educational utilization activities whether supported by the University of Florida, Reactor Sharing or externally funded sources.

The level of administrative work dedicated to regulatory activities is expected to be at a similar or increased level during this next reporting year. The facility received only one NRC inspection during the reporting year, a special health physics and respiratory protection inspection on August 13-14, 1998 in response to implementation of Revision 2 of the UFTR Respiratory Protection Program; there were no violations noted. Some considerable administrative effort was expended to prepare and implement the revised respiratory protection program for core work in addressing the reactivity anomaly for which the reactor was unavailable for the final four months of the year and disassembled at year's end. There were also a number of suggestions on improving operations that were addressed and involved some considerable facility manpower to implement. During the previous year, the facility developed Tech Spec Amendment 22 submitting it by letter dated August 22, 1997, to update the name of the parent Nuclear Engineering Sciences Department to the Nuclear and Radiological Engineering Department and to delete requirements for submittals to NRC Region II since all submittals are now sent to NRC Headquarters to the Document Control Desk. This amendment was finally approved with a letter dated December 3, 1997 and received on December 8, 1997 including a safety evaluation report and directions for installing the three pages affected by the change. Amendment 22 was subsequently prepared for insertion and then inserted in the facility document manuals during December 1997.

Activities in response to NRC regulations as well as various efforts to maintain facility compliance and responsiveness occupied significant facility management and staff time during the reporting year. The total time devoted to NRC communications was similar or even higher than most previous years especially with the reactivity anomaly occurrence to be addressed for May 1998 forward. Considerable time was also spent reviewing various other documents and working on the HEU to LEU conversion including the Emergency Plan Revision 10 which had been submitted with a letter dated April 10, 1997 as the NRC's noncommittal acceptance of it was received on August 28, 1997 with a letter dated August 22, 1997. Therefore, Revision 10 was implemented and distributed early in the reporting year as part of the updating and standardizing of the Emergency Plan copies around the facility. Although the facility submitted no revisions to the UFTR Final Safety Analysis Report or the Emergency Plan during this year, a considerable effort was undertaken to assure all copies of both documents are complete and uniformly documented, signed off as complete and maintained available around the facility. In addition, Revision 14 of the Physical Security Plan was submitted to NRC in October 1997 with no response to date at year's end. All this administrative effort involved considerable commitments of time and resources.

Some additional time was also to be spent updating the estimated cost of decommissioning to meet the new requirements of 10 CFR 50.33 and 50.75 first promulgated in the 1990-91 reporting year. However, the updated cost was not produced and documented during the reporting year as this

is one of the surveillances carried over to be completed early in the next reporting year with information distributed to the UFTR Decommissioning Information File showing the estimated decommissioning cost has been increased to $2.535 million as of June 1998. These special responses to and communications with NRC were in addition to the usual information supplied periodically via telephone calls, the posting of information advisories, the quarterly safeguards reports and the updated HEU-to-LEU Conversion Proposal submitted in March 1997 to meet the requirements of 10 CFR 50.64(c)(2) plus an NRC inspection of the separate SNM-1050 facility license in February 1998. Therefore, the commitment of time and resources to address NRC requirements has been at least as extensive in the 1997-98 reporting year for responses and communications with NRC as in most previous years, especially with the posting of frequent advisories and the NRC periodic requests for various kinds of information to support its licensing and inspection function.

Other regulatory agencies also affected the UFTR in the reporting year as there were various inspections for OSHA, fire code and others requiring a response as well as the annual RSRS audit in March 1998 and an annual safety survey by an inspector from the Environmental Health & Safety Division as well as a DOE Funding Submittal Information survey and several DOE fuel surveys.

During the 1992-93 reporting year, considerable effort was spent in following up the decision made some four years earlier not to utilize the pin type SPERT fuel for conversion of the UFTR from HEU to LEU fuel; this SPERT fuel is now stored in a westerly room attached to the Nuclear Research Field Building. In the 1993-94 reporting year and again in 1994-95, this effort was reduced to about 70 hours though some administrative effort was expended in attempting to arrange shipment of this unneeded fuel to a secure DOE facility like Oak Ridge National Laboratory without success. Similar efforts were expended in the previous several years with no success as the Department of Energy apparently has no room for the SPERT fuel and had even requested to be allowed to return 1200 pins temporarily shipped to ORNL in 1990. This latter request was denied in the 1991-92 year as the current storage facility does not have sufficient room for accepting the 1200 pins back. The effort in this area in the 1995-96 year was reduced to about 55 hours, but this year the effort has involved over 61 hours as several Field Building activities required addressing non-impact on the stored fuel.

After the loss of the student performing the neutronics safety analysis for the UFTR HEU-to-LEU conversion at the end of the 1988-1989 reporting year, there was also considerable management effort involved in training a new student and then rechecking the computational methodology and essentially starting from scratch on the actual core calculations to support the HEU-to-LEU conversion. Although this project had been further delayed, real progress was made in the 1990-91 reporting year in essentially completing the static neutronics calculations based on efforts in the previous year to assure the computational methodology is adequate to analyze the existing core as a benchmark for further calculations. With the previous completion of static neutronics calculations and production of a master's project, efforts during the 1991-92 reporting year were directed toward thermal hydraulics analysis as a 14-plate fuel bundle of standard silicide fuel plates was selected as the final design for the LEU core with near completion of calculations and beginning of the documentation package by one student who left the university. Completion of final calculations and documentation of the analysis for the license submittal has not been completed this year. Another

no-cost extension of funding for this work was submitted to DOE during this reporting year. One other area requiring time in 1991-92 was for Eileen Yokuda from EG&G Idaho to visit for two days in December 1991 to see the unique difficulties involved in trying to check the UFTR core and sub-core connections and dimensions due to the unstacking of shielding and removal of fuel required plus review of fuel drawings sent by Ms. Yokuda in August 1992. It now appears a complete dummy core may be necessary to assure the fuel will fit in the core. Little progress was made in this area in the 1993-94 reporting year though potential corrosion problems were identified by Iowa State in April 1993 with new LEU fuel on a close pitch. This corrosion is apparently only a problem when water is dumped off the core and capillary action keeps the plates wetted. The final UFTR conversion fuel drawings were delivered in April 1993 as well but have not yet been signed and returned to DOE as another extension for the submittal of the safety analysis to NRC was noted in the proposal submitted in March 1997 to NRC.

Early in the year, a call was made to Dennis Wilson to have the small remaining DOE-supplied funding support for this HEU to LEU analysis work extended to keep the grant open, but no money is available to support actual conversion as explained in the submittal to NRC and as indicated in a letter from John Gutteridge, Program Director, Office of Planning and Analysis, Office of Nuclear Energy, Science and Technology, dated February 23, 1998 and received in early March 1998. Little was accomplished during this year until October 1997 when visiting Professor Marc Caner from the SOREQ Institute in Israel began working on the project with hopes this project could be concluded this year, since the loss of several facility personnel had prevented work in this area previously. There had been a delay in the response to the grant support extension request to DOE; however, as of the end of January 1998, some DOE money was available to be used to support some of Dr. Caner's work. As required, the 1998 updated proposal on the HEU-to-LEU conversion to meet requirements of 10 CFR 50.64(c)(2) was submitted to the NRC with a letter dated March 27, 1998 again explaining the reasons for delays and indicating the updated proposal for the conversion schedule to include submission of the license amendment safety analysis package is now scheduled for October 1998. However, little was accomplished during the year since the loss of several facility personnel had prevented work in this area, but at year's end Dr. Marc Caner is now spending his sabbatical time since December 1997 on the project and work is progressing though confirming dimensions and materials to support the calculations has involved considerable time during July 1998 with Dr. Caner receiving a tour to observe the unstacked core on August 27, 1998.

Frequently there is a summary breakdown of reactor utilization for the reporting period. If given, the list would show UFTR utilization divided into over seventy different educational, research, training, tests, surveillances and facility enhancement operations and general tour/demonstration and educational activities. Included in on-campus usage are over twenty different courses utilizing the facility, some for multiple usages, class projects, and experiments. The total reactor run time was just over 189 hours while various experiments, surveillances, maintenance and other projects used just over 1817 hours of facility time, not counting a large block of time devoted to routine daily and weekly checkouts. In addition, there were many concurrent usages during the year to optimize utilization of available personnel. The run time for 1997-98 represents a decrease of about 37% from last year due primarily to the lengthy four-month outage at year's end to investigate the reactivity anomaly; other limitations are availability of operators, as well as qualified NAA Laboratory personnel; the unavailability of a full-time Reactor Manager for

the entire year continues to represent a significant administrative and operational burden. The significantly reduced value of run time is in agreement with the low availability of 58.29% as it is considerably below the 1993-94 availability (89.69%), 1994-95 availability (88.15%) and 1995-96 availability (75.68%), despite continuing to account for lost availability for administrative reasons. Otherwise, the availability value would be over 60%, still a rather low value.

With the large commitment of administrative activities and the usual large educational component of facility usage not requiring or involving only minimal reactor operation, the value of run time is reasonable. Indeed, many facility educational activities have continued despite reactor unavailability. Actually, the experiment time also represents a somewhat smaller decrease of 6.5% without accounting for hundreds of hours of concurrent experiment time in a variety of areas. This concurrent time remains one of the higher ever values showing good use of facility personnel when they are available, especially for educational activities, many involving the Reactor Sharing Program and on-campus courses. The maintenance of experiment time is primarily attributed to the relatively low reactor availability (58.29%) for the year coupled with all the time applied for maintenance and surveillances plus effective utilization of part-time personnel and expansion of activities involving only part-time use of the reactor as for external educational programs. The sustained level of experiment time is also attributed to continued improvement in record keeping of project times using the facility or its staff but not the reactor, such as tour groups, and over 70 hours for project work with the LEU SPERT fuel for checks at the Nuclear Research Building including implementing temporary covers for the fuel racks.

With one large forced outage lasting nearly four months continuing at the end of the reporting year, the total time spent on maintenance activities related to forced outages is significantly increased. It is hoped the reactor inspection can be completed early in the next reporting year and reassembly facilitated but personnel limitations make this a difficult activity.

The significant decrease in run time along with a smaller decrease in experiment time are directly attributable to the combination of relatively low reactor availability (58.29%) for the year coupled with the limited availability of operators despite continued high interest in the usage of the UFTR for education, training, research and service activities. The outlook is somewhat favorable for increased run time in the next year although there is no full-time Reactor Manager following the resignation of the permanent Reactor Manager as of August 9, 1996 and then resignation of an interim full-time Reactor Manager as of March 28, 1997.

In summary, various data indicate continued high and diverse utilization of the UFTR facility with research and educational usage maintained in many areas and increased in some areas partially limited by unavailability of a full time permanent Reactor Manager for all of the year and overall availability at 58.29% including administrative shutdowns. The design and implementation of various new facilities as well as the refurbishment of existing facilities continue to play a key role here to enhance and promote educational, training and research utilization at all levels. The donation by Rhone-Poulenc of various vacuum cassettes and gadolinium screens was used effectively during the year to acquire several sets of quality radiographs. Of course, the Reactor Sharing Program is planned to continue to play a key overall support role in encouraging facility usage in all categories as this support has been renewed again, but this time with an increased level of $32,000 for the next

1998-99 reporting year after three years at decreased levels—from $30,000 for the 1995-96 reporting year, down to $24,000 for the 1996-97 reporting year and only $22,000 for the 1997-98 reporting year. The decreases were unfortunate considering that the past few years have seen the most diverse facility usage in the last twenty-five years, primarily due to the synergistic effect of the Reactor Sharing Program as it causes others to also investigate usage of the facility. As in the current year, the facility expects to utilize the UFTR facilities for reactor sharing supported activities for well over twice and perhaps three times the usage time covered by program funding at only $22,000 this year; the remainder is essentially an inducement to support future growth in facilities utilization among those who can be made cognizant of its unique capabilities. Indeed, researchers on campus have begun to discuss boron neutron capture therapy (BNCT)-related experiments at the UFTR facility precisely because they have observed good educational and NAA research activities occurring over the past few years.

The HEU-to-LEU fuel conversion related efforts also involved relatively low though significant levels of efforts involving reactor facility time this year; nevertheless, continuing analysis efforts were expended in advancing this project with a visiting professor to be continuing this work in the next 1998-99 reporting year.

Of course, the training and operational programs supported under the DOE Reactor Sharing Program, the large amount of internally supported usage for education and research plus several service activities all contribute to maintain the total facility utilization at high levels especially since growth in University of Florida course usage continues at a slower rate. With many educational and several large research projects (including several sponsored by Reactor Sharing and several others possibly deriving from within the university) already scheduled for the upcoming year, this next year promises to produce facility utilization at a higher level than that experienced during this most recent reporting year, again dependent on availability of licensed personnel as well as personnel trained to work in the NAA Laboratory to support reactor operations. A single utility operator training program could also produce a substantial increase in usage time by itself, though this is unlikely. With several significant maintenance projects completed and performed during past years, replacement of the two-pen recorder six years ago plus significant maintenance on the nuclear instrumentation circuits and the thermocouples in the core outlet cooling lines in the 1992-93 year and the blade position indicating circuits in the 1993-94 year and then the rabbit system during the 1994-95 year, the autoflux controller, linear (red) pen and Safety Channel 2 high voltage sensing circuit repairs during the 1995-96 year, and the CIC/UIC circuit, the shield tank demineralizer system and pump, the PC level trip reed switch, the annual nuclear instrumentation calibration check upgrades plus completion of the new roof during this year, this high usage expected for the 1998-99 reporting year is realistic especially in the areas of educational usage for college courses and for research and service activities, both on and off campus. All depends on an effective recovery from the continuing year end outage to address the reactivity anomaly.

Table III-1 contains a breakdown delineating the 40 schools and other educational entities and their 98 usages of the UFTR facilities which were sponsored under the Department of Energy Reactor Sharing Program Grant DE-FG02-96NE38152. These Reactor Sharing usages account for many hours of facility usage even when the reactor was not available to be run. Reactor Sharing usages have resulted in maintaining and fostering improved visibility for the UFTR around the State

of Florida and also among researchers and other users at the University of Florida, many of whom now recognize the unique capabilities of the UFTR facilities per the interactions with the Chemistry Department and interest in BNCT-related research. Several new inquiries for involvement in the Reactor Sharing Program have been received again this year; several new users have also been accommodated. In all, the 98 usages represent a small drop from the last two years despite a small increase in grant funds; this is balanced by large increases in diversity and length of individual usages with the total of 122 participating faculty being one of the highest ever. The total of 691 students involved is also among the highest ever and with the diversity of groups involved again demonstrating the broad-based role of the Reactor Sharing Program as a key factor in UFTR utilization and education in nuclear science and engineering around the State of Florida.

Much of the continued diversity is due to the effort to involve high school science students in research and education programs at the UFTR, which received continued emphasis for the eighth straight year resulting in six high school research projects in addition to the usual educational usages. Obviously this DOE Program remains a key driving force behind the continued utilization and growth of interest in the UFTR facility. This publicity is certainly a key factor in explaining the continued large number of visitors (2270 versus 2261 and 2604 the last two years and 2804, 2418, 2053, 1432 and 1067 in the previous five years) of all types who toured the facility again this year; this is probably the second largest number of visitors in facility history and accounts for much of the facility usage for substantive demonstrations, experiments and tours, many of which occupied a half day or more even when the reactor was not available for irradiations. By maintaining and possibly even increasing further the number of visitors this next year, the facility is continuing to increase the number of persons who are familiar with the facility and its capabilities. Therefore, the UFTR facility continues to build and support a base for long-term permanent interest in and support of facility utilization with the Reactor Sharing Program serving as the catalyst for this growth but by no means the only source of visitors. The implementation of the various facility improvements in the NAA Laboratory and elsewhere in the facility are simply spinoffs from the various expressed needs of those visiting the facility in conjunction with staff interests in diversification of capabilities and can only serve to increase opportunities for new usage. The ability and willingness to tailor experimental usages and demonstrations also plays a significant role in fostering interest among high school and college groups. Similarly, as the neutron radiography facility has become functional, though some optimization and final design efforts continue, plans are continuing to investigate the feasibility of implementing a prompt gamma analysis facility at the UFTR. Interest has been expressed in such a facility by researchers at the University of Florida Materials Science and Engineering Department, at the University of South Florida (Tampa) and by several industry users, all of whom could use such a facility. It would clearly complement the normal NAA capabilities and facilitate further growth and diversification of usage. Again, funding support and facility personnel time for design work are the limiting factors. The current interest in investigating boron neutron capture therapy-related research is also encouraging from on-campus researchers.

Detailed in Table III-2 are the monthly and total energy generation figures, as well as the hours at full-power per month and totals for this past year. The UFTR generated only 11.615 MW-hrs during this twelve-month reporting period, down about 31.29% from last year due primarily to forced unavailability for the reactivity anomaly and limited operator availability. The energy generation in this reporting year relative to previous years is still indicative of high facility usage,

especially when compared to years prior to initiation of the DOE Reactor Sharing Grant in the 1983-1984 reporting year. This fact is emphasized by the high numbers of hours of educational facility usage for which licensed personnel are involved in other than reactor operation and for which reactor operation is only a small but integral part. Since there were several research usages such as Neutron Radiography projects and transmission work as well as extensive operations laboratories and other education-related sessions where the usage was lengthy but at relatively low or fluctuating power levels, the power generation could have been considerably higher in the first eight months of the year. Indeed, even with a 58.65% availability factor for the year, the real limitation on usage has been a combination of personnel unavailability, licensed personnel unavailability, lack of funded support for desired usages especially for some of the reactor sharing projects and time lost for maintenance as well as scheduled surveillances and inspections of all kinds (NRC, ANI, RSRS, etc.) as well as for responses to regulatory agencies (NRC, ANI, EPA, DOE, IAEA, etc.) for which time commitments continue to increase, especially for the NRC component.

Described in Table III-3 is a monthly breakdown of usage and availability data. As noted in Section I of this report, there was increased outage time during the year with one very large individual forced outage and a number of much smaller ones. The large forced outage was for investigation of the reactivity anomaly at year's end (122¼ days). No other forced outages exceeded even two days in length though there were several short outages during the year, so the overall availability was the lowest in about eleven years at 58.65%. Though only quoted as 58.65% availability in Table III-4, this availability accounts for 10¾ days planned unavailability for adjustments and performance of the Annual Nuclear Instrumentation Calibration Check (A-2 Surveillance) as well as lost availability for administrative reasons (7½ days) plus other hardware problems. At 7½ days of administrative shutdown (2.06%) for vacations, absences of personnel and evaluations of records, this contribution is still small. If not counted, availability would only be a little over 60% since forced unavailability for maintenance was high due to addressing the reactivity anomaly. For the year the availability is considerably below the historically high level of 91.5% recorded in the 1987-1988 reporting year and over 90% for the first half of the 1997-98 year.

Similarly, Table III-4 contains a detailed breakdown of days unavailable each month with a brief description of the primary contributors. The overall availability of 58.29% in this table is based on days per year and is well below the average of nearly 80% over the last seven years; however, this value would also be 2.06% higher if administrative shutdowns were not included. Indeed, availability was well above 90% for the first eight months of the year until shutting down, defueling and disassembling the reactor to address the reactivity anomaly which accounted for 122.25 days unavailability out of 144.75 days forced and planned unavailability. As shown in the data in Table III-4, key causes of failures have generally been isolated and corrected to limit recurrences of related failures. Such a maintenance philosophy is expected to assure a return to high availability, hopefully exceeding 90% when recovering from the year end outage; although funds were previously allocated under the DOE Reactor Instrumentation Grant to replace the temperature recorder as well as the area monitoring system, these modifications have received low priority this year as these systems have not continued to be significant contributors of unavailability during the 1994-95, 1995-96, 1996-97 and now the 1997-98 reporting years, especially with the limited number of certified operators.

Described in Table III-5A is an explanation and date for all unscheduled trips for the reporting period. As explained in the table, there were no trips during the 1997-98 reporting year as for the1996-97 reporting year after having two trips during the 1995-96 reporting year, two trips in the 1994-95 year, no trips in the 1993-94 year, two trips in the 1992-93 year, and three trips in the 1991-92 year which were the first trips since the trips on September 7 and 15, 1989 and the trip on November 29, 1989. The first trip on November 16, 1995 was due to a building electrical transient indicated by dimming of lights resulting in a full trip as the reactor was running at full power to perform an irradiation. Following completion of a successful daily checkout, the reactor was returned to normal operations with no further problems with the event evaluated to have no impact on health and safety of the public or reactor personnel and negligible effect on reactor safety. The second trip occurred on April 4, 1996. In this case, the full trip was caused by a failure in the high voltage sensing circuit for Safety Channel 2 and resulted in considerable outage time (11½ days) to effect repairs to the circuit and assure proper operation of the circuit to avoid such spurious trips. This event was also promptly reported in the previous 1995-96 reporting year because the failure may have resulted in operation with the trip setting on loss of high voltage to the Safety Channel 2 detector (Uncompensated Ion Chamber) somewhat above the 10% loss of voltage required by technical specifications for as much as two months. Following completion of maintenance and successful checkouts and evaluation of the incident as having no impact on the health and safety of the public or facility staff and negligible effect on reactor safety, the reactor was returned to normal operations with no further problems and no trips for the succeeding 28 months to include all of the 1996-97 and 1997-98 reporting years though the reactor was not operated after mid-May during the 1997-98 reporting year.

Table III-5B also contains no entries for scheduled trips. The last scheduled trip was on December 1, 1995 and was conducted to obtain data for an inverse kinetics class project with all systems operating properly. In this case, the general lack of scheduled trips is primarily due to the lack of utility training programs where such trips are part of the training exercises. It is expected that some trips will be included in the Reactor Operations Laboratory course for the upcoming year as well as for some of the operations demonstrations for other advanced classes in nuclear engineering.

Several additional incidents (none promptly reportable) described as unusual occurrences (and per UFTR Tech Specs sometimes potentially abnormal occurrences) occurred during this reporting year. Table III-6 contains a descriptive log of six such unusual occurrences with relatively brief descriptive evaluations of each. Several of these occurrences were reported to NRC in their periodic checks over the telephone, some on more than one occasion. None of these occurrences were promptly reported or otherwise directed to be promptly reported though some were called in relatively promptly simply to assure good NRC communications, especially entry 6 for the reactivity anomaly which was the subject of much communication with NRC.

All of these occurrences involved some equipment failure or other event. The most significant occurrence was the reactivity anomaly (occurrence #6) which involved unexplained changes in the critical position accounting for the largest outage in several years (122¼ days) extending into the next year. One other event involved an equipment failure that resulted in an outage (occurrence #4) due to loss of the trip on the primary coolant return line flow sensor discovered during the quarterly checkout accounting for a short outage (2⅞ days). The breakage of

the rupture disk (occurrence #1) during checkout of the console key reset function in response to an occurrence where trip functions were bypassed at another facility with the necessity to replace the disk and clean up the equipment pit also resulted in a short outage (1⅛ days) as did the need to repair the Safety Channel 2 high voltage power supply loss of high voltage trip test switch (occurrence #3) which resulted in a similar short outage (2⅛ days). The other two events (occurrence #2 and occurrence #5) were simply failures to assure calibration of installed survey meters (rabbit system detector monitor and portal monitor) within the prescribed interval with no need to make adjustments when checking the detectors and involving no outage time.

In terms of effect, the most significant occurrences would be the breaking of the rupture disk (occurrence #1), the failure of the PC return line flow switch discovered during a quarterly surveillance (occurrence #4) plus the efforts to address the reactivity anomaly (occurrence #6) because of the dose commitment involved and the fact it resulted in a lengthy and continuous forced outage (122¼ days). In terms of forced outage time, occurrence #6 (122¼ days) and occurrence #4 (2⅞ days) were the most significant of the unusual occurrences. Overall, none of these six unusual occurrences is considered to have had significant impact on the safety of the reactor or on the health and safety of the public. In addition, all have been reviewed to assure adequate consideration of their effects with none officially reported promptly to the NRC though all were reported for information purposes at some point. All were also reported in periodic updates to the NRC.

No uncontrolled releases of radioactivity have occurred from the facility and controlled releases remain well within established limits. The personnel radiation exposures for 1996-97 reporting year have been maintained at a low yearly level, with no significant doses received. Even in the previous 1995-96 reporting year, doses were relatively low considering there were two occasions requiring unstacking of the biological shielding—one in December 1995 to complete the five-year surveillance inspection of mechanical integrity of the control blade and drive systems internal to the biological shielding (V-1 Surveillance) and one in August 1996 to conduct the biennial inspection of incore fuel elements (B-2 Surveillance). There was also no waste or special nuclear material shipped from the reactor this year. Although waste was expected to be shipped to prepare the facility for the HEU-to-LEU fuel conversion activities to commence within the next few years, this has been delayed indefinitely. It was also expected that the remainder of the LEU SPERT fuel would be shipped in the past several years under the SNM-1050 license after 1200 SPERT fuel pins were transferred for shipment on May 17, 1990, but this has not occurred. Because of difficulties in getting DOE to accept the fuel, it will probably not occur in this next year. This activity will be directed and controlled by UFTR personnel assisted by personnel from the Radiation Control Office. Quality Assurance Program Approval Number 0578, Revision 1 will be available for this transfer to assure meeting all shipping requirements as it was renewed prior to expiration on October 31, 1992. The submittal for renewal was dated September 30, 1992. The new Program Approval dated and approved as of October 20, 1992 does not expire until October 31, 1997 in the next reporting year.

Environmental radioactivity surveillances continue to show no detectable off-site dose attributable to the UFTR facility as noted in Section VII. Although environmental film badges (now removed) and TLDs record occasional exposure, this dose is not attributable to UFTR operations as explained in Section VII since it does not correlate with energy generation. The change in the

gaseous releases measurement methodology implemented in the 1988-1989 reporting year to account better for the gas standard and counting geometry utilized since August 1988 in response to an NRC Health Physics Radiation Inspection in March 1988 continues to be utilized. The current methodology used to measure gaseous releases is much improved and the results obtained have been reasonably consistent. Effluent levels for both the gaseous and liquid releases remain well within required limits with no solid waste shipment during the year. Overall, the facility continues to operate within ALARA guidelines with minimal exposure of staff and visitors as delineated in Section VII.

TABLE III-1

REACTOR SHARING PROGRAM
SUMMARY OF USAGE OF UFTR FACILITIES
(September 1997 – September 1998)

School	Usages*	Faculty	Students
1. Altamonte Springs Home School (ASHS)	1	1	2
2. Buchholz High School (BHS)	2	8	67
3. C.K. Steele Leroy Collins Charter Middle School	1	1	27
4. Career Shadowing Days	3	2	16
5. Cobb Middle School (CMS)	1	3	21
6. Cocoa High School (CHS)	6	3	1
7. College Recruiting Days (High School Students)	3	3	85
8. FFFS Science Engineering & Humanities Symposium (High Schl)	3	8	30
9. Fairfax County Chief Archivist	1	1	0
10. Florida A&M University (FAMU)	2	1	1
11. Florida State University (FSU)	2	2	1
12. Ft. Clarke Middle School (FCMS)	2	8	110
13. Francis Marion University (FMU)	2	1	3
14. Gainesville Country Day School	1	2	31
15. Gainesville Home School	1	1	2
16. Hawthorne High School (HHS)	1	3	23
17. Hillsborough Community College (HCC)	1	1	8
18. Hillsborough High School (HHS)	4	3	1
19. Howard Bishop Middle School (HBMS)	1	1	3
20. Indian Trails Middle School (ITMS)	1	1	1
21. Jacksonville University (JU)	1	3	14
22. Lake Worth High School (LWHS)	1	1	1
23. Lecanto High School (LHS)	7	1	2
24. NASA Summer Research High School Apprenticeships	1	1	30
25. Newberry High School (NHS)	12	1	1
26. North Harris Community College (NHCC)	1	0	1
27. Palatka High School (PHS)	1	1	1
28. Palm Harbor University High School (PHUHS)	1	3	1
29. PEEK High School Students Environmental Workshop	1	1	21
30. Pensacola Junior College (PJC)	1	0	4
31. Port St. Lucie Community College (PSLCC)	1	1	1
32. Raines High School (RHS)	1	3	26
33. Santa Fe Community College (SFCC)	1	1	12
34. Stephen Foster Elementary School (SFES)	1	1	1
35. Summer Science Research Training Program (High Schl)	14	2	91
36. Teacher Research Update Experience Program (HS Tchrs)	2	35	0
37. Trilogy School (TS)	2	1	1
38. Union County High School (UCHS)	7	1	3
39. Universal Academy of Florida (UAF)	2	2	41
40. Valencia Community College (VCC)	1	9	6
TOTAL	**98**	**122**	**691**

* Usage is defined as utilization of the University of Florida Training Reactor facilities for all or any part of a day with the average being over four (4) hours. In many cases, a school can have multiple usages but all related to the same research project or training program such as one project for Florida State University that involved long term irradiations as did others such as for Union County High School and Hillsborough High School, or the multiple usage training programs conducted for Central Florida Community College students.

TABLE III-2

MONTHLY REACTOR ENERGY GENERATION[1]
(September 1997 – August 1998)

Month	Energy Generation Monthly Ranking[2]	KW-Hrs	Hours at Full Power
September 1997	4	1615.129	15.866
October 1997	2	2097.446	20.535
November 1997	3	2021.677	19.800
December 1997	6	869.457	8.301
January 1998	5	1609.873	15.716
February 1998	7	682.312	6.384
March 1998	1	2425.632	16.733
April 1998	8	293.712	2.434
May 1998	9	0.000	0.000
June 1998	9	0.000	0.000
July 1998	9	0.000	0.000
August 1998	9	0.000	0.000
YEARLY TOTAL		**11,615.238[3]**	**105.769**

1. The yearly total energy generation of 11.615 megawatt-hours for the 1997-98 reporting year represents a 31.29% decrease from last year's total of 16.904 megawatt-hours, while the 105.769 hours at full power represents a similar 26.49% decrease from the previous yearly total of 143.886 hours. The values for the 1997-98 reporting year are relatively low versus recent years because of the lack of a full-time Reactor Manager. In addition, more outage time this year, especially for the four-month outage at the end of the year resulted in reduced facility availability, as forced unavailability was at its highest value in the last ten years at over 131 days including the continuing year-end outage of 122¼ days. Without a full-time Reactor Manager, operations were very constrained by operator availability during the first eight months of the year and then by the outage at year's end.

2. This column showing the ranking of monthly energy generation is included for potential correlation with results of environmental monitoring in Chapter VII.

3. The 11615 kilowatt-hours energy generation is the lowest value for the past decade, ranking tenth for this period but twenty-fourth for the last twenty-nine years. These rankings show how growth in usage has been greatest and generally well maintained over the past decade since the low value of energy generation in the 1997-98 reporting year would have been tenth during the first fourteen years of 100 kW UFTR operation.

TABLE III-3

MONTHLY REACTOR USAGE/AVAILABILITY DATA
(September 1997 – August 1998)

Month	Key-On Time	Exp. Time[1]	Run Time[2]	Availability[3]
September 1997	26.30 hrs.	136.25 hrs.	22.88 hrs.	97.08%
October 1997	37.60 hrs.	170.08 hrs.	34.27 hrs.	100.00%
November 1997	33.70 hrs.	124.83 hrs.	28.43 hrs.	93.33%
December 1997	21.80 hrs.	176.33 hrs.	18.32 hrs.	86.29%
January 1998	24.70 hrs.	148.83 hrs.	21.97 hrs.	93.55%
February 1998	15.90 hrs.	126.92 hrs.	13.00 hrs.	87.05%
March 1998	34.60 hrs.	158.07 hrs.	32.27 hrs.	65.32%
April 1998	17.30 hrs.	139.25 hrs.	15.02 hrs.	78.75%
May 1998	3.90 hrs.	161.58 hrs.	2.82 hrs.	2.42%
June 1998	1.30 hrs.	165.58 hrs.	0.47 hrs.	0.00%
July 1998	0.30 hrs.	170.00 hrs.	0.00 hrs.	0.00%
August 1998	0.20 hrs.	139.50 hrs.	0.00 hrs.	0.00%
YEARLY TOTAL	**217.60 hrs.**	**1,817.47 hrs.**	**189.45 hrs.**	**58.65%**

1. Experiment time is run time (total key-on time minus checkout time) plus set-up time for experiments, tours, or other facility usage including checkouts, tests and maintenance involving reactor running or facility usage.

2. The three categories of facility usage data in this table show decreases over the previous year, especially those related to reactor operations. Key-on time is down 38.04% while run time is similarly down 37.16%, primarily due to decreased long irradiations for research usage and somewhat due to unavailability of personnel such as reactor operators as well as NAA Laboratory workers but primarily due to over 130 days forced outage time. Although two part-time SROs were licensed for the complete year, one had low work hours over the year; experiment time, however, is also decreased by 6.46% but showing a continued emphasis for class usage as the experiment time is well used for research, training and education during this past year.

3. Monthly average availability is 58.65% as shown above. On a yearly basis, it is 58.29% per Table III-6. As in the previous year, this availability accounts for lost availability for administrative reasons as well as for repair and maintenance related reasons. This unavailability has contributions due to administrative unavailability caused by unavailability of personnel (7½ days or 2.06%) with forced unavailability at 131⅜ days or 35.99% and planned unavailability at 13⅜ days or 3.66%. The yearly availability is reduced from the previous five years (87.33%, 89.69%, 88.15%, 75.68% and 66.67%) to 58.65% for this reporting year with much of the unavailability due to a single continuous forced outage over 122 days long late in the year. Overall the availability represents a significant decrease in the average availability recorded for the past five most recent reporting years and is similar to the three years prior to the 1992-93 reporting year. This is due to having a single large forced outage for addressing the anomalous reactivity changes in May-August 1998 which involved 122¼ days forced unavailability with no other forced outage reaching even 3 days. As in the previous year, there were also significant planned outages in this year as adjustments and reworking of the annual calibration of nuclear instrumentation (A-2 Surveillance) involved 10¾ days planned unavailability in March 1998. Other than these outages, the remainder of the year saw the usual variety of maintenance activities and equipment failures though much less so than in most years. Indeed, there were only 9⅛ days forced outage time beyond that for the one event enumerated above, a good record.

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1997 – August 1998)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
September 1997	97.08%	0.88 days	Maintenance to install and test current sensor in the primary coolant level trip circuit per 10 CFR 50.59 Evaluation Number 97-10 (½ day). Maintenance efforts related to accessing the roof for checks by the roofing contractor (⅜ day).
October 1997	100.00%	0.00 days	No significant forced or planned unavailability.
November 1997	93.33%	2.00 days	Administrative shutdown for Thanks-giving Day holiday (2 days).
December 1997	86.29%	4.25 days	Maintenance to reinstall the mechanical tach-generator to replace failed optical tachometer to provide dilute fan rpm indication (1¼ days). Maintenance to access bearings and verify serial numbers on stack dilute fan shaft bearings (⅛ day). Maintenance efforts to shim dilute fan shaft, replace bearings and install new grease fittings (1⅛ days).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1997 – August 1998)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
			Maintenance to install regulator and display modification for optical tachometer per 10 CFR 50.59 Evaluation Number 97-11 (¼ day). Maintenance to install new tubing for tach housing, solder mechanical tach terminals, correct switched leads and resolder connections (⅜ day). Maintenance to refill the primary coolant storage tank (⅛ day). Administrative shutdown for Christmas holiday (1 day).
January 1998	93.55%	2.00 days	Administrative shutdown for New Year's Day holiday (2 days).
February 1998	87.05%	3.63 days	Maintenance efforts to replace broken primary coolant rupture disk (1⅛ days). Administrative shutdown due to personnel unavailability (2½ days).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1997 – August 1998)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
March 1998	64.92%	10.88 days	Maintenance to replace failed starter in the twelve-point temperature recorder light (⅛ day). Maintenance to adjust nuclear instrumentation voltages and set points, confirm values, verify no need to change out resistors and subsequently perform rough estimates for parts of calorimetric per 10 CFR 50.59 Evaluation and Determination 98-02 with calorimetric calibration and confirmation of values (A-2 Surveillance) (10¾ days).
April 1998	78.75%	6.38 days	Maintenance to troubleshoot and replace a fuse blown during a power outage to allow reset of Safety Channel 2 trip (1¼ days). Maintenance to correct the failure of the Safety Channel 2 high voltage power supply loss of high voltage trip (2⅛ days). Maintenance to replace failed reed switch on primary coolant return line flow sensor (2⅞ days). Maintenance efforts related to roof access to perform preventive maintenance (⅛ day).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1997 – August 1998)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
May 1998	2.42%	30.25 days	Maintenance to investigate the cause of the reactivity anomaly (30¼ days). Maintenance to replace shield tank demineralizer system filter and ion exchange resins (0 days vs. ¼ day). Maintenance to refill the primary coolant storage tank (0 days vs. ⅛ day). Maintenance to troubleshoot and rewire the shield tank demineralizer system pump power supply (0 days vs. 6¼ days).
June 1998	0.00%	30.00 days	Maintenance to investigate the reactivity anomaly including fuel removal, control blade borescoping and beginning graphite removal (30 days). Maintenance to repair loose connections in the optical tach rpm indicating circuit following loss of rpm indication (0 days vs. ¼ day).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1997 – August 1998)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
July 1998	0.00%	31.00 days	Maintenance to investigate the cause of the reactivity anomaly (31 days). Maintenance to repair wiring and connections in failed stack radiation monitor (0 days vs. 8 days). Maintenance to adjust the holder tubing for the mechanical tach to restore proper rpm indication (0 days vs. ⅛ day). Maintenance to remove and repair the failed optical tachometer (0 days vs. 2⅜ days).
August 1998	0.00%	31.00 days	Maintenance to investigate the cause of the reactivity anomaly (31 days). Maintenance to refill the shield tank (0 days vs. ¼ day).

TOTAL ANNUAL UNAVAILABILITY (Availability at 58.29%):	152.250 days	=	41.71%
1. TOTAL FORCED UNAVAILABILITY:	131.375 days	=	35.99%
2. TOTAL PLANNED UNAVAILABILITY:	13.375 days	=	3.66%
3. TOTAL ADMINISTRATIVE UNAVAILABILITY:	7.500 days	=	2.06%

NOTE 1. This availability summary neglects all minor unavailability for periods smaller than one-eighth day. In most cases these periods are for much less than an hour as some minor problem is corrected, usually during or after a preoperational checkout. This availability summary also neglects unavailability for scheduled tests and surveillances except where noted when maintenance becomes necessary.

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1997 – August 1998)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability

NOTE 2. The 152.250 days unavailability were basically for forced outages (131.375 days, up from 102.250 days) and planned outages (13.375 days, down from 16.625 days) due to maintenance for repairs, delay awaiting parts arrival, reactivity evaluations, etc., plus an additional 7.50 days of administrative shutdown (up from 4.50 days) delineated in this table for holidays and associated personnel vacations or unavailability of management to approve operating where the reactor was or could have been made operational if needed. With no full-time Reactor Manager for the year, the last category for administrative shutdowns remains excellent.

NOTE 3. It should be noted that only Category 1 and 2 unavailability values were listed under repair and maintenance related (loss of reactor) unavailability prior to the 1991-92 year. The total unavailability in these categories was relatively constant over the three years prior to the last two years (118.88 days and 86.75 days versus 38.25 days, 34.63 days and 35.25 days) which had been down considerably from the previous two reporting years at 94.25 days (25.82% unavailability) and 76.50 days (20.90% unavailability) and then to 35.25 days (only 9.66% unavailability), 34.63 days (9.49% unavailability), 38.25 days (10.48% unavailability), and then back up to 86.75 days (23.70% unavailability) 118.88 days (32.58% unavailability) and now 144.250 days (39.66% unavailability). The lost availability for administrative reasons has also dropped dramatically from many previous reporting years, from 23.25 days, 23.50 days, 11.50 days, to 3.50 days, 5.00 days, 2.25 days, 4.50 days and 7.50 days for the past five years.

TABLE III-5A

UNSCHEDULED TRIPS
(September 1997 – August 1998)

After the UFTR experienced two unscheduled trips during the 1995-96 reporting year as it did in the 1994-95 reporting year after having no unscheduled trips during the 1993-94 reporting year, the UFTR experienced no unscheduled trips during the 1996-97 reporting year. After three unscheduled trips occurred in the first three months of the 1989-90 reporting year, none occurred during the 1990-91 reporting year; in the 1991-92 reporting year, three unscheduled trips occurred in November 1991, December 1991 and May 1992. It is worth noting that in the 1992-93 reporting year, the first unscheduled trip occurred in March 1993, and was the first experienced in nearly ten months, the second unscheduled trip occurred in August 1993. As with two of the three trips in the 1991-92 reporting year, one of these trips was due to an electrical transient while the other was due to inadvertent operator action as was the third trip in the 1991-92 reporting year. One of last year's two unscheduled trips was also due to an electrical transient with neither considered to have significantly affected reactor safety or the health and safety of UFTR personnel or the public. All safety systems responded properly for each trip and a full review was conducted prior to restart in each case with the second trip considered to be promptly reportable. It is also worth noting that the two trips described and evaluated in this table last year are the only unscheduled trips for the past two reporting years and only the second was evaluated to be due to equipment failure due to faults in the Safety Channel 2 loss of high voltage sensing circuit. Although a number of failed components were replaced to complement replacement of degraded components along with preventive cleaning and repair of circuit connections in the 1989-90 reporting year, as well as in the past six years, these efforts clearly have represented time well spent with only two trips due to facility equipment failure in almost eight years and none during the past 1996-97 and 1997-98 reporting years.

Number	Date	Description of Occurrence
—	—	—

TABLE III-5B

SCHEDULED TRIPS
(September 1997 – August 1998)

There were no scheduled trips performed for experimental or training purposes during this reporting year and only one scheduled trip performed for experimental purposes during the last reporting year. That trip was the first scheduled trip in a number of years. Part of the reason for this general lack of scheduled trips is the failure to schedule any large utility operator training programs where such trips are a designed part of the training program. It was anticipated that some training trips would be included in the ENU-5176L Reactor Operations Laboratory course offered during the 1996-97 or 1997-98 reporting years to demonstrate similarities and differences in power response for trips versus normal shutdown as well as in various student laboratory exercises to demonstrate rapid decay and recovery of stack count rate with power reduction and increase as part of Argon-41 stack effluent measurement exercises, but this did not occur. It is expected these training trips may occur in the 1998-99 reporting year. Such trips can also be used to provide training in control room presence and awareness of changing conditions and responses in training UFTR operator license candidates and may be utilized as time permits in the next reporting year. Since there were no scheduled trips during this reporting year, there are no entries in the table.

Number	Date	Description of Occurrence
—	—	—

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1997 – August 1998)

During this reporting year there were no events which are considered to have compromised reactor safety or the health and safety of the public. Several events classified as unusual occurrences are described below as they deviated from the normal functioning of the facility and are included here as the most important such deviations for the reporting year. Unscheduled shutdowns are included here as well, though none occurred here this year. Unscheduled trips are also addressed though they are also included in Table III-7 along with corrective and preventive maintenance and surveillances implemented in response to the trips, though none occurred during this reporting year. None of the six occurrences described here was considered a potential tech spec violation and treated as promptly reportable.

All of these occurrences involved some equipment failure or other event. The most significant occurrence was the reactivity anomaly (occurrence #6) which involved unexplained changes in the critical position accounting for the largest outage in several years (122¼ days) extending into the next year. One other event involved an equipment failure that resulted in an outage (occurrence #4) due to loss of the trip on the primary coolant return line flow sensor discovered during the quarterly checkout accounting for a short outage (2⅞ days). The breakage of the rupture disk (occurrence #1) during checkout of the console key reset function in response to an occurrence where trip functions were bypassed at another facility with the necessity to replace the disk and clean up the equipment pit also resulted in a short outage (1⅛ days) as did the need to repair the Safety Channel 2 high voltage power supply loss of high voltage trip test switch (occurrence #3) which resulted in a similar short outage (2⅛ days). The other two events (occurrence #2 and occurrence #5) were simply failures to assure calibration of installed survey meters (rabbit system detector monitor and portal monitor) within the prescribed interval with no need to make adjustments when checking the detectors and involving no outage time.

In terms of effect, the most significant occurrences would be the breaking of the rupture disk (occurrence #1), the failure of the PC return line flow switch discovered during a quarterly surveillance (occurrence #4) plus the efforts to address the reactivity anomaly (occurrence #6) because of the dose commitment involved and the fact it resulted in a lengthy and continuous forced outage (122¼ days). In terms of forced outage time, occurrence #6 (122¼ days) and occurrence #4 (2⅞ days) were the most significant of the unusual occurrences. Overall, none of these six unusual occurrences is considered to have had significant impact on the safety of the reactor or on the health and safety of the public. In addition, all have been reviewed to assure adequate consideration of their effects with none officially reported promptly to the NRC though all were reported for information purposes at some point. All were also reported in periodic updates to the NRC.

TABLE III-8

LOG OF UNUSUAL OCCURRENCES
(September 1997 – August 1998)

Number	Date	Description of Occurrence
1.	19 Feb 98	In response to information from Oregon State University that a failure of the console key switch to return fully to operate after resetting the scrams had resulted in a bypass of the manual scram and the other automatic scrams, it was decided to check the UFTR for this possibility. Under MLP #98-03, the key was placed (held) in reset and no blade would withdraw. Subsequently, one blade was withdrawn and the key then placed in reset; this action resulted in the blade dropping (trip action) but also water being dumped off the core and breakage of the rupture disk. A possible electrical transient indicated by flickering lights was thought to be the cause of the rupture disk breakage but could not be immediately verified as communicated to the Facility Director. Nevertheless, the purpose of this check—to verify trip conditions and prevent control blades from being energized while in the key reset condition (nonoperate condition)—was considered to be verified. Subsequently, after cleanup of the equipment pit and replacement and verification of the leak tightness of the rupture disk under MLP #98-04, on 20 February 1998, the reactor was allowed to sit filled with water for a while to verify no leaks from the rupture disk. After examining the circuit schematics on 20 February and discussing the situation with the electronics engineer (D. Ekdahl), it was determined that the console circuitry is acting as designed; that is, with one blade off the bottom and the key in reset, the blade should drop with no other action (no dump valve opening). Subsequently, on 23 February, a preoperational checkout was successfully completed and the reactor core filled with water again after completion of all checkouts. Again, one blade was withdrawn and the console key placed in reset; this time the result was that the blade dropped (as expected) with no chattering of the dump valve or rupture disk breakage. It was then evaluated that the cause of rupture disk breakage with one blade off the bottom was due to an apparent electrical transient which caused the dump valve to cycle partially between open and closed conditions resulting in rupture

TABLE III-8

LOG OF UNUSUAL OCCURRENCES
(September 1997 – August 1998)

Number	Date	Description of Occurrence
		disk breakage. This experimental check was considered to confirm the previous evaluation that the full drop and subsequent rupture disk breakage with the dump valve still shut was due to an electrical transient. This event is evaluated not to have had a significant effect on reactor safety and to have had negligible impact on the health and safety of facility personnel or the public. Subsequently, the reactor was returned to normal operation on 23 February 1998 with no further problems noted.
2.	9 Apr 98	During a walk-through with new Radiation Control employee John Parker in the morning of 9 April 1998, the RM20/361 meter installed in the back of the rabbit shield box was discovered to have been last calibrated (checked) on 24 October 1997. It was due to be calibrated again on 24 January 1998 with the usual allowable interval extending to 24 February 1998. This meter provides one of three readings recorded for all activated samples removed from the rabbit system and serves primarily as an indicator only of relative activity (cpm) as the E-530/1879 or equivalent meter is used for contact and one foot dose rate readings in mR/hr. After the walk-through for Mr. Parker, the RM20/361 meter was removed and its calibration checked with no changes required. Therefore, the meter was concluded to have been providing adequate readings during the 1½-month period when it was beyond its calibration interval. The meter was returned to service in the afternoon of 9 April 1998 after the successful calibration check. Since this meter (RM20/361) provides only an indicating control on activated rabbit samples, since two other readings are taken on samples using another meter (E530/1879), and since this meter required no adjustments during calibration checks on 9 April 1998, this event is considered to have had negligible impact. A further note is that meters used for the university's license are calibrated at six-month intervals versus three-month intervals for the UFTR instruments. Nevertheless, all staff

TABLE III-8

LOG OF UNUSUAL OCCURRENCES
(September 1997 – August 1998)

Number	Date	Description of Occurrence
		members were reminded that all survey meters are to be checked for proper calibration prior to their usage, even ones permanently installed as is the RM20/361. A memorandum was sent to staff members reminding the need of checking all survey meters. Subsequently, a report on this occurrence was submitted to the Radiation Control Officer.
3.	22 Apr 98	During performance of the Quarterly Check of Scram Functions (Q-1 Surveillance), the operator failed to receive a reactor trip when pressing the Safety Channel 2 (SC2) High Voltage Power Supply (HVPS) loss of high voltage test switch. Under MLP #98-12, SC2 high voltage output was measured to be correct. Again, when the test button was pressed, there was no change in high voltage output. It was thought that this could indicate that the high voltage was too high so that even with a 10 percent reduction, it could remain above the bistable set point. Subsequently, switch continuity checks showed no problem. To investigate the possibility that the voltage was too high, the resistor bank for the test circuit was checked since the ~861V high voltage is ~20V above normal. However, when measured with load, the value was ~841V, within specifications. When the power supply voltage and test circuit for bistable trip were checked, the power supply voltage was out of tolerance. The power supply voltage was checked and adjusted and the 10 percent voltage drop trip was repeatedly verified to work properly to restore the proper conservative circuit function. The reason for the failure of the trip is that the power supply provides a 15V reference to the bistable. With a different reference signal, the trip threshold would be different. There is no way to know at what exact level the trip would have occurred without setting the +15V power supply to the originally out of specification level and dialing down the HVPS voltage while holding the test switch, which is not allowed, by procedure. However, it was noted that very little change was necessary in the setting. Since the setting is conservative at ~9 percent HV

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Number	Date	Description of Occurrence
		loss versus 10 percent to get the trip, it is likely the 10 percent SC2 loss of high voltage trip would have occurred for a 10 percent voltage reduction anyway. It was also noted that there was no actual loss of high voltage, but rather, the 10 percent loss of high voltage trip was not as conservative as normal; it was also discovered during shutdown. This failure event is considered to have had negligible effect on reactor safety and no effect on the health and safety of the public or facility personnel. This trip was tested successfully again on 27 April 1998 as part of concluding the Quarterly Check of Scram Functions (Q-1 Surveillance). After successful completion of the weekly and daily checkouts, the reactor was returned to normal operations with no further problems noted.
4.	22 Apr 98	During performance of the Quarterly Check of Scram Functions (Q-1 Surveillance), the flow trip on the primary coolant return line flow sensor failed to yield a trip on loss of flow. Under MLP #98-13, the problem was investigated and isolated to the reed switch. Under RWP 98-2-II, the reed switch was removed and found to have welded contacts. After assuring proper seating of the reed switch, continuity checks were performed satisfactorily with water flow (zero resistance) and without water flow (high resistance). Subsequently, the test of the flow trip on the primary coolant return line flow sensor was completed satisfactorily on 27 April 1998 to complete the Quarterly Check of Scram Functions. This failure event discovered during the normal Q-1 Surveillance at shutdown conditions is considered to have had negligible effect on reactor safety, especially since this trip is for no flow at the core outlet while the flow trip at the core inlet remained operational at 30 gallons per minute. This failure is also considered to have had no effect on the health and safety of the public or facility personnel. After successful completion of the weekly and daily checkouts, the reactor was returned to normal operations with no further problems noted.

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Number	Date	Description of Occurrence
5.	24 Apr 98	During a walk-through on 24 April 1998, the Eberline PMC-4/104 portal monitor at the reactor cell exit was discovered to have been last calibrated (checked) on 6 November 1997. Because it was listed as being on a six-month calibration schedule, it was listed as due for calibration again on 31 May 1998. However, this meter should have been listed as being on a three-month calibration schedule since it is associated with the UFTR facility. So it should have been due for calibration on 6 February 1998 with the allowable interval extending to about 8 March 1998. This meter provides a check of all materials leaving the cell though a pancake-type frisker meter is also available in the air lock room to be used if contamination is possibly expected. The frisker is always used when potential contamination is possible or suspected. After the walk-through, the system was checked for calibration which is primarily to check its alarm settings which are relatively low and did not require changes. The meter was concluded to have been providing adequate readings during the 1½-month period when it was beyond its usual calibration interval being returned to service on the morning of 24 April 1998 after the successful calibration check. It is also noted that meters used for the university's license are calibrated at six-month intervals which is how this meter was inadvertently being tracked due to recent turnover in the radiation control technician staff. Since this detection system (PMC-4/104) provides only a check on those leaving the facility and since this meter required no adjustments during calibration checks on 24 April 1998, this event is considered to have had negligible impact on facility operations and the health and safety of the public or facility personnel. A separate walk-through of all radiation monitoring equipment assured no other meters were being tracked on a six-month schedule. A report on the occurrence was submitted to

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Number	Date	Description of Occurrence
		the Radiation Control Officer. In this case all facility personnel were reminded to check all survey meters to assure they are being checked on a three-month schedule. A copy of the memorandum to facility personnel was supplied to the Radiation Control Officer and to the Reactor Safety Review Subcommittee to close this occurrence.
6.	1 May 98	During March and April, there had been a small gradual change in the critical position moving to a higher required regulating blade critical position. This situation was discussed at the Reactor Safety Review Subcommittee (RSRS) meeting on 23 April 1998 with the RSRS recommending that electronics in the control blade position indicating circuits be checked as the possible cause but with no restrictions on operation in the meantime. By memorandum dated 22 April 1998, the normal banked position for the three safety blades had been raised from 640 to 660 units withdrawn as noted at the RSRS meeting. It was expected that the normal critical position of the regulating blade would then be reduced to below 400 units to assure responsive control during startup and power level changes. To verify the new critical regulating blade position, a startup to one (1) watt was undertaken on 1 May 1998 by SRO-trainee G. Macdonald under supervision of SRO W.G. Vernetson. Instead of the critical position being about 390 units as expected, the critical position was verified to be 484 units at 1435 hours. At this point the reactor was shut down at 1441 hours to evaluate the situation. Since the intent was to shut down anyway, this was not considered to be an unscheduled shutdown though the same type of evaluation was subsequently undertaken with the reactor placed on administrative shutdown except for operations related to addressing this apparent reactivity anomaly which was communicated individually to a majority of the RSRS (RSRS Chairman M.J. Ohanian, Radiation Control Officer D.L. Munroe and NRE Department Chairman J.S. Tulenko on 1 and 4 May 1998). To this point, this event was not considered to be

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Number	Date	Description of Occurrence

promptly reportable though plans were to notify NRC as pertinent information was obtained. Subsequently, under MLP #98-15 opened on May 4, 1998, the blade position indicating circuit voltages were verified and blade withdrawal for all blades (part of the weekly checkout) was twice verified to be smooth. At this point, voltage drift was eliminated as a source of the apparent reactivity anomaly.

The weekly shield tank water sample indicated a resistivity of 0.55 MΩ-cm, somewhat below the 0.60 MΩ-cm procedure requirement for reactor operation. Therefore, under MLP #98-16 and RWP 98-3-II, the filter and ion exchange resin on the shield tank recirculation system were replaced and the resistivity verified to return to 0.60 MΩ-cm on 5 May 1998 and increasing over the next several days.

Under MLP #98-15, it was thought that the shield tank or the primary coolant system could have leaked water to wet the core graphite to cause the reactivity anomaly of concern. Therefore, on 6 May 1998, under MLP #98-15, the areas below the core were subjected to borescope inspection via the equipment pit under RWP 98-4-I. Again, no conditions were found indicative of water intrusion or other situation to account for the reactivity anomaly.

At this point, RSRS members were consulted to assure there was agreement to restart the reactor to one (1) watt to check the regulating blade critical position. Under MLP #98-15, a brief startup was utilized on 7 May 1998 to verify the critical position had changed somewhat again from 484 units withdrawn but now reduced somewhat to 460 units withdrawn.

On 12 May 1998, under MLP #98-15, the thermal column was opened up and checked because the neutron radiography device had recently been used and removed in mid-April. The shielding

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Number	Date	Description of Occurrence

around the rabbit system line entrance on the west face of the reactor shielding was also moved to assure the rabbit system had not moved. The vertical ports were also opened and double-checked with no problems identified to impact the reactivity anomaly. At this point, another brief startup was utilized on 14 May 1998 to verify the critical position which now remained at 460 units withdrawn on the regulating blade.

On 19 May 1998, since the surveillances were due anyway, it was decided to check the control blade drop times, controlled insertion times and replace the clutch current bulbs (S-1, S-5 and S-11 Surveillances). All were conducted with satisfactory results with no problems noted though the controlled insertion time for the regulating blade was noted to be three seconds longer than on the previous check. At this time, the decision was made to begin checks internal to the biological shield since all external checks had failed to reveal any obvious cause of the reactivity anomaly.

Since the biennial fuel inspection (B-2 Surveillance) was due, it was decided on 19 May 1998 to perform at least part of this surveillance next to begin core checks. Fuel handling training was conducted and the core shielding was partially unstacked on 20 May 1998. Subsequently, unstacking was completed and one fuel bundle (UF-19) from the northeast fuel box was inspected satisfactorily and returned to the core on 21 May 1998 with observation of part of this activity by DOE Lockheed Martin consultant Doug Morrell observing for input to the fuel production activities for the planned UFTR HEU-to-LEU fuel conversion. No obvious cause of the anomaly was identified in this activity so it was decided to unload the fuel from the core to the irradiated fuel storage pits. The remainder of the month (26-29 May) was spent removing non-fuel activated materials from several irradiated fuel storage pits (#4, #6 and #7), preparing the pits to receive irradiated fuel and planning the consolidation of

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Number	Date	Description of Occurrence
		existing fuel in the pits to make room to unload the 21½ fueled bundles present in the core and planning the movement of fuel from the core to the irradiated fuel storage pits. At the end of May, two modification packages were prepared for RSRS Executive Committee review. The first modification package addressed unloading the core (10 CFR 50.59 Evaluation and Determination Number 98-04: Core Unloading to Fuel Storage Pits (Modified SOP-C.1)) to include the special test procedure modifying SOP-C.1 to track fuel removal from the core. The second modification package addressed consolidation of the fuel storage pits (10 CFR 50.59 Evaluation and Determination Number 98-05: Irradiated Fuel Storage Pit Consolidation (Modified SOP-C.1)) to include the special test procedure modifying SOP-C.1 to track consolidation of fuel from 4 fuel storage pits into 2 fuel storage pits to provide free storage locations for all 21½ fueled bundles to be coming from the core during the planned fuel unloading. Both modification packages were approved at an RSRS Executive Committee meeting on 1 June 1998. Subsequently, under modified SOP-C.1 and RWP #98-6-I, fuel in pit #23 was consolidated into pit #26 on 2 June 1998. However, efforts to move the old-style low-enriched fuel from pit #25 to pit #27 were unsuccessful because of a differently designed end plate. Therefore, a new modified SOP-C.1 allowing use of an alternate hook lifting tool design with a different safety line design (10 CFR 50.59 Evaluation and Determination #98-06) was developed and approved at another RSRS Executive Committee meeting on 2 June 1998. Subsequent use of the alternate lifting tool and safety line was successful to complete fuel pit consolidation of pit #25 into pit #27 on 3 June 1998. At this point, preparations were complete for unloading the fuel in the core to the irradiated fuel storage pits as a total of 22 empty pits were available to receive the 21½ fuel bundles in the core.

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Number	Date	Description of Occurrence
		Under RWP #98-5-I, three fuel bundles were removed from the northeast fuel box and three fuel bundles were removed from the southeast fuel box to pits 1–6 on 4 June 1998. Subsequently, four fuel bundles were removed from the south central fuel box and one from the north central fuel box on 5 June 1998. Finally, the remaining fuel bundles were removed to the irradiated fuel storage pits (three bundles from the north central box, four bundles from the northwest box and three and one-half bundles from the southwest box) on 11 June 1998 with sufficient shielding placed over the irradiated fuel storage pits to limit radiation to acceptable levels. NRC Senior Project Manager Ted Michaels was updated on the status of investigations into the reactivity anomaly on 18 June 1998, that it was not considered promptly reportable and about continuing plans to locate and address the source of the problem. RWP #98-5-I was closed out on 18 June 1998. Subsequently, under RWP #98-7-I, the borescope was used to examine the insides of the fuel boxes and to perform a swipe survey on the core graphite. A small piece of material (apparently a piece of wire) was found on the bottom grid plate of the northeast fuel box and evaluated not to be the cause of the reactivity anomaly though it was not removed at the time of discovery on 22 June 1998 because its small size (<2 inches long) made it difficult to latch on to for removal. Next the control blades were inspected with the borescope through the shroud top access port. The Safety-1 (S-1) and Safety-2 (S-2) blades were inspected on 23 June 1998 with S-1 noted to be closer to the side of the shroud. The Safety-3 (S-3) blade and Regulating blade (RB) were inspected on 24 June 1998 with some separation apparent but not well defined on the Regulating blade verified by a recheck on S-3 blade. At this point, it became apparent that the Regulating blade should be removed for a closer inspection, so efforts were begun on 26 June 1998 to remove graphite from around the core to access the bottom of

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Number	Date	Description of Occurrence

the control blades where the shroud and blade are attached. Several layers of graphite were removed on this day. However, relatively low levels of airborne contamination were detected after removing considerable graphite including several layers down to outlet piping on 26 June 1998. Subsequently, air samples, graphite samples and swipes were analyzed on the high purity germanium spectrum analyzer and/or a liquid scintillation detector to determine the levels and radioisotopes present. Though not necessarily required, it was decided to provide some optional protection against airborne contamination by reworking the Respiratory Protection Program to allow use of mask respirators and to get several workers certified for respirator use as an ALARA measure. As a result, RWP #98-7-I was closed out on 29 June 1998. It was also decided at this point, in the interest of ALARA, to await completion of the Biennial Fuel Inspection (B-2 Surveillance) until the core is reloaded since all fuel bundles must be inspected prior to being loaded back into the core anyway.

At the end of June 1998 and throughout the month of July, efforts were undertaken to modify the approved UFTR Respiratory Protection Program to allow use of half respirator masks and to schedule the necessary medical examinations for which there was some delay. The necessary physicals for two SRO-trainees were conducted on 10 July 1998. The revised UFTR Respiratory Protection Program was ready for internal review and approval by 24 July 1998 but the RSRS Executive Committee was unable to meet for several days. On 24 July 1998, NRC Senior Project Manager Ted Michaels was updated on the status of the checks on the reactivity problem including probable separation on one control blade and plans to disassemble the entire core since borescope indications are somewhat limited. He was also informed of the detection of airborne particulates at low levels and stop of work and delays in developing and approving the revised Respiratory Protection

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Number	Date	Description of Occurrence

Program. Specifically, we discussed the use of half-face respirators, status of exams/physicals, etc., and 10 CFR 20.1703(d) requiring notification of the Region II Administrator 30 days before the date of using respiratory protection equipment the first time. Since we normally go directly to the NPR Directorate, we requested direction on what to do next. He was not sure whether we should send in something and asked that he be contacted again on 28 July which was done, whereupon he indicated we should send in the proposed Program when internally approved. Revision 2 of the UFTR Respiratory Protection Program was finally internally approved along with the proposed Policy Statement at an RSRS Executive Committee meeting on 30 July 1998. Subsequently, NRC Senior Project Manager Ted Michaels was contacted on 30 July and he requested submission of the Program for review indicating it should not require 30 days. The internally approved Respiratory Protection Program Revision 2 and the proposed Policy Statement were faxed to Ted Michaels (301-415-3313) on 30 July 1998 to get the review started with the formal submission by letter to the Document Control Desk then accomplished on 3 August 1998.

At the beginning of August, maintenance operations were awaiting NRC review of the Respiratory Protection Program Revision 2. On 3 August 1998, NRC Inspector Stephen Holmes of the Non-Power Reactor Directorate indicated he would visit for an inspection on 13-14 August 1998 in order to provide on-site review verifying that the Respiratory Protection Program Revision 2 was acceptable and reviewed by NRC prior to implementation. Therefore, all the preliminary aspects of implementing the Respiratory Protection Program Revision 2 were addressed prior to his arrival to include acquiring half-face respirators and arranging the a visit by the appropriate Environmental Health and Safety supervisor on 6 August to provide half-face respirator fits and training for two SROs and one SRO-trainee. Subsequently, the same fit tests and training

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Number	Date	Description of Occurrence

were provided for the last SRO and SRO-trainee with the whole Respiratory Protection Program Revision 2 administratively reviewed and all documentation completed prior to Mr. Holmes arrival on 13 August. Upon his arrival on 13 August, Mr. Holmes toured the facility to check on maintenance status, he checked records of fit testing and training as well as the Program itself. Though he continued to interview personnel and check the fit testing equipment on 14 August, Mr. Holmes evaluated that the Program was ready for implementation on the afternoon of 13 August 1998. Therefore, the official implementing memorandum for the Program was issued on 13 August 1998. A new Radiation Work Permit 98-8-I was also opened allowing use of respirators per the Respiratory Protection Program Revision 2 and requiring SRO supervision of operations among other controls with respirators used for moving graphite on the afternoon of 13 August with observation by Mr. Holmes. Inspector Holmes held his exit interview on 14 August prior to leaving indicating no problems were identified and respirators are not required but are optional at the worker's convenience.

Subsequently, more graphite was removed on the afternoon of 14 August which was the last day that workers opted to wear respirators as airborne radioactivity levels were measured to be quite low. Subsequently, RWP 98-8-I was reissued several times during the month as work progressed slowly with resumption of classes limiting personnel availability. On 20 August 1998, the SbBe source was removed and the nuts from the three north side fuel boxes were removed which greatly reduced radiation levels and prevented bringing water into the fuel boxes after this date with all bolts and flanges out on the north side of the core on 27 August 1998 though workers were unable to remove any fuel boxes. Subsequently, the northeast fuel box was removed on 28 August 1998 but the flange connections are very tight requiring considerable force to effect

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Number	Date	Description of Occurrence
		removal with only one box removed at month's end. It appears that the other two north side fuel boxes need to be removed to allow access to and removal of the regulating blade and its shroud for detailed examination. At year's end, maintenance operations are continuing to remove graphite and the fuel boxes as plans are to continue removing graphite and remove at least the regulating blade and shroud for further checks to include inspection for any apparent separation of the blade within the shroud as this maintenance work continues.

IV. MODIFICATIONS TO THE OPERATING CHARACTERISTICS OR CAPABILITIES OF THE UFTR

A number of modifications and/or changes in conditions were made to the operating characteristics or capabilities of the UFTR and directly related facilities during the 1997-1998 reporting period. These modifications and/or changes in conditions were all subjected to 10 CFR 50.59 evaluations and then determinations (as necessary) to assure that no unreviewed safety questions were involved.

- Carried over from the 1984-1985 Reporting Year:

  Modification 7: Addition of Secondary Water Flow Sensors (Rotameters)

- Carried over from the 1991-1992 Reporting Year:

  Modification 92-04: Installation of New Manometers on Core Vent System

  Modification 92-06: Modification to the UFTR Thermocouple System: Implementation of Terminal Strips and Quick Disconnects

- Carried over from the 1993-1994 Reporting Year:

  Modification 93-05: Replacement of 12 Point Temperature Recorder with Digital Monitoring System

- Carried over from the 1996-1997 Reporting Year:

  Modification 96-13: Security System Power Pack Replacement

1. Security System Power Pack Replacement (Permanent – Open Item)

(Modification 96-13: Evaluation Completed December 1996)

Following one spurious security alarm on 10 November and two alarms on 11 November 1996, the security system batteries were checked and replaced (S-7 Surveillance). Under MLP #96-30 the rechargeable batteries were found to be low and were recharged. Subsequently, 10 CFR 50.59 Evaluation Number 96-13 was developed to allow modification and replacement of the power pack to prevent recurrence of the problem of spurious alarms due to low voltage. Measurements were made and security system circuits checked and verified. In addition, the 6 volt batteries were recharged in mid-month. At the end of November 1996, the design and development of a new power pack per 10 CFR 50.59 Evaluation Number 96-13 was in progress; at the end of December 1996, the 10 CFR 50.59 Evaluation is complete as is the design, with installation of the new power supply on 7 January 1997 with all but one siren operational to meet requirements. Subsequently, the west lot siren was repaired on 13 January and both the west lot and journalism side siren horn drivers wiring was reterminated on 14 January 1997. Drawings and maintenance log were subsequently updated and an evaluation made that separate grounds would be needed for the security system batteries to assure proper charging and eliminate spurious alarms as the batteries discharge over time. On 10 March 1997, the power supply was removed for modification. Upon installation, various problems occurred resulting in partial and intermittent compensated outage of the security system over the period 10-21 March with circuit mapping performed for troubleshooting on 19 March and the intermittent ground finally repaired on 21 March 1997, but without installation of the modification to separate grounds, basically returning the system to its state prior to 10 March. Subsequently, the 4 volt rechargeable batteries have been replaced on 14 May 1997, 18 June 1997, 7 July 1997 and 24 July 1997 (for prevention purposes on 30 July 1997), on 29 August 1997 and on 29 September 1997. Following a full S-7 Surveillance on 24 October 1997, the loss of the holdup alarm was corrected under MLP #96-30 by reterminating a loose wire. Subsequently, the 4 volt rechargeable batteries were replaced on 16 December 1997 and again on 9 January, 10 February, 10 March, 8 April and on 6 May 1998. Following a full S-7 Surveillance on 27 May 1998, the 4 volt rechargeable batteries were replaced again on 24 June, 24 July and 19 August 1998. MLP #96-30 remains open.

Controlling Documents: Maintenance Log Page #96-30 (Remains Open)
10 CFR 50.59 Evaluation Number 96-13

2. Installation of Current Sensor for PC Level Trip Surveillance (Permanent – Closed Item)

(Modification 97-10: Evaluation Completed 25 February 1997)

During replacement of the failed reed switch for the level trip on the primary coolant system on 3 July 1997, following its failure detected during the daily checkout on 1 July 1997, it was decided to install a better means of verifying the point of occurrence of the level trip. Under MLP #97-28, 10 CFR 50.59 Evaluation and Determination Number 97-10 was developed and approved to install a current sensor in the PC level trip circuit to measure better the level above the fuel at which the PC level trip occurs. Following bench testing, walk-through of the change, and approval of the modification in the applicable surveillance data sheet for quarterly scram check (Q-1 Surveillance), the current sensor was installed and the proper level trip verified using the newly approved protocol. Though the surveillance data sheet instructs marking the PC level when the voltage reading jumps from zero (to about 350μV), the actual jump was to about 440μV which is acceptable per modification package and safety committee discussion that the need is simply to see a significant change—the magnitude not being important—with no problems noted. MLP #97-28 was closed on 30 September 1977.

Controlling Documents: Maintenance Log Page #97-28
10 CFR 50.59 Evaluation and Determination Number 97-10

3. Optical Tachometer Monitoring Circuit and Power Supply Upgrade (Permanent – Closed Item)

(Modification 97-11: Evaluation Completed 18 December 1997)

During the weekly checkout the rpm indication from the optical tachometer was noted to be lost. Under MLP #97-33 the light bulb in the circuit was replaced with no effect so the unit was removed to the electronics shop for troubleshooting. On 2 December 1997, a photodiode was replaced, also without improvement. On 5 December 1997, the optical tach was removed as the signal was noted to be too weak for transmission over the distance involved for readout in the control room. Subsequently, a regulator and display modification was designed and approved as 10 CFR 50.59 Evaluation Number 97-11 with the modification installed in the unit with both the optical tach and display unit returned to service on 16 December 1997 with no further immediate problems noted. MLP #97-33 was closed on 16 December 1997.

Controlling Documents: Maintenance Log Page #97-33
10 C CFR 50.59 Evaluation Number 97-11

4. Security System Modification – Installation of Digital Dialer (Permanent – Closed Item)

(Modification 98-01: Evaluation Completed 19 March 1998)

Following security and fire alarm system supervisor Skip Rockwell's visit on 13 March 1998, a modification package (10 CFR 50.59 Evaluation and Determination Number 98-01) was developed and approved to control changing the UFTR security system alarm to a digital dialer as equivalent and possibly better than the current system since the entire campus is being converted and the fire marshal has so ordered for fire alarm systems as previously converted for the UFTR fire alarm system. Under MLP #98-10, the digital dialer modification was installed by PPD alarm technicians F. Petrone and R. Lund and verified to be operating properly with no problems noted. MLP #98-10 was closed on 31 March 1998.

Controlling Documents: Maintenance Log Page #98-10
10 CFR 50.59 Evaluation and Determination Number 98-01
Physical Security Plan (withheld)

5. Resistor Changes to Change Gain of Picoammeter to Facilitate Calibration of Linear Channel Under Special Test Procedure E.4 (Modified) (Permanent – Closed Item)

(Modification 98-02: Evaluation and Determination Completed 17 March 1998)

During performance of the pre-calorimetric portion of the A-2 Surveillance (UFTR Nuclear Instrumentation Calibration Check and Calorimetric Heat Balance), certain voltages and setpoints were noted to require minor adjustments as expected. Under MLP #98-07, various voltages and setpoints were adjusted to assure proper nuclear instrumentation calibration with further changes then apparently needed at the conclusion of the post-calorimetric checks so that resistor changes were thought to be needed to increase the gain of the picoammeter A-2 amplifier to facilitate linear channel calibration under Special Test Procedure E.4 (Modified) per 10 CFR 50.59 Evaluation and Determination Number 98-02. Subsequently, after nuclear instrumentation adjustments without the need for resistor changes, the A-2 Surveillance was successfully completed on 19 March 1998 with MLP #98-07 closed on the same day.

6. Addition of Annex Basement Pull Station to Meet Fire Code (Permanent – Closed Item)

(Modification 98-03: Evaluation Completed 18 June 1998)

Fire alarm systems technician Wayne Gravely had previously provided information on a planned upgrade of the reactor building fire alarm system to install a pull station and horn in the downstairs part of the Materials Science Annex to meet fire code requirements with 10 CFR 50.59 Evaluation Number 98-03 approved to cover installation of the upgrade. Under MLP #98-18, technician Wayne Gravely placed the necessary conduit, mounted junction boxes, a pull station and a new horn in the downstairs Materials Science Annex and then continued the conduit in preparation to connect to the existing system with an oversight visit by supervisor Skip Rockwell at this point. Subsequently, on 14 May 1998, the fire alarm system was taken out of service, the connections made, the system placed back in service and all tests completed satisfactorily with no problems noted. MLP #98-18 was closed on 14 May 1998.

Controlling Documents: Maintenance Log Page #98-18
10 CFR 50.59 Evaluation #98-03

7. Core Unloading to Fuel Storage Pits (Modified/Augmented SOP-C.1) (Permanent – Closed Item)

(Modification 98-04: Evaluation and Determination Completed 1 June 1998)

This 10 CFR 50.59 Evaluation and Determination was worked under MLP #98-15 along with 10 CFR 50.59 Evaluations and Determinations Numbers 98-05 and 98-06. This description of activities for all three modifications involves full movement activities as described below and controlled under MLP #98-15.

During March and April, there had been a small gradual change in the critical position moving to a higher required regulating blade critical position. This situation was discussed at the Reactor Safety Review Subcommittee (RSRS) meeting on 23 April 1998 with the RSRS recommending that electronics in the control blade position indicating circuits be checked as the possible cause but with no restrictions on operation in the meantime. By memorandum dated 22 April 1998, the normal banked position for the three safety blades had been raised from 640 to 660 units withdrawn as noted at the RSRS meeting. It was expected that the normal critical position of the regulating blade would then be reduced to below 400 units to assure responsive control during startup and power level changes. To verify the new critical regulating blade position, a startup to one (1) watt was undertaken on 1 May 1998 by SRO-trainee G. Macdonald under supervision of SRO W.G. Vernetson. Instead of the critical position being about 390 units as expected, the critical position was verified to be 484 units at 1435 hours. At this point the reactor was shut down at 1441 hours to evaluate the situation. Since the intent was to shut down anyway, this was not considered to be an unscheduled shutdown though the same type of evaluation was subsequently

undertaken with the reactor placed on administrative shutdown except for operations related to addressing this apparent reactivity anomaly which was communicated individually to a majority of the RSRS (RSRS Chairman M.J. Ohanian, Radiation Control Officer D.L. Munroe and NRE Department Chairman J.S. Tulenko on 1 and 4 May 1998). To this point, this event was not considered to be promptly reportable though plans were to notify NRC as pertinent information is obtained. Subsequently, under MLP #98-15 opened on 4 May 1998, the blade position indicating circuit voltages were verified and blade withdrawal for all blades (part of the weekly checkout) was twice verified to be smooth. At this point, voltage drift was eliminated as a source of the apparent reactivity anomaly.

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Under MLP #98-15, it was thought that the shield tank or the primary coolant system could have leaked water to wet the core graphite to cause the reactivity anomaly of concern. Therefore, on 6 May 1998, under MLP #98-15, the areas below the core were subjected to borescope inspection via the equipment pit under RWP 98-4-I. Again, no conditions were found indicative of water intrusion or other situation to account for the reactivity anomaly.

At this point, RSRS members were consulted to assure there was agreement to restart the reactor to one (1) watt to check the regulating blade critical position. Under MLP #98-15, a brief startup was utilized on 7 May 1998 to verify the critical position had changed somewhat again from 484 units withdrawn but now reduced somewhat to 460 units withdrawn.

On 12 May 1998, under MLP #98-15, the thermal column was opened up and checked because the neutron radiography device had recently been used and removed in mid-April. The shielding around the rabbit system line entrance on the west face of the reactor shielding was also moved to assure the rabbit system had not moved. The vertical ports were also opened and double-checked with no problems identified to impact the reactivity anomaly. At this point, another brief startup was utilized on 14 May 1998 to verify the critical position which now remained at 460 units withdrawn on the regulating blade.

On 19 May 1998, since the surveillances were due anyway, it was decided to check the control blade drop times, controlled insertion times and replace the clutch current bulbs (S-1, S-5 and S-11 Surveillances). All were conducted with satisfactory results with no problems noted though the controlled insertion time for the regulating blade was noted to be three seconds longer than on the previous check. At this time, the decision was made to begin checks internal to the biological shield since all external checks had failed to reveal any obvious cause of the reactivity anomaly.

Since the biennial fuel inspection (B-2 Surveillance) was due, it was decided on 19 May

1998 to perform at least part of this surveillance next to begin core checks. Fuel handling training was conducted and the core was partially unstacked on 20 May 1998. Subsequently, unstacking was completed and one fuel bundle (UF-19) from the northeast fuel box was inspected satisfactorily and returned to the core on 21 May 1998 with observation of part of this activity by DOE Lockheed Martin consultant Doug Morrell observing for input to the fuel production activities for the planned UFTR HEU-to-LEU fuel conversion. No obvious cause of the anomaly was identified in this activity so it was decided to unload the fuel from the core to the irradiated fuel storage pits. The remainder of the month (26-29 May) was spent removing non-fuel activated materials from several irradiated fuel storage pits (#4, #6 and #7), preparing the pits to receive irradiated fuel and planning the consolidation of existing fuel in the pits to make room to unload the 21½ fueled bundles present in the core and planning the movement of fuel from the core to the irradiated fuel storage pits.

At the end of May, two modification packages were prepared for RSRS Executive Committee review. The first modification package addressed unloading the core (10 CFR 50.59 Evaluation and Determination Number 98-04: Core Unloading to Fuel Storage Pits (Modified SOP-C.1)) to include the special test procedure modifying SOP-C.1 to track fuel removal from the core. The second modification package addressed consolidation of the fuel storage pits (10 CFR 50.59 Evaluation and Determination Number 98-05: Irradiated Fuel Storage Pit Consolidation (Modified SOP-C.1)) to include the special test procedure modifying SOP-C.1 to track consolidation of fuel from 4 fuel storage pits into 2 fuel storage pits to provide free storage locations for all 21½ fueled bundles to be coming from the core during the planned fuel unloading. Both modification packages were approved at an RSRS Executive Committee meeting on 1 June 1998. Subsequently, under modified SOP-C.1 and RWP #98-6-I, fuel in pit #23 was consolidated into pit #26 on 2 June 1998. However, efforts to move the old-style low-enriched fuel from pit #25 to pit #27 were unsuccessful because of a differently designed end plate. Therefore, a new modified SOP-C.1 allowing use of an alternate hook lifting tool design with a different safety line design (10 CFR 50.59 Evaluation and Determination Number 98-06) was developed and approved at another RSRS Executive Committee meeting on 2 June 1998. Subsequent use of the alternate lifting tool and safety line was successful to complete fuel pit consolidation of pit #25 into pit #27 on 3 June 1998 to close out 10 CFR 50.59 #98-05 and #98-06. At this point, preparations were complete for unloading the fuel in the core to the irradiated fuel storage pits as a total of 22 empty pits were available to receive the 21½ fuel bundles in the core.

Under RWP #98-5-I, three fuel bundles were removed from the northeast fuel box and three fuel bundles were removed from the southeast fuel box to pits 1–6 on 4 June 1998. Subsequently, four fuel bundles were removed from the south central fuel box and one from the north central fuel box on 5 June 1998. Finally, the remaining fuel bundles were removed to the irradiated fuel storage pits (three bundles from the north central box, four bundles from the northwest box and three and one-half bundles from the southwest box) on 11 June 1998 with sufficient shielding placed over the irradiated fuel storage pits to limit radiation to acceptable levels which is when 10 CFR 50.59 #98-04 was completed. NRC Senior Project Manager Ted Michaels was updated on the status of investigations into the reactivity anomaly on 18 June 1998, that it was not considered promptly reportable and about

continuing plans to locate and correct the source of the problem. RWP #98-5-I was closed out on 18 June 1998 though MLP #98-15 remained open past the end of the 1997-1998 reporting year with all three 10 CFR 50.59 Evaluations/Determinations also completed in their application by 11 June 1998.

Controlling Documents:
Maintenance Log Page #98-15
10 CFR 50.59 Evaluation and Determination Number 98-04
10 CFR 50.59 Evaluation and Determination Number 98-05
10 CFR 50.59 Evaluation and Determination Number 98-06
Radiation Work Permit #98-6-I
Modified Standard Operating Procedure C.1

8. Irradiated Fuel Storage Pit Consolidation (Modified SOP-C.1) (Permanent – Closed Item)

(Modification 98-05: Evaluation and Determination Completed 1 June 1998)

Both Modification 98-04 and 98-06 were worked under MLP #98-15 along with Modification 98-05. They are discussed in detail under item 7 above.

Controlling Documents:
Maintenance Log Page #98-15
10 CFR 50.59 Evaluation and Determination Number 98-04
10 CFR 50.59 Evaluation and Determination Number 98-05
10 CFR 50.59 Evaluation and Determination Number 98-06
Radiation Work Permit #98-6-I
Modified Standard Operating Procedure C.1

9. Modification to Pit Consolidation Instructions to Allow Movement of Low Enriched Single Plates Using Substitute Fuel Handling Tool (Permanent – Closed Item)

(Modification 98-06: Evaluation and Determination Completed 2 June 1998)

Both Modification 98-04 and 98-05 were worked under MLP #98-15 along with Modification 98-06. They are discussed in detail under item 7 above.

Controlling Documents:
Maintenance Log Page #98-15
10 CFR 50.59 Evaluation and Determination Number 98-04
10 CFR 50.59 Evaluation and Determination Number 98-05
10 CFR 50.59 Evaluation and Determination Number 98-06
Radiation Work Permit #98-6-I
Modified Standard Operating Procedure C.1

V. SIGNIFICANT MAINTENANCE, TESTS AND SURVEILLANCES OF UFTR REACTOR SYSTEMS AND FACILITIES

A review of records for the 1984-85 reporting year shows extensive corrective and preventive maintenance was performed on all four control blade drive systems external to the biological shield. Similarly maintenance work during the 1985-86 reporting year was even more extensive as the problem of a sticking safety blade (S-3) recurred on September 3, 1985. The recurrence necessarily demanded a detailed and complete check of all control blade drive systems to determine finally and correct the cause of the sticking blade internal to the biological shield with the 1986-87 reporting year involving relatively little maintenance and no large maintenance projects.

For the 1987-88 reporting year, there were two dominant though manageable maintenance projects. The first large scale maintenance project during the 1987-88 reporting year involved an extensive effort to clean the control blade drive motor gear assemblies to free them of hardened grease and replace worn bearings. The second large scale project involved the evaluation, corrective action, testing and monitoring of the two safety channels due to two occurrences of the downscale failure of the Safety Channel 1 meter indication (and probably the function). This was the largest maintenance effort since the control blade drive system maintenance performed internal to the biological shield in the 1985-86 reporting year. The 79.2% availability for the 1987-88 year indicated more or less routine maintenance and surveillance checks and tests throughout the year except for the two large projects cited above.

For 1988-89, the availability was up to 87.67%. Of the 45 equivalent full days of unavailability, only 28.25 days were actually due to forced unavailability primarily due to corrective maintenance for repairs. There was no single project dominating unavailability, though multiple maintenance tasks on the two-pen recorder and on the Radiation Monitoring System clearly warranted consideration of replacing these items when funds could be made available.

Maintenance efforts in the 1989-90 reporting year increased again so that total availability for the year was only 68.84%. Especially significant efforts were devoted to checks, repairs, surveillances and other maintenance activities connected with the biennial fuel inspection resulting in a two-month outage, part of which was due to the final failure and subsequent replacement of the 2-pen log/linear recorder. Though no other single maintenance effort was really large, there was considerable effort devoted to Safety Channel and other control and reactor protection system-related repairs during the year both for repairs following trips or other failures and for preventive maintenance. Certainly, the 113.75 total days unavailability (31.16% unavailability) was one of the poorer records in recent years.

Although availability in the 1990-91 reporting year was not as high as hoped, it was greatly improved as there were 93 days forced unavailability, 1.25 days planned unavailability and 23.25 days of administrative shutdown. Primary sources of forced outage time were replacement of

seals and connectors on the primary coolant system and extensive maintenance performed to complete the nuclear instrumentation calibration. These values were somewhat elevated, especially administrative shutdown time, by the lack of a full-time Reactor Manager and lack of replacement part inventory along with a shortage of licensed personnel, especially senior reactor operators over the last six months of the year.

Although no permanent Reactor Manager was able to be hired in the 1991-92 reporting year, two new part-time student senior reactor operators (SROs) were licensed and certified on October 17, 1992. Although availability in the 1991-92 reporting year was not as high as had been hoped, availability was again improved significantly as there were only 72.25 days forced unavailability, 4.25 days planned unavailability and 23.50 days of administrative shutdown. The 76.50 days total unavailability (20.90% unavailability) for maintenance is approximately average for the past decade. Again, these values for unavailability were elevated by the lack of a full-time Reactor Manager, especially early in the reporting year before certification of the two new SROs. With the appointment of a part-time Acting Reactor Manager on August 11, 1992, this situation improved in the next reporting year.

Although there were no large maintenance projects for the 1991-92 year, several major projects contributed to forced unavailability. First, and most significantly, two failures of the thermocouple connections to the south center fuel box were responsible for over 31 days of forced unavailability. Similarly, various failures related to the nuclear instrumentation system, including Safety Channel 2 trip indication, Safety Channel 2 meter circuit, Safety Channel 1 +15 volt and high voltage power supplies and the control blade position indicating circuits as well as replacement of bearings and pillow blocks for the stack diluting fan and the motor on the deep well pump were responsible for significant amounts of forced unavailability. As is indicated, these four areas account for most of the forced unavailability for the 1991-92 reporting year with the failed thermocouple connections and the safety channels meriting the most concern for preventive maintenance.

Although a permanent Reactor Manager was not hired until July 1993, the availability of part-time operators was good throughout the 1992-93 reporting year. Availability in the 1992-93 reporting year returned to a high level as there were only 22.63 days forced unavailability, 12.63 days planned unavailability and 11.50 days of administrative shutdown. The 35.25 days total unavailability (9.66% unavailability) for maintenance is one of the best in ten years. With appointment of a full-time Reactor Manager in July 1993 it was hoped this situation could be improved even further in the next year though much would depend on support for part-time personnel. Significant sources of forced unavailability for the 1992-93 reporting year were repair of deep well pump piping, adjustment and repair of Safety Channel 1 during the annual calibration and repair of the north side core area thermocouple connections and replacement of wiring following failure of temperature point #4 plus repeated small outages and several unscheduled shutdowns due to failures of the control blade position indicators/indicator circuits with an effort planned to replace these nixie tube systems in the next reporting year.

With a full-time Reactor Manager available for the full 1993-94 reporting year, good availability of other licensed and unlicensed personnel and no large maintenance efforts,

availability for the 1993-94 reporting year was even better than in the previous year. There were only 21.38 days forced unavailability, 13.25 days planned unavailability and 3.00 days of administrative shutdown. Significant sources of forced unavailability were to check out and verify proper detector current and operation of the compensated ion chamber and linear (red) pen following failure due to excessive moisture in October 1993, to check, locate and correct erratic response in the Safety-3 control blade position indicating (BPI) circuit in December 1993 and January 1994, to locate and correct an open circuit in the Safety-3 control blade drive circuit in January/February 1994, and to replace the intermittently failing shield tank water level trip magnetic reed switch in February 1994. The replacement of the nixie tube indicators in the control blade position indicating circuits in June 1994 promised to reduce forced outages from failures of the BPI circuits in the future.

With a full-time Reactor Manager again available for the full 1994-95 reporting year, reasonable availability of other licensed and unlicensed personnel and a limited number (3) of medium length forced outages, availability for the 1994-95 reporting year was only slightly reduced to 88.15% from the previous year. There were 26.50 days forced unavailability, 11.75 days planned unavailability and 5.00 days administrative shutdown. The three significant sources of forced unavailability were for the outage to address the anomalous primary coolant resistivity drop in March 1995, for the outage to remove debris and perform checks of the primary coolant system return line flow trip switch following removal of debris in June 1995, and finally for the outage to repair the automatic flux controller in August 1995 and which was still in progress at year's end.

With a full-time Reactor Manager again available for most of the 1995-96 reporting year, limited somewhat by family illness until resigning the position effective August 9, 1996, and with reasonable availability of other licensed and unlicensed personnel, but with several (3) medium length forced outages plus considerable planned outage time for roof repair, availability for the 1995-96 reporting year was somewhat reduced to 75.68% from the previous year. There were 44.875 days forced unavailability, 41.875 days planned unavailability and 2.25 days administrative shutdown. The three significant sources of forced unavailability were for the continued outage at the beginning of the year in September 1995 for the outage to repair the automatic flux controller begun in August 1995, for the outage to repair the linear (red) pen circuit in October 1995, and for the outage to troubleshoot and repair the Safety Channel 2 loss of high voltage monitoring circuit in April 1996 and again in July 1996. There was also significant planned outage time for the year for two surveillances to complete the inspection of mechanical integrity of the control blade drive systems internal to the biological shielding (V-1 Surveillance) in December 1995 and the biennial inspection of incore fuel elements (B-2 Surveillance) in August 1996. Similarly, the contract work to replace and then repair the reactor building roof involved considerable planned unavailability throughout the 1995-96 year and was still in progress at the end of the 1995-96 year.

With a full-time Reactor Manager only available for about three months beginning in late December 1996 until March 28, 1997, plus the loss of one part-time SRO and the licensing of another in midyear leading to somewhat restricted availability of licensed as well as unlicensed personnel, plus considerable forced outage time for replacement of failed equipment and some

planned outage time for conducting and improving the annual calibration checks of nuclear instrumentation, availability for the 1996-97 reporting year was further reduced to 62.20% from 75.68% the previous year. There were 102.25 days forced unavailability, only 16.625 days planned unavailability and 4.50 days administrative shutdown. The three most significant sources of forced unavailability were for the outage to replace the failed compensated ionization chamber (CIC) with the uncompensated ionization chamber (UIC) run in CIC mode, to obtain a new UIC, to replace the connectors and cables on both detectors and then test and assure proper calibration of the nuclear instruments in September to December 1996 (72.875 days); for replacement of the shield tank demineralizer system pump including flow circuit rearrangement in July/August 1997 (20.875 days); and replacement of a failed reed switch in the primary coolant level trip circuit in July 1997 (2.75 days). There was also significant planned outage time for the year to make adjustments and rework the annual calibration of nuclear instrumentation (A-2 Surveillance) in March 1997 (10 days) plus continuing periodic contract work to replace and then repair/upgrade the reactor building roof until June 1997 (4.75 days).

With a full-time Reactor Manager not available at all for the 1997-98 reporting year plus the extended outage beginning in May 1998, the hiring of two SRO-trainees did not result in the licensing of any new operators for this past year resulting in continued somewhat restricted availability of licensed as well as unlicensed personnel, plus considerable forced outage time—some involving failed equipment but the vast majority to investigate the cause of the reactivity anomaly resulting in higher than expected critical regulating blade position. There was also some planned outage time, mostly for conducting and improving the annual calibration checks of nuclear instrumentation. Therefore, availability for the 1997-98 reporting year was further reduced to 58.29% from 62.20% the previous year. There were 131.375 days forced unavailability, only 13.375 days planned unavailability and 7.50 days administrative shutdown. The most significant source of "forced" unavailability was the outage to investigate the reactivity anomaly lasting from the beginning of May through the end of the year in August (122.25 days). Only two other sources of forced outage time accounted for over two days; repair of the failure of the Safety Channel 2 high voltage power supply loss of high voltage trip (2.875 days) and replacement of a failed reed switch on the primary coolant return line flow sensor (2.875 days), both in April 1998. Several pieces of maintenance would have involved significant forced outage in the last few months as shown in Table III-6 except the reactor was already unavailable due to addressing the reactivity anomaly. There was also significant planned outage time for the year to make adjustments and perform the annual calibration of nuclear instrumentation (A-2 Surveillance) in March 1998 (10.75 days).

In the tables that follow, all significant maintenance, tests and surveillances of UFTR reactor systems and facilities are tabulated and briefly described in chronological order; these tabulations also include administrative checks. Table V-1 contains all regularly scheduled surveillances, tests or other checks and maintenance required by the Technical Specifications, NRC commitments, UFTR Standard Operating Procedures, or other administrative controls; these items are normally delineated with a prefix letter and a number for tracking purposes. The number of these surveillances increases each year as the UFTR Quality Assurance Program matures and requirements become more restrictive.

A listing of all the maintenance projects required to repair a failed system or component or to prevent a failure of a degraded system or component is presented in Table V-2. These maintenance efforts are frequently not scheduled though they can be when a problem is noted to be developing and preventive actions are implemented. In addition, they frequently are associated with reactor unavailability. Finally, these maintenance items can be associated with surveillances, checks or test items listed in Table V-1 since some of these scheduled surveillances are also required to be performed on a system after the system undergoes maintenance. For example, when the area monitor check sources or detectors are the subject of preventive or corrective maintenance as listed in Table V-2, the Q-2 calibration check of the area monitors must be completed as listed in Table V-1 before the reactor is considered operable. Similarly, when maintenance is performed on the control system, various surveillances such as control blade drive time and drop time measurements must be performed satisfactorily before the reactor can return to normal operations.

In Table V-2 the first date for each entry is the date when the Maintenance Log Page (MLP) was opened; in a few cases, this date may be one or more days after the original problem was noted. The date for work completion and the MLP number are included at the end of the maintenance description. As a result, in some years the first items listed in Table V-2 can have a starting date prior to the beginning of the current reporting year as the maintenance could be completed in a subsequent reporting year. This is the case for the first five entries in Table V-2 which involved maintenance in progress at the end of the 1996-97 reporting year; indeed the first item was opened during the 1992-93 reporting year as MLP #93-10 was used to control planned installation of a new temperature recorder. Two of these five entries (MLP #97-19 to control installation of new bearings for the stack dilute fan shaft, and MLP #97-26 to control repair of a low level portable radiation survey meter) were closed out during the current 1997-98 reporting year, but MLP #93-10 is still not closed out as work has been delayed and now postponed as implementation of the new temperature recorder is a major modification. The same situation applies for MLP #94-14 to install a new area radiation monitoring system while MLP #96-30 to control repair and upgrade of the security system is also still not closed out.

Similarly, seven maintenance log pages remain open at the end of the current reporting year: MLP #93-10 opened on April 5, 1993 to control installation of the new temperature recorder, MLP #94-14 to control installation of a new area radiation monitoring system, MLP #96-30 to control repair and upgrade of the security system, MLP #98-15 involving core disassembly to investigate the reactivity anomaly resulting in an increased regulating blade critical position, MLP #98-21 involving repair of the portal monitor, MLP #98-23 to repair and finally replace a failed high volume air sampler, and MLP #98-30 to repair the failed optical tachometer and finally to convert the direct reading tachometer for dilute fan rpm from an optical tachometer to a Hall effect tachometer. It is expected that MLP #93-10 and MLP #94-14 will be open for some time as implementation of the new temperature recorder is a major modification as is implementation of a new area radiation monitoring system, neither of which is currently a high priority. However, MLP #96-30, MLP #98-15, MLP #98-21, MLP #98-23 and MLP #98-30 should all be closed out relatively early in the new reporting year.

TABLE V-1

CHRONOLOGICAL TABULATION AND DESCRIPTION OF SCHEDULED UFTR SURVEILLANCES, CHECKS AND TESTS

Date		Surveillance/Check/Test Description
3 Sep 97	A-5	Annual Update of UFTR Decommissioning Cost Estimates
4 Sep 97	Q-5	Quarterly Radiological Survey of Restricted Areas
9/23 Sep 97	Q-4	Quarterly Radiological Survey of Unrestricted Areas
4 Sep 97	B-4	Biennial Evaluation of UFTR Standard Operating Procedures (Partial to Include Review of F-Series Procedure Changes by Acting Reactor Manager)
11 Sept 97	Q-9	Quarterly Calibration Check of AMS^4 Air Particulate Detector
18 Sep 97	Q-7	Quarterly Check of UFTR Building Fire Alarm System (Zone 3 – Upstairs Laboratories and Offices)
28 Sep 97	Q-6	Quarterly Check of Posting Requirements (Partial to Post New NRC Form 3)
29 Sep 97	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
30 Sep 97	Q-1	Quarterly Check of Scram Functions
5 Oct 97	Q-8	Quarterly Report of Safeguards Events
6 Oct 97	S-6	Semiannual Security Plan Key Inventory for UFTR and UFSA
7 Oct 97	S-3	Semiannual Inventory of Special Nuclear Material
13 Oct 97	A-3	Annual Measurement of UFTR Temperature Coefficient of Reactivity
13/14 Oct 97	B-4	Biennial Evaluation of UFTR Standard Operating Procedures (Completion of Full Documentation)
18 Oct 97	Q-6	Quarterly Check of Posting Requirements (Partial to Post New RSRS Appointment Letter) (Extra)
21 Oct 97	S-8	Semiannual Leak Check of PuBe and SbBe Neutron Sources
23 Oct 97	Q-3	Quarterly Radiological Emergency Evacuation Drill
24 Oct 97	S-7	Semiannual Check (Replacement) of Security System Batteries
28 Oct 97	Q-6	Quarterly Check of Posting Requirements (Partial to Post New DH-1081 State Form) (Extra)

TABLE V-1

CHRONOLOGICAL TABULATION AND DESCRIPTION OF SCHEDULED UFTR SURVEILLANCES, CHECKS AND TESTS

Date		Surveillance/Check/Test Description
11-26 Nov 97	B-3	Biennial Evaluation of UFTR Standard Operating Procedure Manuals for Completeness (Generated and Distributed Review Standard with Initial Checks on All Controlled Copies and All Information Copies Except One SRO Assigned and Four RSRS Assigned)
11 Nov 97	S-1	Measurement of Control Blade Drop Times
13 Nov 97	S-1	Measurement of Control Blade Drop Times (Extra)
13 Nov 97	S-5	Measurement of Control Blade Controlled Insertion Times
13 Nov 97	S-11	Semiannual Replacement of Control Blade Clutch Current Light Bulbs
26 Nov 97	Q-6	Quarterly Check of Posting Requirements
1 Dec 97	Q-9	Quarterly Calibration Check of AIM-3BL Air Particulate Detector
1 Dec 97	Q-2	Quarterly Calibration Check of Area Radiation Monitors
1 Dec 97	Q-2	Quarterly Calibration Check of Stack Radiation Monitor
1-2 Dec 97	B-3	Biennial Evaluation of UFTR Standard Operating Procedure Manuals for Completeness (Completed Initial Check on One SRO Assigned Copy and Second Checks on All Controlled Copies and All But One SRO Assigned Information Copy and Four RSRS Assigned Information Copies)
9 Dec 97	Q-5	Quarterly Radiological Survey of Restricted Areas
9/19 Dec 97	Q-4	Quarterly Radiological Survey of Unrestricted Areas
11 Dec 97	Q-6	Quarterly Check of Posting Requirements (Partial to Post New Memo Updating Those Authorized to Carry Cell Keys for Drills and Emergencies, to Post Updated EH&S Telephone List and to Post Updated Memo on UFTR Charges) (Extra)
16 Dec 97	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
17 Dec 97	Q-3	Quarterly Radiological Emergency Evacuation Drill (Large Drill Including Outside Agencies)
19 Dec 97	Q-9	Quarterly Calibration Check of AMS^4 Air Particulate Detector

TABLE V-1

CHRONOLOGICAL TABULATION AND DESCRIPTION OF SCHEDULED UFTR SURVEILLANCES, CHECKS AND TESTS

Date		Surveillance/Check/Test Description
23 Dec 97	Q-7	Quarterly Check of UFTR Building Fire Alarm System (Zone 4 - Reactor Building Annex)
30 Dec 97	Q-1	Quarterly Check of Scram Functions
2 Jan 98	Q-8	Quarterly Report of Safeguards Events
7 Jan 98	Q-6	Quarterly Check of Posting Requirements (Partial to Post New 1997-98 Campus Telephone Directories) (Extra)
8,9,21 Jan 98	S-10	Semiannual Check and Update of Emergency Call Lists
9 Jan 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
21 Jan 98	Q-6	Quarterly Check of Posting Requirements (Partial to Post New 1998 Gainesville Telephone Directories) (Extra)
22 Jan 98	S-4	Measurement of Argon-41 Stack Concentration (Includes Measurement of Dilution Air Flow Rate—Previously A-2 Surveillance)
28 Jan 98	B-3	Biennial Evaluation of UFTR Standard Operating Procedure Manuals for Completeness (Completed Checks on One RSRS-Assigned Information Copy and Reissued Review Standard and Forms to One SRO for Checking His Assigned Information Copy)
1/3/15 Feb 98	B-3	Biennial Evaluation of UFTR Standard Operating Procedure Manuals for Completeness (Completed Checks on Two RSRS-Assigned Information Copies and Reissued Review Standard and Forms for One RSRS Information Copy and Completed Checks on One SRO-Assigned Information Copy)
2 Feb 98	S-9	Semiannual Replacement of Well Pump Fuses
6-24 Feb 98	A-1	Instrument and Test Equipment Calibration
10 Feb 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
27 Feb 98	S-12	Semiannual Review of Requalification Training Program Binders

TABLE V-1

CHRONOLOGICAL TABULATION AND DESCRIPTION OF SCHEDULED UFTR SURVEILLANCES, CHECKS AND TESTS

Date		Surveillance/Check/Test Description
4/17 Mar 98	B-3	Biennial Evaluation of UFTR Standard Operating Procedure Manuals for Completeness (Completion of Checks on One RSRS Manual Plus Final Documentation)
9-19 Mar 98	A-2	UFTR Nuclear Instrumentation Calibration Check and Calorimetric Heat Balance
10 Mar 98	A-4	Annual Check/Replacement of Fire Alarm System Monitoring Station Batteries
10 Mar 98	Q-7	Quarterly Check of UFTR Building Fire Alarm System (Zone 1 – Reactor Cell and Control Room)
10 Mar 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
12 Mar 98	Q-6	Quarterly Check of Posting Requirements
19/26 Mar 98	Q-4	Quarterly Radiological Survey of Unrestricted Areas
23 Mar 98	Q-9	Quarterly Calibration Check of AMS^4 Air Particulate Detector
26 Mar 98	Q-9	Quarterly Calibration Check of AIM-3BL Air Particulate Detector
26 Mar 98	Q-5	Quarterly Radiological Survey of Restricted Areas
27 Mar 98	Q-2	Quarterly Calibration Check of Area and Stack Radiation Monitors
6/7 Apr 98	S-6	Semiannual Inventory of Security Keys for UFTR & UFSA
7 Apr 98	Q-8	Quarterly Report of Safeguards Events
7 Apr 98	S-3	Semiannual Inventory of Special Nuclear Material
8 Apr 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
15 Apr 98	Q-3	Quarterly Radiological Emergency Evacuation Drill
20 Apr 98	A-6	Annual Physical Inventory of Security-Related Locks/Cores
22/27 April 98	Q-1	Quarterly Check of Scram Functions
23 Apr 98	S-10	Semiannual Check and Update of Emergency Call Lists (Partial to Update State Warning Point Area Code on Call List #2) (Extra)
23 Apr 98	S-8	Semiannual Leak Check of PuBe and SbBe Neutron Sources
23 Apr 98	Q-6	Quarterly Check of Posting Requirements (Partial to Post Updated EH&S Spill Procedures) (Extra)

TABLE V-1

CHRONOLOGICAL TABULATION AND DESCRIPTION OF SCHEDULED UFTR SURVEILLANCES, CHECKS AND TESTS

Date		Surveillance/Check/Test Description
6 May 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
19 May 98	S-1	Measurement of Control Blade Drop Times
19 May 98	S-5	Measurement of Control Blade Controlled Insertion Times
19 May 98	S-11	Semiannual Replacement of Control Blade Clutch Current Light Bulbs
21 May 98	B-2	Biennial Inspection of Incore Reactor Fuel Elements (Partial—Inspection of One Fuel Bundle: UF-19)
27 May 98	S-7	Semiannual Check (Replacement) of Security System Batteries
8-10 Jun 98	S-10	Check and Update of Emergency Call Lists (Partial to Add SRO Trainees)
9 Jun 98	Q-7	Quarterly Check of UFTR Building Fire Alarm System (Zone 2 – Downstairs Offices and Laboratories)
16 Jun 98	Q-9	Quarterly Calibration Check of AIM3BL Air Particulate Detector
17 Jun 98	Q-9	Quarterly Calibration Check of AMS^4 Air Particulate Detector
24 Jun 98	Q-2	Quarterly Calibration Check of Area and Stack Radiation Monitors
24 Jun 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
25 Jun 98	Q-6	Quarterly Check of Posting Requirements
30 Jun 98	Q-5	Quarterly Radiological Survey of Restricted Areas (Shutdown Conditions Only)
30 June 98	Q-4	Quarterly Radiological Survey of Unrestricted Areas (Partial—Shutdown Conditions Only)

TABLE V-1

CHRONOLOGICAL TABULATION AND DESCRIPTION OF SCHEDULED UFTR SURVEILLANCES, CHECKS AND TESTS

Date		Surveillance/Check/Test Description
1 Jul 98	Q-4	Quarterly Radiological Survey of Unrestricted Areas (Completion–Shutdown Conditions Only)
7-10 Jul 98	S-10	Check and Update of Emergency Call Lists
7 Jul 98	Q-8	Quarterly Report of Safeguards Events
24 Jul 98	Q-3	Quarterly Radiological Emergency Evacuation Drill
24 Jul 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
29 Jul 98	S-9	Semiannual Replacement of Well Pump Fuses
19 Aug 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries)
27 Aug 98	Q-2	Quarterly Calibration Check of Area and Stack Radiation Monitors
27 Aug 98	Q-9	Quarterly Calibration Check of AIM3BL Air Particulate Detector
31 Aug 98	Q-6	Quarterly Check of Posting Requirements (Partial)

Note: An asterisk on the surveillance tracking designation is used to indicate surveillance was not completed within the allowable interval resulting in reactor unavailability for normal operations. None are so marked this year.

All required UFTR surveillances, checks and tests are up to date at the end of the reporting year as far as possible. In some years, surveillances have been carried over to the new year within the allowable interval; such is the case this year for the Q-4 (shutdown conditions), Q-5 (shutdown conditions), Q-6, Q-9 (AMS[4]), S-12 and A-5 surveillances, all of which were subsequently completed within the required interval. In addition, this year six surveillances are past due not within the allowable interval at the end of the reporting year due to reactor unavailability or other consideration to complete the surveillance; these include the Q-1, Q-4 (full power conditions), Q-5 (full power conditions), S-2, S-4 and B-2 surveillances.

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
5 Apr 93	Following general checkout of the new temperature recorder obtained under the DOE instrumentation grant, the unit is considered generally acceptable. Under MLP #93-10, maintenance work is being performed to develop a safety evaluation and investigate installation of the new temperature recorder to include various checks and consultation with Professor G.J. Schoessow in April 1993; in May 1993 work continued in design development for installing the new recorder; in June 1993, work continued in design development with considerable computer work completed including work descriptions and evaluations along with proposed changes to the annual nuclear instrumentation calibration check (UFTR SOP-E-4) and consultations with the NES electronics engineer in July 1993 work continued at a slower rate as the change package is nearing the point for final drafting with the complete modification package submitted to the RSRS for review at its 30 September 1993 meeting where the modification was approved to the point of being ready for implementation at which the RSRS wishes to review the materials including SOP changes prior to implementation. During October 1993 the materials necessary for this modification to be completed were ordered and their delivery was being awaited; during November, most but not all of the material arrived; the remainder of the material arrived in January 1994. During March 1994, linearity checks were performed on the new temperature monitoring system. No work has been performed since that time, especially since the recorder has been relatively problem free in the last several years. (MLP #93-10 remains open.)
16 Mar 94	After the new area radiation monitoring system including a 19-inch rack, recorder, computer console, battery backup, probes, attachments, cabling and hardware was received, MLP #94-14 was used to control setup of the new ARM system including connecting the battery power supply and the recording module. During April 1994, the new detectors were also mounted. During May, electrical cables were run from the detectors to the control room monitors. Actual on-line installation of the new system will require a modification package which is now in progress. No work has been accomplished since May 1994, again primarily because of relatively trouble-free operation. (MLP #94-14 remains open.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
11 Nov 96	Following one spurious security alarm on 10 November and two alarms on 11 November 1996, the security system batteries were checked and replaced (S-7 Surveillance). Under MLP #96-30 the rechargeable batteries were found to be low and were recharged. Subsequently, 10 CFR 50.59 Evaluation Number 96-13 was developed to allow modification and replacement of the power pack to prevent recurrence of the problem of spurious alarms due to low voltage. Measurements were made and security system circuits checked and verified. In addition, the 6 volt batteries were recharged in mid-month. At the end of November 1996, the design and development of a new power pack per 10 CFR 50.59 Evaluation Number 96-13 was in progress; at the end of December 1996, the 10 CFR 50.59 Evaluation is complete as is the design, with installation of the new power supply on 7 January 1997 with all but one siren operational to meet requirements. Subsequently, the west lot siren was repaired on 13 January and both the west lot and journalism side siren horn drivers wiring was reterminated on 14 January 1997. Drawings and maintenance log were subsequently updated and an evaluation made that separate grounds would be needed for the security system batteries to assure proper charging and eliminate spurious alarms as the batteries discharge over time. On 10 March 1997, the power supply was removed for modification. Upon installation, various problems occurred resulting in partial and intermittent compensated outage of the security system over the period 10-21 March with circuit mapping performed for troubleshooting on 19 March and the intermittent ground finally repaired on 21 March 1997, but without installation of the modification to separate grounds, basically returning the system to its state prior to 10 March. Subsequently, the 4 volt rechargeable batteries have been replaced on 14 May 1997, 18 June 1997, 7 July 1997 and 24 July 1997 (for prevention purposes on 30 July 1997), on 29 August 1997 and on 29 September 1997. Following a full S-7 Surveillance on 24 October 1997, the loss of the holdup alarm was corrected under MLP #96-30 by reterminating a loose wire. Subsequently, the 4 volt rechargeable batteries were replaced on 16 December 1997 and again on 9 January, 10 February, 10 March, 8 April and on 6 May 1998. Following a full S-7 Surveillance on 27 May 1998, the 4 volt rechargeable batteries were replaced again on 24 June, 24 July and 19 August 1998. (MLP #96-30 remains open.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
11 Jun 97	In preparing to conduct a daily checkout, it was noted that the mechanical tach-generator rpm indication had been lost again. Under MLP #97-19, the mechanical tach connecting wires were noted to be broken apparently due to axial thrust of the stack dilute fan shaft. The mechanical tach was then removed to await the arrival and installation of new fan shaft bearings previously requested under MWO #301271 per MLP #97-07. Subsequently, PPD technician D. Walton visited during August to verify the need for and type of bearings to assure they were properly ordered. Checks by Acting Reactor Manager J. Powers on 26 September 1997 confirmed that MWO #358160 was open for replacing the bearings. A call by Acting Reactor Manager J. Powers on 6 October 1997 updated the status confirming that MWO #301271 is applicable for replacing the bearings. D. Walton again visited in November to check on the status of the fan bearings. On 1 December 1997 the optical tachometer failed, so on 2 December 1997 the mechanical tach-generator was reinstalled and temporarily reterminated to meet the applicable Tech Spec Limiting Condition for Operation. Subsequently, the mechanical tach-generator had to be reterminated on 8 December 1997 before the weekly checkout and again on 10 December 1997 before the daily checkout to meet tech specs. In the interim, on 2 December 1997, PPD mechanical technician Rick Smith visited but could not access the fan shaft bearings due to operations in progress; he then returned on 3 December 1997 to check the bearing serial numbers. Subsequently, Mr. Rick Smith and an assistant arrived with new bearings on 15 December 1997. After being unable to pull the shaft for replacement, the shaft was shimmed and new bearings installed with grease fittings installed on 16 December 1997 and rpm verified using the strobotac (528 rpm) with much decreased vibrations and no further problems noted. (On 10 December 1997, MLP #97-19 was closed.)
21 Aug 97	During preparations to segregate radioactive trash, the Bicro Microanalyst survey meter (SN B707L) was found to be inoperable with the high voltage out. Under MLP #97-26, this survey meter was transferred to the electronics engineer for diagnosis and repair. The meter calibration and high voltage circuits were adjusted on 9 December 1997 and the meter transferred to Radiation Control for a calibration check which was completed successfully

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
	on 31 December 1997 with the meter ready to be returned to service with no further problems noted. (On 31 December 1997, MLP #97-26 was closed.)
11 Sep 97	During the quarterly calibration check on the ESP-2 neutron rem survey meter, there was no source response. Under MLP #97-27, the ESP-2 survey meter was transferred to the electronics repair shop where the operational manual was reviewed and troubleshooting was undertaken. Subsequently, the dead time and calibration constant were reset; following a subsequent successful calibration check, the meter was returned to service with no further problems noted. (On 19 Sep 97, MLP #97-27 was closed.)
11 Sep 97	During replacement of the failed reed switch for the level trip on the primary coolant system on 3 July 1997, following its failure detected during the daily checkout on 1 July 1997, it was decided to install a better means of verifying the point of occurrence of the level trip. Under MLP #97-28, 10 CFR 50.59 Evaluation and Determination Number 97-10 was developed and approved to install a current sensor in the PC level trip circuit to measure better the level above the fuel at which the PC level trip occurs. Following bench testing, walk-through of the change, and approval of the modification in the applicable surveillance data sheet for quarterly scram check (Q-1 Surveillance), the current sensor was installed and the proper level trip verified using the newly approved protocol. Though the surveillance data sheet instructs marking the PC level when the voltage reading jumps from zero (to about 350μV), the actual jump was to about 440μV which is acceptable per modification package and RSRS discussion that the need is simply to see a significant change—the magnitude not being important—with no problems noted. (On 30 Sep 97, MLP #97-28 was closed.)
15 Oct 97	During preparations to remove a sample, a source and battery check of the RO2A/4296 ionization chamber initially showed proper response but then the meter pegged downscale with no response on battery check. Under MLP #97-29, the batteries were replaced, the meter was overhauled and calibration checks performed successfully with the meter returned to use at the UFTR with no further problems noted. (On 23 Oct 97, MLP #97-29 was closed.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
18 Nov 97	During initial cell entry, the security lock cylinder on the control room door was noted to be loose. Under MLP #97-30, the lock cylinder was tightened and MLP #97-30 was closed. Subsequently, a UPD officer initiated the Call List because the key slot for the door lock cylinder was not aligned as usual so the UPD officer thought the control room door might not be properly secured. Therefore, MLP #97-30 was reopened and the lock cylinder was further tightened and aligned to indicate in the usual fashion with no further problems noted. (On 18 Nov 97, MLP #97-30 was closed.)
25 Nov 97	During the daily checkout, the AMS[4] air particulate detector was noted to have a decreased though still acceptable air flow rate. Under MLP #97-31, the AMS[4] technical manual was checked and the air particulate detector was checked. It was discovered that two filter papers had been inadvertently inserted instead of one so there was more resistance to air flow resulting in the decreased air flow rate. After removal of one of the filter papers, the air flow rate was returned to normal with no further problems noted. (On 25 Nov 97, MLP #97-31 was closed.)
1 Dec 97	During the weekly checkout the rpm indication from the optical tachometer was noted to be lost. Under MLP #97-33 the light bulb in the circuit was replaced with no effect so the unit was removed to the electronics shop for troubleshooting. On 2 December 1997, a photodiode was replaced, also without improvement. On 5 December 1997, the optical tach was removed as the signal was noted to be too weak for transmission over the distance involved for readout in the control room. Subsequently, a regulator and display modification was designed and approved as 10 CFR 50.59 Evaluation Number 97-11 with the modification installed in the unit with both the optical tach and display unit returned to service on 16 December 1997 with no further problems noted. (On 16 December 1997, MLP #97-33 was closed.)
8 Dec 97	During the weekly checkout the primary coolant storage tank level was noted to be getting low. Under MLP #97-34, 35 gallons of demineralized water were added to the PC storage tank to raise the tank level to 25 inches with no problems noted. (On 8 December 1997, MLP #97-34 was closed.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
23 Dec 97	During a visit to the control room the mechanical tach-generator indication was noted to be zero. Under MLP #97-35, the mechanical tach terminals were soldered on 23 December 1997 but a downscale response resulted. On 24 December the terminal leads were reversed and resoldered with a new rubber tubing housing installed around the generator to restore proper rpm indication with periodic subsequent checks verifying no further problems. (On 29 December 1997, MLP #97-35 was closed.)
30 Dec 97	During the week the depletion of the city water demineralized water makeup system resins was noted. Under MLP #97-36, the depleted resins were replaced to assure a source of demineralized makeup water for the shield tank and primary coolant storage tank with no problems noted. (On 30 December 1997, MLP #97-36 was closed.)
15 Jan 98	During checks of the E-530/1879 GM survey meter, the meter was noted to read low and then drop to zero. Under MLP #98-01, the meter was removed to the electronics repair shop where a loose connection to the GM tube was repaired and then the meter was calibrated and returned to service with no further problems. (On 21 January 1998, MLP #98-01 was closed.)
20 Jan 98	During performance of the Argon-41 measurements (S-4 Surveillance), the squeeze bulb used to facilitate drawing a sample was noted to be degraded. Under MLP #98-02, a new squeeze bulb was obtained and installed on the line at the base of the stack. Subsequent repetition of the Argon-41 measurements with similar results demonstrated proper squeeze bulb replacement with no further problems noted. (On 20 January 1998, MLP #98-02 was closed.)
19 Feb 98	In response to information from Oregon State University that a failure of the console key switch to return fully to operate after resetting the scrams had resulted in a bypass of the manual scram and the other automatic scrams, it was decided to check the UFTR for this possibility. Under MLP #98-03, the key was placed (held) in reset and no blade would withdraw. Subsequently, one blade was withdrawn and the key then placed in reset; this action resulted in the blade dropping (trip action) but also water being dumped off the core and breakage of the rupture disk. A possible electrical transient indicated by

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Date	Maintenance Description
	flickering lights was thought to be the cause of the rupture disk breakage but could not be immediately verified as communicated to the Facility Director. Nevertheless, the purpose of this check—to verify trip conditions and prevent control blades from being energized while in the key reset condition (nonoperate condition)—was considered to be verified. Subsequently, after cleanup of the equipment pit and replacement and verification of the leak tightness of the rupture disk under MLP #98-04, on 20 February 1998, the reactor was allowed to sit filled with water for a while to verify no leaks from the rupture disk. After examining the circuit schematics on 20 February and discussing the situation with the electronics engineer (D. Ekdahl), it was determined that the console circuitry is acting as designed; that is, with one blade off the bottom and the key in reset, the blade should drop with no other action (no dump valve opening). Subsequently, on 23 February, a preoperational checkout was successfully completed and the reactor core filled with water again after completion of all checkouts. Again, one blade was withdrawn and the console key placed in reset; this time the result was that the blade dropped (as expected) with no chattering of the dump valve or rupture disk breakage. It was then evaluated that the cause of rupture disk breakage with one blade off the bottom was due to an apparent electrical transient which caused the dump valve to cycle partially between open and closed conditions resulting in rupture disk breakage. This experimental check was considered to confirm the previous evaluation that the full drop and subsequent rupture disk breakage with the dump valve still shut was due to an electrical transient. This event is evaluated not to have had a significant effect on reactor safety and to have had negligible impact on the health and safety of facility personnel or the public. Subsequently, the reactor was returned to normal operation on 23 February 1998 with no further problems noted. (On 23 February 1998, MLP #98-03 was closed).
19 Feb 98	Following the inadvertent breakage of the rupture disk, probably due to dump valve cycling due to an electrical transient, while checking under MLP #98-03 that the reactor cannot be operated and bypass trips while the console key is not in operate, MLP #98-04 was opened to control cleanup of the equipment pit (~60 gallons of primary coolant were lost from the primary system). Under MLP #98-04, the pit water was sampled and evaluated, the pit was cleaned up and the rupture disk replaced with a spare from inventory

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Date	Maintenance Description
	on 20 February 1998. Subsequently, water was brought into the core and the rupture disk was verified not to be leaking. The same was repeated on 23 February after the weekend at which point the MLP was closed out and successful weekly and daily checkouts were completed as the reactor was returned to normal operations with no further problems noted. This event is evaluated not to have had a significant effect on reactor safety and to have had negligible impact on the health and safety of facility personnel or the public. (On 23 February 1998, MLP #98-04 was closed.)
20 Feb 98	During efforts to replace the broken rupture disk, it was noted that the secondary system vent line fitting was broken. Under MLP #98-05, a replacement fitting (garden hose type) was installed with no further problems noted. (On 23 Feb 98, MLP #98-05 was closed.)
20 Feb 98	During previous operations, the light on the twelve point temperature recorder was noted to be only partially lit. Under MLP #98-06, a preliminary diagnosis indicated the problem was due to a bad ballast so two replacement ballasts were ordered from "Valve & Control" in Jacksonville. These had not been received at the end of February. Subsequently, an on-hand ballast was found but the problem was ultimately found to be in the starter which was replaced with a spare with no further problems noted. (On 6 Mar 98, MLP #98-06 was closed.)
9 Mar 98	During performance of the pre-calorimetric portion of the A-2 Surveillance (UFTR Nuclear Instrumentation Calibration Check and Calorimetric Heat Balance), certain voltages and setpoints were noted to require minor adjustments as expected. Under MLP #98-07, various voltages and setpoints were adjusted to assure proper nuclear instrumentation calibration with further changes then apparently needed at the conclusion of the post-calorimetric checks so that resistor changes were thought to be needed to increase the gain of the picoammeter A-2 amplifier to facilitate linear channel calibration under Special Test Procedure E.4 (Modified) per 10 CFR 50.59 Evaluation and Determination No. 98-02. Subsequently, after nuclear instrumentation adjustments without the need for resistor changes, the A-2 Surveillance was successfully completed on 19 March 1998. (On 19 Mar 98, MLP #98-07 was closed.)

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Date	Maintenance Description
12 Mar 98	When further adjustment appeared to be needed to increase the gain of picoammeter A-2 amplifier to facilitate linear channel calibration, 10 CFR 50.59 Evaluation and Determination No. 98-02 was developed and approved at a RSRS Executive Committee meeting on 17 March 1998. Under MLP #97-07 and 50.59 Evaluation and Determination No. 98-02, two brief power operations were conducted; in attempting adjustments of the linear channel, the contact action of wiping the resistor arm removed corrosion to allow a proper setting estimate with the full A-2 Surveillance then expected to allow proper adjustment of the linear with no further problems noted with adjustments of the picoammeter A-2 amplifier. Subsequently, after nuclear instrumentation adjustments, the A-2 Surveillance was successfully completed on 19 March 1998. (On 19 Mar 98, MLP #98-08 was closed.)
30 Mar 98	During a facility check, the Bicron microanalyst survey meter was noted to show no high voltage and no response. Under MLP #98-09, the meter was removed to the electronics shop for repair. At the end of May, it remained out of service as it was sent off in April to the manufacturer for repair work before it could be calibrated. The detector was finally returned from the factory calibrated on 12 June 1998. Subsequently, it passed the usual on-site calibration checks on 15 June 1998 with the meter returned to service on 22 June 1998 after assuring it would not inadvertently stop operating as it has in the past. (On 22 Jun 98, MLP #98-09 was closed.)
31 Mar 98	Following security and fire alarm system supervisor Skip Rockwell's visit on 13 March 1998, a modification package (10 CFR 50.59 Evaluation and Determination No. 98-01) was developed and approved to control changing the UFTR security system alarm to a digital dialer as equivalent and possibly better than the current system since the entire campus is being converted and the fire marshal has so ordered for fire alarm systems as previously converted for the UFTR fire alarm system. Under MLP #98-10, the digital dialer modification was installed by PPD alarm technicians F. Petrone and R. Lund and verified to be operating properly with no problems noted. (On 31 Mar 98, MLP #98-10 was closed.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
Apr 98	During performance of the weekly checkout on 6 April 1998, the "Safety 2" trip indicator was found to be locked in and not able to be cleared. Under MLP #98-11, a voltage measurement yielded zero volts so the fuse was replaced and the high voltage power supply was found to be reading properly at 841.22V. The immediate cause of the failure to reset was therefore determined to be a blown fuse. Subsequent multiple checks of the reset on the "Safety 2" check including completion of successful weekly and daily preoperational checks demonstrated continued proper operation of the "Safety 2" trip indicator. The cause of the blown fuse was finally attributed to transients associated with removal and restoration of building electrical power over the weekend for work on the campus power distribution system. Following replacement of the fuse and successful completion of the preoperational checks, the reactor was returned to normal operations with no further problems noted. Another daily checkout was completed successfully on 8 April 1998 prior to the first subsequent startup. (On 7 Apr 98, MLP #98-11 was closed.)
22 Apr 98	During performance of the Quarterly Check of Scram Functions (Q-1 Surveillance), the operator failed to receive a reactor trip when pressing the Safety Channel 2 (SC2) High Voltage Power Supply (HVPS) loss of high voltage test switch. Under MLP #98-12, SC2 high voltage output was measured to be correct. Again, when the test button was pressed, there was no change in high voltage output. It was thought that this could indicate that the high voltage was too high so that even with a 10 percent reduction, it could remain above the bistable setpoint. Subsequently, switch continuity checks showed no problem. To investigate the possibility that the voltage was too high, the resistor bank for the test circuit was checked since the ~861V high voltage is ~20V above normal. However, when measured with load, the value was ~841V, within specifications. When the power supply voltage and test circuit for bistable trip were checked, the power supply voltage was out of tolerance. The power supply voltage was checked and adjusted and the 10 percent voltage drop trip was repeatedly verified to work properly to restore the proper conservative circuit function. The reason for the failure of the trip is that the power supply provides a 15V reference to the bistable. With a different reference signal, the trip threshold would be different. There is no way to know at what exact level the trip would have

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Date	Maintenance Description
	occurred without setting the +15V power supply to the originally out of specification level and dialing down the HVPS voltage while holding the test switch, which is not allowed, by procedure. However, it was noted that very little change was necessary in the setting. Since the setting is conservative at ~9 percent HV loss versus 10 percent to get the trip, it is likely the 10 percent SC2 loss of high voltage trip would have occurred for a 10 percent voltage reduction anyway. It was also noted that there was no actual loss of high voltage, but rather, the 10 percent loss of high voltage trip was not as conservative as normal. It was also discovered during shutdown. This failure event is considered to have had negligible effect on reactor safety and no effect on the health and safety of the public or facility personnel. After successful completion of the weekly and daily checkouts, the reactor was returned to normal operations with no further problems noted. (On 24 Apr 98, MLP #98-12 was closed.)
22 Apr 98	During performance of the Quarterly Check of Scram Functions (Q-1 Surveillance), the flow trip on the primary coolant return line flow sensor failed to yield a trip on loss of flow. Under MLP #98-13, the problem was investigated and isolated to the reed switch. Under RWP 98-2-II, the reed switch was removed and found to have welded contacts. After assuring proper seating of the reed switch, continuity checks were performed satisfactorily with water flow (zero resistance) and without water flow (high resistance). Subsequently, the test of the flow trip on the primary coolant return line flow sensor was completed satisfactorily on 27 April 1998 to complete the Quarterly Check of Scram Functions. This failure event discovered during the normal Q-1 Surveillance at shutdown conditions is considered to have had negligible effect on reactor safety, especially since this trip is for no flow at the core outlet while the flow trip at the core inlet remained operational at 30 gallons per minute. This failure is also considered to have had no effect on the health and safety of the public or facility personnel. After successful completion of the weekly and daily checkouts, the reactor was returned to normal operations with no further problems noted. (On 27 Apr 98, MLP #98-13 was closed.)

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Date	Maintenance Description
23 Apr 98	Because a number of the reactor cell overhead lights were burned out, Maintenance Work Order #382473 was opened in early April 1998 with the Physical Plant Division to have the cell relamped. Under MLP #98-14, PPD electrical technicians Jay Lancaster and Chris West relamped the reactor cell overhead fixtures. They noted one exception where a four-foot fixture was not relamped to await replacement of a failed special ballast which has been ordered and will be replaced later. No other problems were noted. (On 23 Apr 98, MLP #98-14 was closed.)
1 May 98	During March and April, there had been a small gradual change in the critical position moving to a higher required regulating blade critical position. This situation was discussed at the Reactor Safety Review Subcommittee (RSRS) meeting on 23 April 1998 with the RSRS recommending that electronics in the control blade position indicating circuits be checked as the possible cause but with no restrictions on operation in the meantime. By memorandum dated 22 April 1998, the normal banked position for the three safety blades had been raised from 640 to 660 units withdrawn as noted at the RSRS meeting. It was expected that the normal critical position of the regulating blade would then be reduced to below 400 units to assure responsive control during startup and power level changes. To verify the new critical regulating blade position, a startup to one (1) watt was undertaken on 1 May 1998 by SRO-trainee G. Macdonald under supervision of SRO W.G. Vernetson. Instead of the critical position being about 390 units as expected, the critical position was verified to be 484 units at 1435 hours. At this point the reactor was shut down at 1441 hours to evaluate the situation. Since the intent was to shut down anyway, this was not considered to be an unscheduled shutdown though the same type of evaluation was subsequently undertaken with the reactor placed on administrative shutdown except for operations related to addressing this apparent reactivity anomaly which was communicated individually to a majority of the RSRS (RSRS Chairman M.J. Ohanian, Radiation Control Officer D.L. Munroe and NRE Department Chairman J.S. Tulenko on 1 and 4 May 1998). To this point, this event was not considered to be promptly reportable though plans were to notify NRC as pertinent information is obtained. Subsequently, under MLP #98-15 opened on 4 May 1998, the blade position indicating circuit voltages were verified and blade withdrawal for all blades (part of the weekly checkout) was twice verified to

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Date	Maintenance Description

be smooth. At this point, voltage drift was eliminated as a source of the apparent reactivity anomaly.

The weekly shield tank water sample indicated a resistivity of 0.55 MΩ-cm, somewhat below the 0.60 MΩ-cm procedure requirement for reactor operation. Therefore, under MLP #98-16 and RWP 98-3-II, the filter and ion exchange resin on the shield tank recirculation system were replaced and the resistivity verified to return to 0.60 MΩ-cm on 5 May 1998 and increasing over the next several days.

Under MLP #98-15, it was thought that the shield tank or the primary coolant system could have leaked water to wet the core graphite to cause the reactivity anomaly of concern. Therefore, on 6 May 1998, under MLP #98-15, the areas below the core were subjected to borescope inspection via the equipment pit under RWP 98-4-I. Again, no conditions were found indicative of water intrusion or other situation to account for the reactivity anomaly.

At this point, RSRS members were consulted to assure there was agreement to restart the reactor to one (1) watt to check the regulating blade critical position. Under MLP #98-15, a brief startup was utilized on 7 May 1998 to verify the critical position had changed somewhat again from 484 units withdrawn but now reduced somewhat to 460 units withdrawn.

On 12 May 1998, under MLP #98-15, the thermal column was opened up and checked because the neutron radiography device had recently been used and removed in mid-April. The shielding around the rabbit system line entrance on the west face of the reactor shielding was also moved to assure the rabbit system had not moved. The vertical ports were also opened and double-checked with no problems identified to impact the reactivity anomaly. At this point, another brief startup was utilized on 14 May 1998 to verify the critical position which now remained at 460 units withdrawn on the regulating blade.

On 19 May 1998, since the surveillances were due anyway, it was decided to check the control blade drop times, controlled insertion times and replace the

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Date	Maintenance Description

clutch current bulbs (S-1, S-5 and S-11 Surveillances). All were conducted with satisfactory results with no problems noted though the controlled insertion time for the regulating blade was noted to be three seconds longer than on the previous check. At this time, the decision was made to begin checks internal to the biological shield since all external checks had failed to reveal any obvious cause of the reactivity anomaly.

Since the biennial fuel inspection (B-2 Surveillance) was due, it was decided on 19 May 1998 to perform at least part of this surveillance next to begin core checks. Fuel handling training was conducted and the core was partially unstacked on 20 May 1998. Subsequently, unstacking was completed and one fuel bundle (UF-19) from the northeast fuel box was inspected satisfactorily and returned to the core on 21 May 1998 with observation of part of this activity by DOE Lockheed Martin consultant Doug Morrell observing for input to the fuel production activities for the planned UFTR HEU-to-LEU fuel conversion. No obvious cause of the anomaly was identified in this activity so it was decided to unload the fuel from the core to the irradiated fuel storage pits. The remainder of the month (26-29 May) was spent removing non-fuel activated materials from several irradiated fuel storage pits (#4, #6 and #7), preparing the pits to receive irradiated fuel and planning the consolidation of existing fuel in the pits to make room to unload the 21½ fueled bundles present in the core and planning the movement of fuel from the core to the irradiated fuel storage pits.

At the end of May, two modification packages were prepared for RSRS Executive Committee review. The first modification package addressed unloading the core (10 CFR 50.59 Evaluation and Determination Number 98-04: Core Unloading to Fuel Storage Pits (Modified SOP-C.1)) to include the special test procedure modifying SOP-C.1 to track fuel removal from the core. The second modification package addressed consolidation of the fuel storage pits (10 CFR 50.59 Evaluation and Determination Number 98-05: Irradiated Fuel Storage Pit Consolidation (Modified SOP-C.1)) to include the special test procedure modifying SOP-C.1 to track consolidation of fuel from 4 fuel storage pits into 2 fuel storage pits to provide free storage locations for all 21½ fueled bundles to be coming from the core during the planned fuel unloading. Both modification packages were approved at an RSRS

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Date	Maintenance Description

Executive Committee meeting on 1 June 1998. Subsequently, under modified SOP-C.1 and RWO #98-6-I, fuel in pit #23 was consolidated into pit #26 on 2 June 1998. However, efforts to move the old-style low-enriched fuel from pit #25 to pit #27 were unsuccessful because of a differently designed end plate. Therefore, a new modified SOP-C.1 allowing use of an alternate hook lifting tool design with a different safety line design (10 CFR 50.59 Evaluation and Determination #98-06) was developed and approved at another RSRS Executive Committee meeting on 2 June 1998. Subsequent use of the alternate lifting tool and safety line was successful to complete fuel pit consolidation of pit #25 into pit #27 on 3 June 1998. At this point, preparations were complete for unloading the fuel in the core to the irradiated fuel storage pits as a total of 22 empty pits were available to receive the 21½ fuel bundles in the core.

Under RWP #98-5-I, three fuel bundles were removed from the northeast fuel box and three fuel bundles were removed from the southeast fuel box to pits 1–6 on 4 June 1998. Subsequently, four fuel bundles were removed from the south central fuel box and one from the north central fuel box on 5 June 1998. Finally, the remaining fuel bundles were removed to the irradiated fuel storage pits (three bundles from the north central box, four bundles from the northwest box and three and one-half bundles from the southwest box) on 11 June 1998 with sufficient shielding placed over the irradiated fuel storage pits to limit radiation to acceptable levels. NRC Senior Project Manager Ted Michaels was updated on the status of investigations into the reactivity anomaly on 18 June 1998, that it was not considered promptly reportable and about continuing plans to locate and correct the source of the problem. RWP #98-5-I was closed out on 18 June 1998.

Subsequently, under RWP #98-7-I, the borescope was used to examine the insides of the fuel boxes and to perform a swipe survey on the core graphite. A small piece of material (apparently a piece of wire) was found on the bottom grid plate of the northeast fuel box and evaluated not to be the cause of the reactivity anomaly though it was not removed at the time of discovery on 22 June 1998 because its small size (<2 inches long) made it difficult to latch on to for removal. Next the control blades were inspected with the borescope through the shroud top access port. The Safety-1 (S-1) and

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Date	Maintenance Description

Safety-2 (S-2) blades were inspected on 23 June 1998 with S-1 noted to be closer to the side of the shroud. The Safety-3 (S-3) blade and Regulating blade (RB) were inspected on June 24, 1998 with some separation apparent but not well defined on the Regulating blade verified by a recheck on S-3 blade. At this point, it became apparent that the Regulating blade should be removed for a closer inspection, so efforts were begun on 26 June 1998 to remove graphite from around the core to access the bottom of the control blades where the shroud and blade are attached. Several layers of graphite were removed on this day. However, relatively low levels of airborne contamination were detected after removing considerable graphite including several layers down to outlet piping on 26 June 1998. Subsequently, air samples, graphite samples and swipes were analyzed on the high purity germanium spectrum analyzer and/or a liquid scintillation detector to determine the levels and radioisotopes present. Though not necessarily required, it was decided to provide some optional protection against airborne contamination by reworking the Respiratory Protection Program to allow use of mask respirators and to get several workers certified for respirator use as an ALARA measure. As a result, RWP #98-7-I was closed out on 29 June 1998. It was also decided at this point, in the interest of ALARA, to await completion of the Biennial Fuel Inspection (B-2 Surveillance) until the core is reloaded since all fuel bundles must be inspected prior to being loaded back into the core.

At the end of June 1998 and throughout the month of July, efforts were under taken to modify the approved UFTR Respiratory Protection Program to allow use of half respirator masks and to schedule the necessary medical examinations for which there was some delay. The necessary physicals for Rick Salazar and Glenn Macdonald were conducted on 10 July 1998. The revised UFTR Respiratory Protection Program was ready for internal review and approval by 24 July 1998 but the RSRS Executive Committee was unable to meet for several days. On 24 July 1998, NRC Senior Project Manager Ted Michaels was updated on the status of the checks on the reactivity problem including probable separation on one control blade and plans to disassemble the entire core since borescope indications are somewhat limited. He was also informed of the detection of airborne particulates at low levels and stop of work and delays in developing and approving the revised

TABLE V-2

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Date	Maintenance Description

Respiratory Protection Program. Specifically, we discussed the use of half-face respirators, status of exams/physicals, etc., and 10 CFR 20.1703(d) requiring notification of the Region II Administrator 30 days before the date of using respiratory protection equipment the first time. Since we normally go directly to the NPR Directorate, we requested direction on what to do next. He was not sure whether we should send in something and asked that he be contacted again on 28 July which was done, whereupon he indicated we should send in the proposed Program when internally approved. Revision 2 of the UFTR Respiratory Protection Program was finally internally approved along with the proposed Policy Statement at an RSRS Executive Committee meeting on 30 July 1998. Subsequently, NRC Senior Project Manager Ted Michaels was contacted on July 30 and he requested submission of the Program for review indicating it should not require 30 days. The internally approved Respiratory Protection Program Revision 2 and the proposed Policy Statement were faxed to Ted Michaels (301-415-3313) on 30 July 1998 to get the review started with the formal submission by letter to the Document Control Desk then accomplished on 3 August 1998.

At the beginning of August, maintenance operations were awaiting NRC review of the Respiratory Protection Program Revision 2. On 3 August 1998, NRC Inspector Stephen Holmes of the Non-Power Reactor Directorate indicated he would visit for an inspection on 13-14 August 1998 in order to provide on-site review verifying that the Respiratory Protection Program Revision 2 was acceptable and reviewed by NRC prior to implementation. Therefore, all the preliminary aspects of implementing the Respiratory Protection Program Revision 2 were addressed prior to his arrival to include acquiring half-face respirators and arranging a visit by Mary Russell on 6 August to provide half-face respirator fits and training for SRO J. Powers and SRO J. Wolf plus SRO-trainee R. Salazar. Subsequently, Vince McLeod provided the same fit tests and training for SRO W.G. Vernetson and SRO-trainee G. Macdonald with the whole Respiratory Protection Program Revision 2 administratively reviewed and all documentation completed prior to Mr. Holmes arrival on 13 August. Upon his arrival on 13 August, Mr. Homes toured the facility to check on maintenance status, he checked records of fit testing and training as well as the Program itself. Though he continued to interview personnel and check the fit testing equipment on 14 August,

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Date	Maintenance Description
	Mr. Holmes evaluated that the Program was ready for implementation on the afternoon of 13 August 1998. Therefore, the official implementing memorandum for the Program was issued on 13 August 1998. A new Radiation Work Permit 98-8-I was also opened allowing use of respirators per the Respiratory Protection Program Revision 2 and requiring SRO supervision of operations among other controls with respirators used for moving graphite on the afternoon of 13 August with observation by Mr. Holmes. Inspector Holmes held his exit interview on August 14 prior to leaving indicating no problems were identified and respirators are not required but are optional at the worker's convenience. Subsequently, more graphite was removed on the afternoon of 14 August which was the last day that workers opted to wear respirators as airborne radioactivity levels were measured to be quite low. Subsequently, the RWP 98-8-I was reissued several times during the month as work progressed slowly with resumption of classes limiting personnel availability. On 20 August 1998, the SbBe source was removed and the nuts from the three north side fuel boxes were removed which greatly reduced radiation levels and prevented bringing water into the fuel boxes after this date with all bolts and flanges out on the north side of the core on 27 August 1998 though workers were unable to remove any fuel boxes. Subsequently, the northeast fuel box was removed on 28 August 1998 but the flange connections are very tight requiring considerable force to effect removal with only one box removed at month's end. It appears that the other two north side fuel boxes need to be removed to allow access to and removal of the regulating blade and its shroud for detailed examination. At year's end (31 August 1998), maintenance operations are continuing to remove graphite and the fuel boxes. Current plans are to continue removing graphite and remove at least the regulating blade and shroud for further checks to include inspection of the apparent separation of the blade within the shroud as this maintenance work continues. (MLP #98-15 remains open.)
5 May 98	During the weekly checkout, the shield tank resistivity was discovered to be below the procedural requirements for operation (0.55 MΩ-cm versus 0.60 MΩ-cm). Under MLP #98-16 and RWP 98-3-II, the filter and ion exchange

TABLE V-2

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Date	Maintenance Description
	resins were replaced in the shield tank recirculation system with the resistivity then restored sufficiently to meet the procedure requirements and continuing to improve with no further problems noted. (On 5 May 98, MLP #98-16 was closed.)
12 May 98	Following a visit by Steve Wargo of Atlas Scientific Technologies, Incorporated to scope out needs on 11 May 1998, equipment was moved and surveys performed in preparation for asbestos abatement in the NAA Laboratory area. Under MLP #98-17, with Steve Wargo supervising, various technicians from Merit Insulation removed asbestos from all pipes in the NAA Laboratory with removal operations completed on 18 May 1998. Subsequently, Merit Insulation supervisor Eddie Rhoden and several technicians then replaced the insulation on 18-19 May 1998 to complete planned asbestos abatement activities. (On 19 May 98, MLP #98-17 was closed.)
2 May 98	Fire alarm systems technician Wayne Gravely had previously provided information on a planned upgrade of the reactor building fire alarm system to install a pull station and horn in the downstairs part of the Materials Science Annex to meet fire code requirements with 10 CFR 50.59 Evaluation #98-03 approved to cover installation of the upgrade. Under MLP #98-18, technician Wayne Gravely placed the necessary conduit, mounted junction boxes, a pull station and a new horn in the downstairs Materials Science Annex and then continued the conduit in preparation to connect to the existing system with an oversight visit by supervisor Skip Rockwell at this point. Subsequently, on 14 May 1998, the fire alarm system was taken out of service, the connections made, the system placed back in service and all tests completed satisfactorily with no problems noted. (On 14 May 98, MLP #98-18 was closed.)
19 May 98	During the weekly checkout, the water level in the primary coolant storage tank was noted to be approaching the refill point. Under MLP #98-19, 51 gallons of demineralized water were added to the primary coolant storage tank to raise the water level from 21 inches to 27.5 inches to complete filling with no problems noted. (On 19 May 98, MLP #98-19 was closed.)

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Date	Maintenance Description
22 May 98	During fuel inspection (B-2 Surveillance) related activities, a ground fault was discovered in the shield tank demineralizer system pump power supply. Under MLP #98-20, the circuit as well as the circuit diagram were checked along with consulting the supplier. Subsequently, the power supply was rewired to eliminate the ground fault. Proper flow was then verified with no further problems noted. (On 28 May 98, MLP #98-20 was closed.)
28 May 98	During a calibration on April 24, 1998, detector #2 on the PMC-4A/#104 portal monitor was noted not to yield an alarm when removed. Subsequently, detector #2 was providing occasional spurious alarms. Under MLP #98-21, various circuit and detector checks were undertaken to troubleshoot the problem with the portal monitor and detector #2, with the probable cause of the problem being in a failing GM detector and possibly also a high voltage card though all channels were alarming as intended. Several replacement detectors were ordered along with a high voltage card with continuation of maintenance efforts to await arrival of the GM detectors and high voltage card. The portal monitor remained in service with only one spurious alarm noted in June. Eberline shipped more expensive NaI instead of GM detectors in June so at the end of June the repair parts remained on order. Repair parts were reordered and the need for GM detectors and reception of the incorrect NaI detectors was clarified with Eberline on July 6, 1998. The correct GM tubes were finally received on July 10, 1998 with the acquisition paperwork completed and the incorrect detectors prepared for return though they sat around Room 202 NSC until the end of the month awaiting action by NRE Department staff. No work was accomplished in August as the system is functioning adequately. (MLP#98-21 remains open.)
29 Jun 98	During performance of the weekly preoperational checks on June 22, 1998, the optical tachometer indication was noted to be lost. Under MLP #98-22, the optical tachometer detector circuitry was reworked to correct an intermittent short circuit; the mirror was also aligned and the optical tachometer restored to normal on June 29, 1998 with the device allowed to operate overnight to assure no further problems. (On 30 Jun 98, MLP #98-22 was closed.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
8 Jul 98	During performance of the weekly radiation protection survey checks on July 8, 1998, the staplex high volume air sampler was noted to be failed due to sparking from the motor internals. Under MLP #98-23, the outer housing was removed and the brushes were removed. One brush was noted to be completely worn down to the copper pigtail which had in turn damaged the commutator. Gainesville Motor Supply Company was contacted but they require the brushes to be brought to them to be matched. Some flexabraiding of the commutator was also accomplished. At month's end the decision has still not been made on whether or not to repair this air sampler since another one is currently on loan from the Radiation Control Office to meet UFTR needs. On August 25, 1998, an order was placed to acquire a new air sampler for UFTR use. (MLP #98-23 remains open.)
15 Jul 98	During a walk-through, the RM14/2907 frisker survey instrument was noted not to be responding to a source check on any of its scales. Under MLP #98-24, the instrument was removed to Radiation Control for a checkout. Subsequently, it was returned by RCT J. Parker on July 22, 1998 and then taken for repair to the electronics shop where a switch was discovered in the wrong position. The switch was positioned back to its proper location and frisker operations restored to normal with no further problems noted. (On 29 Jul 1998, MLP #98-24 was closed.)
16 Jul 98	On entering the cell at the beginning of the day, the stack radiation monitor was noted to be failed on July 16, 1998. Under MLP #98-25, the problem was isolated to the detector circuitry which was removed for troubleshooting and repair with the GM tube assembly noted to be discrete from the detector circuitry. Wiring and the amphenol connector were replaced to restore proper operation as verified by a satisfactory calibration check of the instrument (Q-2 Surveillance) with no further problems noted. (On 23 Jul 98, MLP #98-25 was closed.)
27 Jul 98	During the weekly preoperational checks, the mechanical tachometer was noted to be reading low (<480 RPM). Under MLP #98-26, the tubing was adjusted to restore the indication to 510 RPM with the system allowed to run for a few days to determine whether the problem was solved with no problems noted upon a final check. (On 7 Aug 98, MLP #98-26 was closed.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
29 Jul 98	During a walk-through of the control room, the optical tachometer was noted to be failed reading zero rpm. Under MLP #98-27, the problem was found to be an intermittent in wiring between the optical tachometer and the control room display unit. The optical tachometer was removed and bench tested to show an apparent bad voltage regulator. Subsequently, the nolex connectors and wiring were replaced; a capacitor was replaced as a result of a determination of low capacitance on the voltage regulating circuit to repair the voltage regulator circuit, with the optical tachometer then reinstalled. Following testing and verification of rpm with the strobotac, the system was returned to normal operation with no further problems noted. (On 31 Jul 98, MLP #98-27 was closed.)
4 Aug 9	During the weekly preoperational checks, the makeup demineralized water supply system was noted to be providing water at a resistivity somewhat below 1.0 megohm-cm. Under MLP #98-28, the city water ion exchange resins in the makeup system were replaced to restore the reactor source of high resistivity demineralized makeup water with no further problems noted. (On 4 Aug 98, MLP #98-28 was closed.)
12 Aug 98	During the weekly check it was noted that the shield tank had lost sufficient water due to fuel inspection and other activities requiring the cover to be off that the shield tank level trip could not be cleared though with fuel removed the full shielding is not really required. Subsequently, under MLP #98-29, 130 gallons of high resistivity demineralized makeup water were added to fill the shield tank to allow clearing the level trip and to assure proper shielding levels with no further problems noted. (On 12 Aug 98, MLP #98-29 was closed.)
18 Aug 98	During the weekly checkout and several observations, the optical tachometer stack dilute fan RPM indication was noted to be intermittently lost in the control room. Under MLP #98-30, the optical tachometer was adjusted and the voltage regulation was verified. Subsequently, the situation was evaluated to be apparently due to light bulb and/or sensor switch intermittent failure possibly due to thermal effects. With these continuing problems and with the RPM indication from the operational mechanical tachometer, it was decided to cease troubleshooting the problem with the direct indicating

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Date	Maintenance Description
	optical tachometer and to implement a modification using a direct reading tachometer based on the hall effect. Therefore, at month's end a modification package (10 CFR 50.59 Evaluation and Determination Number 98-07, "Conversion of Direct Reading Tachometer for Dilute Fan RPM from Optical Tach to Hall Effect Tachometer") has been developed including a page change in SOP-A.1 allowing use of either type of direct reading tachometer (optical or hall effect) to meet tech spec requirements for dilute fan RPM monitoring. At month's end this package awaits approval to be followed by installation and implementation of the alternate direct reading tachometer hopefully to eliminate the problem with intermittent loss of RPM indication on this channel. (MLP #98-30 remains open.)

MLP #93-10 remains open from 5 April 1993.
MLP #94-14 remains open from 16 March 1994.
MLP #96-30 remains open from 11 November 1996.
MLP #98-15 remains open from 4 May 1998.
MLP #98-21 remains open from 28 May 1998.
MLP #98-23 remains open from 8 July 1998.
MLP #98-30 remains open from 18 August 1998.

VI. CHANGES TO TECHNICAL SPECIFICATIONS, SAFETY ANALYSIS REPORT, STANDARD OPERATING PROCEDURES AND OTHER KEY DOCUMENTS

This chapter contains a narrative description and status report on the various changes to key UFTR license-related documents that occurred during the 1996-97 reporting year. As such, this chapter provides a ready reference for the status of various license-related documents to include Technical Specifications, Safety Analysis Report, Standard Operating Procedures, Emergency Plan, Security Response Plan, Reactor Operator Requalification and Recertification Training Program, HEU-to-LEU Conversion Documents as well as Quality Assurance Program Approval for Radioactive Material Shipments and other key documents as they are generated or changed.

A. Changes to Technical Specifications

The new Technical Specifications for the UFTR were issued on August 30, 1982 and officially established on September 30, 1982. Two sets of requested corrections/changes to the Technical Specifications were submitted to the NRC during the 1982-83 reporting period. As noted in the 1983-84 annual report, the UFTR facility received approval for Amendments 14 and 15 to the UFTR Technical Specifications during that reporting year. As noted in the 1985-86 annual report, the UFTR facility requested and received approval for Amendment 16 in that year to correct an error in numbering Section 3.5 which had been incorrectly numbered Section 3.4.

Approved license (Tech Spec) Amendment 17 was received on May 3, 1988 per a letter from NRC dated April 27, 1988. The approved amendment consisted of a revision to the Tech Specs to permit conducting certain activities when the reactor is shutdown, the reactor vent system is secured and the stack monitor is reading greater than 10 cps. This Amendment 17 is basically a relaxation of UFTR Technical Specifications in Section 3.4.3 as a limiting condition for operation which states that "the vent system shall be operated until the stack monitor indicates less than 10 counts per second." As requested by NRC and submitted by the licensee, the Tech Specs were also revised to include a backup means for quantifying the radioactivity in the effluent during abnormal or emergency operating conditions in addition to administrative changes. The backup core vent sampling system was installed on May 4, 1988 and available for all subsequent reactor operations.

For the 1992-93 reporting year, Tech Spec Amendment 18 was submitted to NRC with a letter dated September 28, 1992. Approved license (Tech Spec) Amendment 18 was received on March 29, 1993 per a letter from NRC dated March 25, 1993. The approved amendment consisted of a revision to the Tech Specs to permit submittal of the annual report of activities up to December 31, rather than November 30 of each year. Also, the current mailing address for the annual report was changed to correspond to the current NRC mailing requirement.

For the 1993-94 reporting year, two Tech Spec Amendments were submitted. Tech Spec Amendment 19 was submitted to NRC with a letter dated December 2, 1993. Approved license (Tech Spec) Amendment 19 was received on March 10, 1994 per a letter from NRC dated March 25,

1993. The approved amendment consisted of a revision to address the revised 10 CFR Part 20; areas addressed include updating the limitation on Argon-41 discharge concentrations, updating the references to Part 20 for liquid and gaseous effluent discharges and changing the reference to "Maximum Permissible Concentration" to "maximum concentration," correcting the 500 mrem/yr federal limit to 100 mrem/yr for members of the public, and deleting any reference to active plans to upgrade the UFTR to 500 kW operation. Documentation for Amendment 19 is contained in Appendix A of the 1993-94 annual report.

Tech Spec Amendment 20 was submitted to NRC with a letter dated June 2, 1994. This initial request was to permit sanitary sewage system disposal of aqueous radioactive material in accordance with 10 CFR Part 20.2002. In late August 1994, NRC staff members indicated the amendment as proposed did not address the proper sections of the new Part 20 for releases from the facility holdup tanks. As of a conference call with NRC staff on September 1, 1994, it was decided to amend the submission to address the releases from the holdup tank as normal effluents versus waste; that is, to address effluents and refer to 10 CFR Part 20.1301 and 10 CFR Part 20.1302 in Paragraphs (1) and (2), respectively, of Section 3.4.5 of the UFTR Technical Specifications on Page 12 entitled "Liquid Effluents Discharge." The key here is the facility releases via the holdup tanks are to meet normal effluent requirements; they are not to be considered waste. During review of the draft submission deleting references to all attachments to the earlier amendment submission, it was also decided to change the UFTR technical specifications in Section 4.2.4, Paragraph (3) on Page 20 to refer to release of liquid effluents versus radioactive waste in agreement with the change to Section 3.4.5 and with the existing title of Section 4.2.4 which is "Radiation Monitoring Systems and Radioactive Effluents Surveillance."

For the 1994-95 year, these changes in the revised Amendment 20 letter and attachments were mailed to NRC as a letter dated September 9, 1994. After a number of inquiries and discussions, this License Amendment 20 (Tech Specs) was finally approved by NRC per a letter dated February 6 and received on February 10, 1995. All the documentation for Tech Spec Amendment 20 including the revised Amendment 20 letter and attached Tech Spec change pages 12 and 20 as well as the letter notifying issuance of the amendment, the amendment indicating it is effective on the date of issuance as February 6, 1995, along with the amendment pages and the NRC Safety Evaluation supporting the amendment are contained in Appendix A of the 1994-95 annual report.

For the 1995-96 reporting year, one Tech Spec Amendment was submitted. Tech Spec Amendment 21 was submitted to NRC with a letter dated August 2, 1996, all of which is in Appendix A of the 1995-96 annual report. The only change is at the beginning of Section 6.6.1 and simply allows two additional months for submittal of the "routine annual report covering the activities of the reactor facility during the previous calendar year." Because December is normally a relatively high activity month at the UFTR facility with the end of fall semester classes and because a number of other commitments also come due in December, plus facility staff typically take leave time after the end of classes, this change to allow two further months for submittal is expected to provide assurance that this report can be filed on time to avoid the problem of failure to submit reports cited in NRC Inspection Report 50-83/96-01. This change as requested is not considered to have any safety significance and involves an administrative change only. Approved Tech Spec Amendment 21 was received on October 15, 1996 per a letter from NRC dated October 10, 1996 as

the effective date of the amendment allowing submittal of the UFTR annual report of activities six months following the end of the reporting year which occurs on August 31 each year. The full NRC transmittal including the cover letter, the amendment indicating it is effective on the date of issuance as October 10, 1996 along with the amendment pages and the NRC Safety Evaluation Report supporting the amendment are contained in Appendix A of this report.

For the 1996-97 reporting year, one more Tech Spec amendment was submitted. Tech Spec Amendment 22 was submitted to NRC with a letter dated August 21, 1997. The first change is on Figure 6.1 (UFTR Organization Chart) on page 30 in the Level 1 organization box which is updated to reflect the name change from the "Department of Nuclear Engineering Sciences" to the "Department of Nuclear and Radiological Engineering" for the department that continues to be responsible for operation of the University of Florida Training Reactor. The submittal notes that this change was initiated by the faculty of the department to reflect better the educational and research activities and goals of the department and was approved by the University of Florida administration; the change is in name only as the same administrative structure continues in existence. On page 32, this same department name change is made once in paragraph 6.2.5(1), Composition and Qualifications, and three times in paragraph 6.2.5(2), Charter and Rules, subparagraph (a) of Membership. Finally, on page 37, at the end of Section 6.6.1 (Operating Reports), the Attention Line is moved to the second line of the NRC's Washington, DC address. In addition, the address for submission of annual reports to NRC Region II is deleted to reflect the transfer of the Non-Power Reactor Inspection Program from the NRC Region II office to the Office of Nuclear Reactor Regulation, Non-Power Reactor Directorate per a letter from Luis A. Reyes, Region II Regional Administrator dated August 1, 1997 and received on August 7, 1997. These changes as requested are not considered to have any safety significance and involve nomenclature/administrative changes only. This entire Amendment 22 submittal package was contained in Appendix B of the 1996-97 report. Approval for this change request had not yet been received at the end of the 1996-97 reporting year.

A letter dated December 3, 1997 from NRC Project Manager Theodore S. Michaels approving Tech Spec Amendment 22 was received on December 8, 1997. Enclosures with the letter enumerating the changes involved in Amendment 22 included Amendment 22 to the Facility Operating License signed by Seymour Weiss, Director of the NRC Non-Power Reactors and Decommissioning Project Directorate and dated December 3, 1997 along with directions for inserting the three amendment pages and the three pages (30, 32, 37) themselves plus the two-page Safety Evaluation supporting Amendment 22 to Facility License No. R-56. Amendment 22 was subsequently prepared for insertion and inserted in document manuals during December 1997.

No further requests for changes in the approved Tech Specs are anticipated for the operation of the UFTR with its present high-enriched fuel at a rated power level of 100 kWth. It is expected, however, that another substantive amendment to the Technical Specifications will be required before the UFTR can be converted from utilizing high-enriched MTR plate-type fuel to utilizing low-enriched silicide plate-type fuel.

B. Revisions to UFTR Safety Analysis Report

FSAR Revision 5 was submitted to NRC and inserted in the UFTR Safety Analysis Report (SAR) in 1988 to incorporate changes that were the result of ongoing reviews of the UFTR Safety Analysis Report to assure updated accurate contents. Revision 6 of the FSAR comprises a complete updating of Chapter 11 (Radioactive Waste Management) of the UFTR Safety Analysis Report as part of a continuing effort to assure an accurate document for controlling facility operations. This revision was submitted to NRC with a letter dated September 18, 1989. During the 1991-92 reporting year, Revision 7 of the UFTR SAR was submitted with a letter dated April 3, 1992 and consisted of changes to two pages. The first change was on Page 5-8 to allow use of an equivalent deep well pump per the slightly changed but equivalent description in Section 5.2 describing the UFTR Secondary Cooling System. The second change was to Page 9-6 in Sections 9.2.3 and 9.2.4 to allow use of an equivalent resin in the Demineralized Water Makeup System and the Primary Coolant Purification System because the Amberlite IRN-150 nuclear grade resins previously specified for use in the purification systems are no longer available.

Revision 8 of the UFTR Safety Analysis Report dated 5/95 was submitted to NRC with a letter dated May 11, 1995. Revision 8 consists of changes to two pages. The revision resulted from the need to make certain minor changes in the schematics describing the UFTR Secondary Water Cooling System to reflect modifications that have been implemented. There were no textual changes required in the Safety Analysis Report.

Revision 9 of the UFTR Safety Analysis Report dated 8/95 was submitted to NRC with a letter dated September 14, 1995 and consists of changes to two chapters. Although the changes were initiated for only several pages as a result of the CY 1993 audit by the Reactor Safety Review Subcommittee, continuing review resulted in changes on Pages 1 through 5 and Pages 19 and 20 of Chapter 12 (Radiation Protection) and a complete update of all pages for Chapter 13 (Conduct of Operations). The changes are not considered to involve any unreviewed safety question or to impact the UFTR Safety Analysis and include a number of simple wording clarifications, updates of organization names, corrected document references, deletion of references to UFTR power upgrades, updates of surveillance references and examples, update of UFTR administrative structure diagram to delete specific named individuals as well as a number of corrections to match Tech Spec requirements, and many typographical error corrections made in the interest of readability. There are also a number of changes made to match the designations in Chapter 13 with the current approved UFTR Requalification and Recertification Training Program. For details on the changes in Revision 9, the reader is referred to complete documentation for SAR Revision 9 contained in Appendix B of the 1995-96 annual report.

For the 1996-97 reporting year, Revision 10 of the UFTR Safety Analysis Report was submitted to NRC with a letter dated March 17, 1997. This change was approved as 10 CFR 50.59 Evaluation and Determination Number 97-03; it was made to correct inconsistent labeling of scales for percent power and power level in Figure 7.2 (Operating Range of UFTR Neutron/Power Level Detectors) on page 7-5. The complete submittal for SAR Revision 10 including letter of transmittal and revised page 7-5 labeled "REV10, 3/97" was contained in Appendix C of the 1996-97 annual report. As expected, there was no response on this submittal to date but it was inserted into facility

copies of the FSAR in the 1996-97 reporting year. Although the facility submitted no revisions to the UFTR Final Safety Analysis Report during the 1997-98 reporting year, a considerable effort was undertaken to assure all copies of the FSAR through Revision 10 are complete and uniformly documented, signed off as complete, and maintained available around the facility.

There have been no other subsequent revisions of the UFTR SAR. However, with completion of most neutronics and thermal-hydraulics analyses to support the HEU-to-LEU conversion, other SAR updates are planned as necessary to keep the SAR current and to support the planned HEU-to-LEU fuel conversion and subsequent preparations for relicensing the UFTR.

C. Generation of New Standard Operating Procedures

No new Standard Operating Procedures (SOPs) were generated during the 1997-98 reporting year. This condition marks the maturity of the UFTR Standard Operating Procedures as great efforts have been undertaken to implement good practice requirements in generating new procedures. At the end of the reporting year, also in contrast to many earlier previous years, no further new procedures are in progress.

D. Revisions to Standard Operating Procedures

All existing UFTR Standard Operating Procedures were reviewed and rewritten into a standard format during the 1982-83 reporting period as required by a commitment to NRC following an inspection during that year. As committed to NRC, the final approved version of each SOP (except certain security response procedures which are handled separately) is permanently stored in a word processor to facilitate revisions and updates which are incorporated on a continuing basis in the standard format.

Table VI-1 contains a complete list of the approved UFTR Standard Operating Procedures as they existed at the end of the previous (1996-97) reporting year exclusive of applicable Temporary Change Notices (TCNs) since these do not change procedure intent. Table VI-2 contains a similar complete up-to-date list of the approved Standard Operating Procedures as they exist at the end of the current (1997-98) reporting year. The latest revision number and date for each non-security (not withheld from public disclosure) related procedure is listed in Table VI-2 in parentheses for each SOP; TCNs refer to minor changes made to an SOP in lieu of a full revision and are not noted on the two tables to simplify the presentation. A comparison of Tables VI-1 and VI-2 indicates that there were two revisions to SOPs generated during this reporting year versus three last year and none in the 1995-96 reporting year which was in contrast to the significant administrative effort by UFTR facility staff when eight revisions were generated three years ago in the 1994-95 reporting year. The basic reasons for the two SOP revisions in 1997-98 are explained in the following paragraphs with a copy of each revision available at the UFTR facility for review if desired.

The two revisions to UFTR Standard Operating Procedures generated during the 1997-98 reporting year include UFTR SOP-0.7 and SOP-F.8. The revisions this year were relatively minor in nature. Both could have probably been Temporary Change Notices (TCNs) except that the number of page changes made a revision more appropriate. The revisions for SOP-0.7 and SOP-F.8

were generated as a direct result of the follow-up upon evaluation of the operating procedures as they are used.

UFTR SOP-0.7 (Control of NRC 10 CFR 50 Written Communications Requirements) underwent a complete revision (1) primarily to collect several previous temporary changes and to address no longer making submissions to NRC Region II, how to submit documents containing safeguards information, how to contact NRC, how to submit special reports and to update NRC emergency numbers. In essence, this change could have been a TCN except so many minor changes and updates were made that a revision was implemented.

UFTR SOP-F.8 (UFTR Safeguards Reporting Requirements) underwent a complete revision to delete references to submitting written reports to NRC Region II per the move of the inspection function to the Non-Power Reactor Directorate. It also updates telephone and fax numbers for the Emergency Operations Center, provides updated example date used in the SOP, adds a title for reference to the safeguards event reporting form and gives more guidance in documenting the fact of no safeguards event log entries in a quarter. Since all pages were affected by these minor changes, again a revision was generated instead of a TCN.

In addition to the two revisions generated during the 1997-98 reporting year, a number of minor changes were incorporated into the UFTR Standard Operating Procedures as needs and/or errors were identified especially in response to the Reactor Safety Review Subcommittee (RSRS) annual audit and facility evaluations and as a result of training on the Standard Operating Procedures and their periodic review as well as NRC Inspection recommendations and follow-up on completion of the Biennial Evaluation of UFTR Standard Operating Procedures (B-4 Surveillance). In contrast to the previous two reporting years when twenty-nine (29) and then eleven (11) TCNs were issued, only eight (8) TCNs were issued this year to correct minor discrepancies or better express the unchanged intent of four (4) different procedures, with only SOP-0.5 (QA Program) changed more than once, including SOP-A.1, SOP-A.8 and SOP-C.2. It should be noted that all of the TCNs for SOP-0.5 simply updated surveillance data sheets; the others usually affected one or at most two pages.

The remaining TCNs all involve similar minor changes affecting one or a few sections of the respective SOP, sometimes as little as a single sentence. All were fully reviewed by UFTR facility management and approved by the RSRS. Because of the quantity of paper involved and the relatively minor nature of TCNs, copies of these SOP changes or the SOPs as currently revised and implemented are not included in this report. A copy of each may, however, be obtained directly from the UFTR facility if desired.

E. Revisions to UFTR Emergency Plan

With a letter dated December 10, 1992, Revision 8 was submitted to the NRC, providing updates and minor revisions to fifteen (15) pages. In a letter dated July 20, 1993, the NRC notified the facility of their evaluation that these changes do not decrease the effectiveness of the Plan which maintains compliance with 10 CFR 50 Appendix E. Therefore, the approved changes were

incorporated into the current Emergency Plan. Revision 8 was then distributed to all holders of the Plan with a letter dated August 2, 1993 just prior to the beginning of the 1994-95 year.

During the 1994-95 reporting year, with a letter dated January 20,1995, Revision 9 was completed and submitted to the NRC. Revision 9 consists of a set of updates and revisions to thirteen (13) pages: iii, iv, 1-12, 5-1, 5-2, 7-5, 7-6, 7-7, 8-2, 8-3, 10-2, 10-6 and 11-1, as well as Appendix I – Shands Teaching Hospital and Clinics, Inc. Plan for Emergency Handling of Radiation Accident Cases. In addition, Appendix II – Agreement Letters and Appendix III – Emergency Implementing Procedures were to be removed from the Plan.

Revision 9 was reviewed by UFTR management and the Reactor Safety Review Subcommittee (RSRS) to assure Revision 9 did not decrease the effectiveness of the UFTR Emergency Plan. All the changes were considered relatively minor in nature; they were the result of reviews of the Plan and our response to simulated emergencies following emergency drills. The two revised emergency procedures (SOP-B.1 and SOP-B.2) were implemented in early February 1995. Further minor revisions to SOP-B.1 were implemented in July 1995. Minor revisions to SOP-B.2 were implemented in August 1995. The remainder of the changes were not implemented during the 1994-95 reporting year awaiting NRC approval of the submittal before distributing changes to holders of the Emergency Plan. Except for discussing the implementation of the revised emergency procedures and the general content and scope of Emergency Plan Revision 9 with Craig Bassett during a call on January 26, 1995, and documenting his favorable evaluation, there had been no response from NRC up to August 1995. Documentation for Emergency Plan Revision 9 omitting the emergency procedures and including only the title page and signature page for the "Shands Hospital Emergency Department Plan for Emergency Handling of Radiological Accident Cases" was contained in Appendix D of the 1994-95 report.

In a letter dated October 10, 1995, the NRC indicated that their staff had reviewed this Revision 9 and found that the changes in the body of the plan as well as the new Shands Hospital Emergency Plan in Appendix I are acceptable and can be implemented without prior NRC approval in accordance with 10 CFR 50.54(q). However, in addition to these minor modifications, the NRC letter indicated that certain other changes, i.e., removal of Appendix II – Letters of Agreement, and Appendix III – Emergency Implementing Procedures were found to be of a substantive nature. These changes were reviewed by the NRC staff for their impact on the effectiveness of the Plan and/or their potential safety significance which concluded that the Letters of Agreement should be an integral part of the Plan and must be maintained in the Emergency Plan on the basis that their removal would decrease the effectiveness of the Plan. Further, the NRC found that the Emergency Implementing Procedures may be removed from the Plan; however, a list of these procedures, by title, must be referenced in the Plan. A copy of this NRC letter approving Emergency Plan Revision 9 subject to the above noted limitations is contained in Appendix F of the 1995-96 annual report. Subsequently, all of the Revision 9 changes were incorporated into the Plan with the exception that the Letters of Agreement were left in Appendix II and a list of the Emergency Implementing Procedures by title is referenced in the Plan as had been incorporated into Revision 9. This Revision 9 was completely implemented and supplied to all Emergency Plan holders in December 1995.

During the 1996-97 reporting year, with a letter dated April 10, 1997, Revision 10 of the UFTR Emergency Plan was completed and submitted to the NRC. Revision 10 of the Emergency Plan consists of a set of updates and revisions to thirteen (13) pages: ii, iv, 1-11, 3-1, 3-2, 3-3, 3-4, 3-5, 3-8, 7-1, 8-1, 8-4 and 8-5, as well as Appendix I - Shands Teaching Hospital and Clinics, Inc. Plan for Emergency Handling of Radiological Accident Cases and Appendix II - Agreement Letters. First, Figure 1.8 on page 1-11 is updated to show a large addition made to the J.W. Reitz Union building and show its location a little better. This addition has no effect on UFTR building access routes.

Second, there are a number of changes on six pages in Chapter 3, all updating the Plan to account for various department name changes. On page 3-1, section 3.1, paragraph 1 is updated in two places to reflect the name change from the "Department of Nuclear Engineering Sciences" to the "Department of Nuclear and Radiological Engineering" and also to correct a misspelling where "eduction" should be "education." On page 3-2, the UFTR Organization Chart in Figure 3.1 is updated to reflect the name change from the "Department of Nuclear Engineering Sciences" to the "Department of Nuclear and Radiological Engineering" in the Level 1 organization box. On page 3-3, section 3.2.3, line 4 is updated to reflect the name change from the "Department of Nuclear Engineering Sciences" to the "Department of Nuclear and Radiological Engineering" and section 3.3 is updated in two places to reflect the name change from the "State of Florida Department of Health and Rehabilitative Services Office of Radiation Control" to the "State of Florida Department of Health, Bureau of Radiation Control." On page 3-4, section 3.4.3 is changed to correct a typographical error in the reference to the Shands Hospital "Plan for Emergency Handling of Radiation Accident Cases" which is changed to the "Plan for Emergency Handling of *Radiological* Accident Cases." In addition, on page 3-4, section 3.4.4 is updated to correct an incorrect word in line 2 so that "of" the environs now reads "to" the environs. Also on page 3-4, section 3.4.5 is updated as the section title changes from "State of Florida Office of Radiation Control" to the "State of Florida Bureau of Radiation Control" and the first line of the section 3.4.5 text is updated to reflect the name change from the "State of Florida Department of Health and Rehabilitative Services Office of Radiation Control" to the "State of Florida Department of Health, Bureau of Radiation Control." On page 3-5, section 3.5 is updated near the end of the first paragraph to reflect the name change from the "State of Florida Department of Health and Rehabilitative Services Office of Radiation Control" to the "State of Florida Department of Health, Bureau of Radiation Control." On page 3-8, section 3.9 is updated to reflect the name change from the "State of Florida Department of Health and Rehabilitative Services Office of Radiation Control" to the "State of Florida Department of Health, Bureau of Radiation Control."

Third, on page 7-1, section 7.1.1, paragraph 4 is updated to reflect the name change from the "Department of Health and Rehabilitative Services" to the "Department of Health."

Fourth, there are changes to three pages in Chapter 8, one to account for a name change and two to correct typographical errors. On page 8-1, section 8.2, paragraph 2 is updated to reflect the name change from "Department of Nuclear Engineering Sciences" to the "Department of Nuclear and Radiological Engineering." On page 8-4, section 8.3, paragraph 1 is changed to correct a typographical error in two references to the "Plan for Emergency Handling of Radiation Accident Cases" which are changed to the "Plan for Emergency Handling of *Radiological* Accident Cases."

Similarly, on page 8-5, section 8.3.4 is also changed to correct the typographical error in the reference to the "Plan for Emergency Handling of Radiation Accident Cases" which is changed to the "Plan for Emergency Handling of *Radiological* Accident Cases." Also on page 8-5, section 8.4, paragraph 1, the area code for the telephone in the Emergency Support Center is noted to be changed to reflect the new Gainesville area code so the number becomes "352-392-1428" versus "904-392-1428."

Fifth, Appendix I of the UFTR Emergency Plan is updated by removing the version dated 12/94 and adding the latest updated version of the Shands Hospital "Plan for Emergency Handling of Radiological Accident Cases" dated 12/95. The Appendix I cover sheet is also updated to reflect the typeface used for other changes.

Sixth, Appendix II of the UFTR Emergency Plan is updated by removing older versions of agreement letters for the Alachua County Office of Emergency Management and Shands Teaching Hospital and Clinics Inc. and replacing them with current letters dated December 10, 1996 for the Office of Emergency Management and March 20, 1997 for Shands.

Finally, the Table of Contents is updated on page ii to reflect the name change in section 3.4.5 from the "State of Florida Office of Radiation Control" to the "State of Florida Bureau of Radiation Control" and on page iv to add back Appendix II – Agreement Letters, removed inadvertently with Revision 9.

Several changes were also made in SOP-B.1 (Radiological Emergency) primarily as a result of the recent name changes. However, the Emergency Procedures are no longer contained in the Emergency Plan document but are maintained separately, so these changes were not submitted for approval since they are not part of Revision 10 of the Emergency Plan.

As indicated, all these Revision 10 changes were reviewed by UFTR management and by the Reactor Safety Review Subcommittee to assure they do not decrease the effectiveness of the UFTR Emergency Plan. In general, these changes make the Plan better suited to assuring a proper response to emergencies at the University of Florida Training Reactor.

In a letter dated August 22, 1997 and received on August 28, 1997, NRC Senior Project Manager of the Non-Power Reactors and Decommissioning Project Directorate, Division of Reactor Program Management, Office of Nuclear Reactor Regulation, acknowledged receipt of Revision 10 to the University of Florida Training Reactor Emergency Plan. Based on our determination that the changes do not decrease the effectiveness of our Emergency Plan, and that it continues to meet the requirements of Appendix E to Part 50, the letter indicated NRC approval is not required. The letter also notes their initial review of these changes indicates them to be in accordance with 10 CFR 50.54(q). However, implementation of these changes will be subject to inspection to confirm that they did not decrease the effectiveness of our Emergency Plan. The submission to the NRC including the cover letter summarizing Revision 10 plus the changes themselves are included in Appendix E except that only the first page of the Shands "Plan for Emergency Handling of Radiological Accident Cases" is included in the interest of space. In addition, the attachments are deleted from the agreement letter from Alachua County Emergency Management. Both are available

at the UFTR facility for those interested. A copy of the Project Manager's acknowledgment letter is also available at the facility.

At the end of September 1997, preparations were under way to install this revision in all facility copies of the Emergency Plan and to send them to all off-site holders of the Emergency Plan. In October, with a memorandum dated October 17, 1997, copies of the changes were sent to all off-site holders of the plan with directions for insertion. Subsequently, Pam Koltz of UPD called to say that part of their copy of the Emergency Plan was missing and they needed a new copy. Subsequently, a complete current copy of the Emergency Plan in a 3-ring binder for ease of inserting future changes was supplied to UPD.

At the end of October 1997, preparations were under way to obtain 3-ring binders for all facility copies of the Emergency Plan to facilitate insertion of changes and to track locations on all copies as is done for SOP manuals. The binders were obtained in November and the necessary cover pages planned for tracking purposes. All facility copies of the Emergency Plan were converted in this way with new 3-ring binder copies placed in assigned locations including Director's office, control room, staff offices and Emergency Support Center during the month of December 1997 with a page inserted in all binder copies for ease of tracking future updates.

As the Emergency Plan continues to be evaluated, it is likely that additional changes will be implemented during the upcoming year, especially as the Emergency Plan is reviewed for training purposes. At reporting year's end, no further revisions are planned.

F. Revisions to UFTR Physical Security Plan

In the 1994-95 reporting year, as a result of a Safeguards and Material Control and Accountability Inspection conducted by NRC inspectors on May 18-19, 1995, several recommendations were made including submitting a Security Plan change concerning material allowed on site. They also reviewed a security plan procedure change identified by UFTR review and outlined the proper submission procedure. No violations were identified. With a letter dated July 18, 1995, Physical Security Plan Revision 12 was submitted to NRC as promised to the NRC inspectors. As indicated to the inspection team, this revision involved one change to the plan concerning allowable quantities and locations for special nuclear material on site as well as one correction of a section number in SOP-F.2. In addition, one further minor change was submitted to update SOP-F.2. Since these changes involved no reduction in the effectiveness of the Security Plan, they were submitted per 10 CFR 50.54(p) to keep the Plan updated. The NRC requested and additional information was submitted by letter dated October 27, 1995 and the revision was finally approved by letter dated November 2, 1995. This revision is withheld from public disclosure.

As a result of the annual RSRS audit and a review for training, Physical Security Plan Revision 13 was submitted to NRC per 10 CFR 50.54(p) with a letter dated June 6, 1996 to update various sections of the Security Plan to correct typographical errors, name changes, errors in the text and a number of inconsistencies in the Security Plan, all of which were considered minor in nature. Subsequently, this revision was approved by letter from NRC dated June 19, 1996. This revision is also withheld from public disclosure.

As a result of conducting the Biennial Evaluation of the UFTR Standard Operating Procedures (B-4 Surveillance) completed near the end of the 1996-97 reporting year, Temporary Change Notices were generated and approved for six security response procedures per Table VI-3. The procedures are withheld from public disclosure and are part of the UFTR Physical Security Plan. Changes involved primarily updating the procedures for the name change to the Nuclear and Radiological Engineering Department and movement of all UFTR inspection and reporting requirements from NRC Region II to NRC Headquarters. As a result, Revision 14 of the UFTR Physical Security Plan was under development at the end of the 1996-97 reporting year for submission in the 1997-98 reporting year.

Physical Security Plan Revision 14 was finally submitted to NRC on October 9, 1997 via letter dated October 7, 1997 referencing an attached letter dated September 25, 1997 describing changes and attached change pages submitted per 10 CFR 50.54(p). Most of the changes were administrative in nature such as updating the Plan for changes in the name of the department from "Nuclear Engineering Sciences" to "Nuclear and Radiological Engineering," updating the name of the Radiation Control Office to the Environmental Health and Safety Division, Radiation Control and Radiological Services Department, and changing written submissions to reflect that regulation of non-power reactors is now from the NRC Non-Power Reactor Directorate office and not Region II. To date, there has been no response from NRC as of August 1998.

G. Biennial Reactor Operator Requalification and Recertification Program

The existing operator requalification and recertification program training cycle for the UFTR was scheduled to end in June 1997. Therefore, renewal of the program for the July 1, 1997 through June 30, 1999 period with minor changes and new dates was undertaken by submission to the NRC of the new two-year program cycle with a letter dated May 29, 1997. Since the entire program had been rewritten and approved by NRC in the 1991-92 reporting year, as contained in Appendix H of the 1991-92 annual report, this renewed training program was not expected to require significant review and approvals. In effect, the revised plan was essentially the same as that currently being used for the two-year training cycle with only the name of the Department of Nuclear Engineering Sciences changed to Department of Nuclear and Radiological Engineering in paragraph 3 on page 1 to reflect a change made in late 1996, and several training sessions being moved to later in the cycle. Subsequently, in a letter from the NRC Project Manager dated July 9, 1997 and received on July 14, 1997, the NRC indicated that the revisions do not alter the intent of the approved Plan and therefore are acceptable. A copy of the renewal letter, the revised plan and the NRC letter approving the revised Plan was contained in Appendix F of the 1996-97 report. This program was not changed during the 1997-98 reporting year.

H. UFTR ALARA Program

As the part of the process of implementing the requirements of the new 10 CFR Part 20, a UFTR ALARA Program was generated. This ALARA Program was developed to be consistent with the University of Florida ALARA Program as well and was implemented along with the new 10 CFR Part 20 in January 1994 of this reporting year. A copy of the original UFTR ALARA

Program was in Appendix D of the 1993-94 annual report and was not changed during this reporting year.

I. UFTR Respiratory Protection Program

NRC Inspection Report No. 50-83/94-01 dated April 6, 1994 contained a Severity Level IV Notice of Violation for the failure to have issued a written policy statement on respirator usage and for not having advised users that they could leave an area at any time for relief. Also, the potential respirator users had not been fit tested for the types of respiratory protection equipment at the facility. During May 1994 much work was performed on developing the required respiratory protection program. The facility reply to the Notice of Violation was submitted to NRC as a letter dated May 6, 1994. It indicated that a written statement to all potential respirator users informing them that they may leave the area at any time for relief was issued on May 2, 1994 and that the written policy statement concerning respirator usage was under development with full compliance including documented review and approval of the policy committed to be achieved by August 31, 1994. In a letter dated May 25, 1994 and received on May 31, 1994, the NRC indicated that they had evaluated the UFTR response and found it met the requirements of 10 CFR 20.201 (should be 20.2001).

A draft Respiratory Protection Program was completed and submitted to the RSRS on August 25, 1994. The NRC (Craig Bassett) was informed that the Program would not be approved by the August 31, 1994 commitment date and indicated that such should be officially transmitted to NRC. Subsequently, via letter dated August 31, 1994, the delay in the UFTR commitment was transmitted to the NRC with a new commitment to have the UFTR Respiratory Protection Program approved at the next RSRS meeting scheduled for September 29, 1994 and full compliance including documented review and approval of the policy achieved by September 30, 1994. The initial revised version of the Respiratory Protection Program with a Policy Statement was finally reviewed and approved by the RSRS at its meeting on September 29, 1994 and implemented on September 30, 1994. A revised UFTR Respiratory Protection Program (Revision 1) amending the required frequency of medical examinations was implemented on March 16, 1995. The original (Revision 0) Program Document as well as the Revision 1 version of the UFTR Respiratory Protection Program are contained in Appendix E of the 1994-95 annual report. The Severity Level IV Notice of Violation for failure to comply with all portions of the Respiratory Protection Program was finally closed out during the NRC Inspection conducted on May 22, 1996 per page 7 of NRC Inspection Report No. 50-83/96-01.

As a result of core area maintenance, disassembly and inspection efforts in response to a reactivity anomaly, at the end of June 1998 and throughout the month of July, efforts were under taken to modify the approved UFTR Respiratory Protection Program to allow use of half respirator masks and to schedule the necessary medical examinations for which there was some delay. The necessary physicals for two individuals were conducted on 10 July 1998. The revised UFTR Respiratory Protection Program was ready for internal review and approval by 24 July 1998 but the RSRS Executive Committee was unable to meet for several days. On 24 July 1998, NRC Senior Project Manager Ted Michaels was updated on the status of the checks on the reactivity problem including probable separation on one control blade and plans to disassemble the entire core since

borescope indications are somewhat limited. He was also informed of the detection of airborne particulates at low levels and stop of work and delays in developing and approving the revised Respiratory Protection Program. Specifically, we discussed the use of half-face respirators, status of exams/physicals, etc., and 10 CFR 20.1703(d) requiring notification of the Region II Administrator 30 days before the date of using respiratory protection equipment the first time. Since we normally go directly to the NPR Directorate, we requested direction on what to do next. He was not sure whether we should send in something and asked that he be contacted again on 28 July which was done, whereupon he indicated we should send in the proposed Program when internally approved. Revision 2 of the UFTR Respiratory Protection Program was finally internally approved along with the proposed Policy Statement at an RSRS Executive Committee meeting on 30 July 1998. Subsequently, NRC Senior Project Manager Ted Michaels was contacted on July 30 and he requested submission of the Program for review indicating it should not require 30 days. The internally approved Respiratory Protection Program Revision 2 and the proposed Policy Statement were faxed to the Project Manager on 30 July 1998 to get the review started with the formal submission by letter to the Document Control Desk then accomplished on 3 August 1998.

At the beginning of August, maintenance operations were awaiting NRC review of the Respiratory Protection Program Revision 2. On 3 August 1998, NRC Inspector Stephen Holmes of the Non-Power Reactor Directorate indicated he would visit for an inspection on 13-14 August 1998 in order to provide on-site review verifying that the Respiratory Protection Program Revision 2 was acceptable and reviewed by NRC prior to implementation. Therefore, all the preliminary aspects of implementing the Respiratory Protection Program Revision 2 were addressed prior to his arrival to include acquiring half-face respirators and arranging a visit by Mary Russell on 6 August to provide half-face respirator fits and training three personnel. Subsequently, Vince McLeod provided the same fit tests and training for two other operations personnel including the Facility Director with the whole Respiratory Protection Program Revision 2 administratively reviewed and all documentation completed prior to Mr. Holmes arrival. Upon his arrival on 13 August, Mr. Holmes toured the facility to check on maintenance status, he checked records of fit testing and training as well as the Program itself. Though he continued to interview personnel and check the fit testing equipment on 14 August, Mr. Holmes evaluated that the Program was ready for implementation on the afternoon of 13 August 1998. Therefore, the official implementing memorandum for the Program was issued on 13 August 1998. A new Radiation Work Permit 98-8-I was also opened allowing use of respirators per the Respiratory Protection Program Revision 2 and requiring SRO supervision of operations among other controls with respirators used for moving graphite on the afternoon of 13 August with observation by Mr. Holmes. Inspector Holmes held his exit interview on August 14 prior to leaving indicating no problems were identified and respirators are not required but are optional at the worker's convenience. Subsequently, more graphite was removed on the afternoon of 14 August which was the last day that workers opted to wear respirators as airborne radioactivity levels were measured to be quite low. Subsequently, the RWP 98-8-I was reissued several times during the month as work progressed slowly on further disassembly of the reactor core to address the reactivity anomaly.

J. HEU to LEU Fuel Conversion Documents

The original proposal submitted to NRC to meet 10 CFR 50.64 requirements for scheduling UFTR conversion from HEU to LEU fuel was accepted as meeting the legal requirements for submission in March 1987. However, in a letter dated April 17, 1987 and received on April 22, 1987, the NRC claimed the scheduled span of time from receipt of funding to submittal of our application to convert was too long. The updated (reduced) schedule (Revision 1) showing a reduction of 8 months as presented in Table VI-4 was then submitted to NRC licensing in Washington with a cover letter dated May 14, 1987. During subsequent reporting years, new proposals updating the UFTR conversion schedule and work status per 10 CFR 50.64(b)(2) requirements were submitted to NRC each March to meet the annual March 27 deadline.

After receiving funding, work proceeded as quickly as possible though a shortage of graduate students to perform the neutronic and other analyses caused this work to lag each year. In addition, because of extensive efforts to decontaminate and remodel a room in which to store the SPERT LEU fuel, to change the license description of the SPERT storage facility, to move the fuel to the new facility, to release the previous storage room to unrestricted usage, to revise the facility security plan (SNM-1050) and then to perform a detailed pin by pin visual inspection and verification of serial numbers, the conversion analysis was further delayed in the first two years.

The required visual inspection and identification of SPERT fuel pins was completed on September 19, 1988. As committed, a sufficient number of SPERT fuel pins was radiographed to provide an LEU core and replacement pins for the UFTR by March 31, 1989, when the SPERT usage license was to expire. As for the SNM-1050 license, a significant effort was involved as the renewal license application for renewal under "storage only" conditions was submitted with a letter on March 1, 1989 as required. License No. SNM-1050, as renewed, was dated June 23, 1989 and was received on June 29, 1989. The renewed license authorized "storage only" conditions and has an expiration date of June 30, 1994. The cover letter also specified that any request for amendment to the SNM-1050 license should be submitted in the form of replacement pages to the renewal application submitted on March 1, 1989 with changes or new items clearly identified. Subsequently, in June 1989, an engineering-based decision was finally made not to use the SPERT fuel but rather to use the alternate low enriched silicide plate-type fuel. As a result plans were developed to ship the fuel.

A proposal for support to provide 1200 SPERT fuel pins for transfer for shipment to Oak Ridge National Laboratory was submitted to Martin Marietta Energy Systems, Inc. in January 1990 in response to Request for Proposal CO378-19 dated December 12, 1989. This proposal was submitted to Martin Marietta Energy Systems in January and accepted. Loading of the drums was completed per approved UFSA SOP-U.4 on May 16, 1990 and 1200 pins in 19 DOT type 6M drums plus one (1) empty drum were transferred to Mr. Leon Fair of Martin-Marietta Systems Inc. for shipment by truck to a secure DOE facility at Oak Ridge National Laboratory on May 17, 1990. Revision 3 of the Physical Security Plan (PSP) for the SNM-1050 License was then transmitted to the NRC with a letter dated June 7, 1990 to update the Special Nuclear Material on site following the May 17 transfer of 1200 pins to Martin-Marietta's control. Approval of Revision 3 to the University of

Florida SPERT Assembly Physical Security Plan occurred with a letter dated June 20, 1990 and received on June 26, 1990.

An application to amend the storage-only SNM-1050 license to allow storage of the fuel in the North Quonset Hut (Room 6) versus Room 5 of the Nuclear Research Field Building was submitted to NRC with a letter dated June 6, 1990. This SNM-1050 license amendment making the smaller Room 6 an allowed storage location was approved per a letter and license amendment dated June 14, 1990. All of the remaining 4200 SPERT fuel pins not previously shipped were then moved to Room 6 on July 30. Revision 4 of the SNM-1050 Physical Security Plan was submitted to NRC with a letter dated September 13, 1990 while the response to several security allegations was submitted as a letter also dated September 13, 1990. The next security inspection was conducted on October 25, 1990 by NRC Security Inspector Orysia Masnyk, to investigate security violation allegations associated with the SNM-1050 license as well as to consider final approval of Revision 4 to the Physical Security Plan for the SNM-1050 license. In NRC Inspection Report No. 50-83/90-02 dated November 23, 1990, NRC Region II did close out the allegation and accept implementation of Revision 4 of the UFSA Security Plan.

Throughout the 1988-89 reporting year, the neutronics analysis to support the conversion had been progressing at a slow pace with the graduate student involved deciding to leave for another university when not approved to pursue a doctoral degree. This loss greatly hindered analysis work at the beginning of the 1989-90 reporting year. As a result of the overall slow progress on this work related to UFTR HEU to LEU conversion and funded by DOE, the proposal submitted to NRC with a letter dated March 22, 1989 to meet the annual March 27, 1989 and 1990 deadlines per 10 CFR 50.64(b)(2) showed a further lengthening of the schedule.

An updated proposal was submitted to NRC with a letter dated March 26, 1991 explaining that a student thesis project had resulted in good progress in assuring neutronics methodology is adequate and the modeling of the existing core was nearly complete lacking only several confirmatory calculations and calculations to predict changes caused by temperature effects. NRC was also updated that only scoping calculations had been completed for the proposed LEU core with the number of fuel plates per bundle not yet set in March 1991. It was expected that DOE-supplied funding support of this work would be extended beyond April 30, 1991 so this work could be concluded along with basic thermal hydraulics analysis to conclude the required HEU to LEU safety analysis. A no-cost extension of the Department of Energy Grant DE-FG05-88ER75387 entitled "Conversion of University of Florida Reactor to Low Enriched Uranium (LEU)" was submitted to Ms. Ann Rydalch via a letter dated April 25, 1991 with a copy supplied to Keith Brown. The extension was agreed to be until April 30, 1992 with notification of the extension not received until fall 1991 making some plans and efforts difficult to implement. The updated proposed schedule submitted as required by March 27, 1991 per 10 CFR 50.64(b)(2) therefore showed a further schedule slippage.

The individual working on the neutronics analysis completed his benchmark calculations on the existing UFTR HEU core in April 1991. Subsequently, he completed his thesis work in May 1991 and continued his work until May 23, 1991. After the number of fuel plates per bundle was set at 14 from the neutronics analysis, thermal hydraulics analyses were begun late in the 1990-91

reporting year. During the 1991-92 reporting year, a graduate assistant continued working on the thermal hydraulics area on the 14 plate fuel bundle arrangement selected for the conversion with good progress made to nearly complete this work during that reporting year. Work on the NRC submission package was also begun with limited progress made. During the 1992-93 reporting year and again in the 1993-94, 1994-95 and 1995-96 reporting years, the delay of official grant extension and unavailability of personnel made financial support of this effort more difficult. The same was true in this latest reporting year, so the latest updated proposal schedule submitted as required on March 27, 1997 per 10 CFR 50.64(b)(2) as Revision 11 therefore shows a further schedule slippage as depicted in Table VI-5 of the 1996-97 report. This further delay is because the basic thermal-hydraulics analysis proceeded more slowly than expected and because of DOE questions about fuel and core design arrangements that are requiring staff time to answer in preparation for approving the final fuel bundle design.

Early in the year, a call was made to Dennis Wilson to have the small remaining DOE-supplied funding support for this HEU to LEU analysis work extended to keep the grant open, but no money is available to support actual conversion as explained in the submittal to NRC and as indicated in a letter from John Gutteridge, Program Director, Office of Planning and Analysis, Office of Nuclear Energy, Science and Technology, dated February 23, 1998 and received in early March 1998. Little was accomplished during this year until October 1997 when visiting Professor Marc Caner from the SOREQ Institute in Israel began working on the project with hopes this project could be concluded this year, since the loss of several facility personnel had prevented work in this area previously. There had been a delay in the response to the grant support extension request to DOE; however, as of the end of January 1998, some DOE money was available to be used to support some of Dr. Caner's work. As required, the 1998 updated proposal on the HEU-to-LEU conversion to meet requirements of 10 CFR 50.64(c)(2) was submitted to the NRC with a letter dated March 27, 1998 again explaining the reasons for delays and indicating the updated proposal for the conversion schedule to include submission of the license amendment safety analysis package is now scheduled for October 1998. However, little was accomplished during the year since the loss of several facility personnel had prevented work in this area, but at year's end Dr. Marc Caner is now spending his sabbatical time since December 1997 on the project and work is progressing though confirming dimensions and materials to support the calculations has involved considerable time during July 1998 with Dr. Caner receiving a tour to observe the unstacked core on August 27, 1998.

K. Quality Assurance Program Approval for Radioactive Material Package

During the 1987-88 reporting year, plans were made to ship ~1200 SPERT fuel pins held under the SNM-1050 license to Oak Ridge National Laboratory (ORNL). Since ORNL wanted the University of Florida to be the shipper of record, an approved Quality Assurance Program was needed with the University to be responsible to see that the shipment would meet all 10 CFR 71 requirements. ORNL was planning to have these pins shipped in 6M Type drums on which they would have performed the necessary criticality calculations. The initial request for QA Program approval to ship SPERT F-1 LEU fuel pins was submitted to NRC with a letter dated September 2, 1987. NRC Quality Assurance Program Approval for Radioactive Materials Packages No. 0578, Revision No. 1 with an expiration date of October 31, 1992 and dated November 5, 1987 was received on November 9, 1987.

These 1200 fuel pins were finally transferred to the Oak Ridge National Laboratory on May 17, 1990 under the existing QA Program approval. Efforts are underway to transfer the remainder of the pins but no specific acceptance has ever been received from DOE. Indeed, several inquiries were made by ORNL seeking to ship the 1200 fuel pins back to the University of Florida. Since there was no longer any room to store them in the smaller storage room, this return was categorically disallowed and documented in a letter to Don Ingersoll at ORNL dated October 13, 1992. Even if some or all of the remaining pins are not wanted by ORNL, the QA Program approval will also allow transfer shipment of the SPERT fuel to other secure facilities such as the low power training reactor at RPI. Therefore, it had been hoped that all of these pins could be transferred during this most recent year since they are no longer being considered for the HEU-to-LEU fuel conversion of the UFTR and since the QA Program Approval was to expire on October 31, 1992. However, because DOE has been unable to locate space at a storage facility and because RPI will not accept the fuel unless DOE funds a larger storage facility for them and pays for the fuel shipment, UFTR management is no longer hopeful of near-term shipment of these pins. Therefore, an amended program dated September 30, 1992 was submitted to NRC on September 30, 1992. Quality Assurance Program approval for Radioactive Material Packages No. 0578, Revision 2, dated October 20, 1992 was received on October 26, 1992 and has an expiration date of October 31, 1997. It is contained in Appendix D of the 1994-95 annual report for ease of reference. Nevertheless, the presence of the remaining 4200 SPERT fuel pins in the more confining North Quonset Hut (Room 6) of the Nuclear Research Field Building promises to make the transfer more difficult, time consuming and costly whenever it occurs.

The SNM-1050 license was due to expire on June 30, 1994. However, with a letter dated May 31, 1994, the SNM-1050 License Renewal Application for storage only was submitted on June 4, 1994 under Docket No. 70-1068 to assure extension of the license until the NRC NMSS office could decide on the storage only renewal package in the upcoming year. In various discussions with NRC, NMSS representatives, one of whom visited the facility to clarify geometry and subcriticality considerations, it was decided to cite two unlikely events based on geometry and moderator exclusion in modifying the relicensing submittal. The revised paragraph on Page 4-1 referencing both geometry control and moderator exclusion to prevent inadvertent criticality was finally submitted by fax and letter dated May 12, 1995. NRC NMSS called several more times to say they would extend the exemption on the criticality alarm except when moving fuel and to clarify license renewal to say both Room 6 and Room 5 would be allowed by the license renewal for storage. They verified there is no sprinkler in Room 6. They also verified concern of no sprinkler in Room 5 for fire suppression; that is, they do <u>not</u> want a sprinkler available. Double contingency requires geometry control and moderator (H_2O!) exclusion. They indicated that we could submit a change deleting Room 5 as allowable or they could disallow Room 5 as a license condition. It was agreed that such a license condition is acceptable, so the license renewal was finally received on June 12, 1995 with a letter dated June 8, 1995. The renewal was effective on June 8, 1995 through June 30, 2000. The cover letter and license renewal are contained in Appendix F of the 1994-95 annual report.

NRC representatives of Region II and Region III conducted a material control and accountability inspection of this SNM-1050 fuel storage facility on February 24, 1998. No violations or other concerns were noted.

TABLE VI-1

LISTING OF APPROVED UFTR STANDARD OPERATING PROCEDURES
(as of August 31, 1997)

O. ADMINISTRATIVE CONTROL PROCEDURES

O.1 Operating Document Controls (REV 2, 7/91)
O.2 Control of Maintenance (REV 4, 5/87)
O.3 Control and Documentation of UFTR Modifications (REV 0, 10/85)
O.4 10 CFR 50.59 Evaluation and Determination (REV 1, 5/86)
O.5 UFTR Quality Assurance Program (REV 2, 7/91)
O.6 Reactor Trip and Unscheduled Shutdown Review and Evaluation (REV 0, 5/87)
O.7 Control of NRC 10 CFR 50 Written Communications Requirements (REV 0, 7/87)
O.8 Operator Licensing Requalification Examination Controls (REV 1, 10/89)

A. ROUTINE OPERATING PROCEDURES

A.1 Pre-Operational Checks (REV 16, 2/97)
A.2 Reactor Startup (REV 12, 5/87)
A.3 Reactor Operation at Power (REV 12, 11/94)
A.4 Reactor Shutdown (REV 11, 10/89)
A.5 Experiments (REV 4, 12/88)
A.6 Operation of Secondary Cooling Water (REV 3, 5/95)
A.7 Determination of Control Blade Integral or Differential Reactivity Worth (REV 1, 6/85)
A.8 Pneumatic Rapid Sample Transfer (Rabbit) System (REV 0, 12/88)

B. EMERGENCY PROCEDURES

B.1 Radiological Emergency (REV 5, 1/95)
B.2 Fire (REV 9, 1/95)
B.3 Threat to the Reactor Facility (Superseded by F-Series Procedures)
B.4 Flood (REV 2, 8/97)

C. FUEL HANDLING PROCEDURES

C.1 Irradiated Fuel Handling (REV 4, 2/85)
C.2 Fuel Loading (REV 4, 4/83)
C.3 Fuel Inventory Procedure (REV 4, 8/97)
C.4 Assembly and Disassembly of Irradiated Fuel Elements (REV 0, 9/84)

TABLE VI-1 (CONTINUED)

LISTING OF APPROVED UFTR STANDARD OPERATING PROCEDURES
(as of August 31, 1997)

D. RADIATION CONTROL PROCEDURES

D.1 UFTR Radiation Protection and Control (REV 5, 12/93)
D.2 Radiation Work Permit (REV 10, 3/87)
D.3 Primary Equipment Pit Entry (REV 3, 5/95)
D.4 Removing Irradiated Samples From UFTR Experimental Ports (REV 6, 5/95)
D.5 UFTR Reactor Waste Shipments: Preparations and Transfer (REV 1, 4/92)
D.6 Control of UFTR Radioactive Material Transfers (REV 0, 12/88)

E. MAINTENANCE PROCEDURES

E.1 Changing Primary Purification Demineralizer Resins (REV 4, 8/95)
E.2 Alterations to Reactor Shielding and Graphite Configuration (REV 3, 5/87)
E.3 Shield Tank and Shield Tank Recirculation System Maintenance (REV 2, 4/83)
E.4 UFTR Nuclear Instrumentation Calibration Check (REV 1, 4/90)
E.5 Superseded
E.6 Argon-41 Concentration Measurement (REV 1, 9/93)
E.7 Measurement of Temperature Coefficient of Reactivity (REV 0, 5/85)
E.8 Verification of UFTR Negative Void Coefficient of Reactivity (REV 0, 12/85)

F. SECURITY PLAN RESPONSE PROCEDURES (Reactor Safeguards Material, Disposition Restricted)

F.1 Physical Security Controls (Confidential, except for UFTR Form SOP-F.1A)
F.2 Bomb Threat (Confidential, except for UFTR Form SOP-F.2A)
F.3 Theft of (or Threat of the Theft of) Special Nuclear Material (Confidential, except for UFTR Form SOP-F.3A)
F.4 Civil Disorder (Confidential)
F.5 Fire or Explosion (Confidential)
F.6 Industrial Sabotage (Confidential)
F.7 Security Procedure Controls (REV 2, 10/89)
F.8 UFTR Safeguards Reporting Requirements (REV 0, 9/87)

TABLE VI-2

LISTING OF APPROVED UFTR STANDARD OPERATING PROCEDURES
(as of August 31, 1998)

O. ADMINISTRATIVE CONTROL PROCEDURES

- O.1 Operating Document Controls (REV 2, 7/91)
- O.2 Control of Maintenance (REV 4, 5/87)
- O.3 Control and Documentation of UFTR Modifications (REV 0, 10/85)
- O.4 10 CFR 50.59 Evaluation and Determination (REV 1, 5/86)
- O.5 UFTR Quality Assurance Program (REV 2, 7/91)
- O.6 Reactor Trip and Unscheduled Shutdown Review and Evaluation (REV 0, 5/87)
- O.7 Control of NRC 10 CFR 50 Written Communications Requirements (REV 1, 12/97)
- O.8 Operator Licensing Requalification Examination Controls (REV 1, 10/89)

A. ROUTINE OPERATING PROCEDURES

- A.1 Pre-Operational Checks (REV 16, 2/97)
- A.2 Reactor Startup (REV 12, 5/87)
- A.3 Reactor Operation at Power (REV 12, 11/94)
- A.4 Reactor Shutdown (REV 11, 10/89)
- A.5 Experiments (REV 4, 12/88)
- A.6 Operation of Secondary Cooling Water (REV 3, 5/95)
- A.7 Determination of Control Blade Integral or Differential Reactivity Worth (REV 1, 6/85)
- A.8 Pneumatic Rapid Sample Transfer (Rabbit) System (REV 0, 12/88)

B. EMERGENCY PROCEDURES

- B.1 Radiological Emergency (REV 5, 1/95)
- B.2 Fire (REV 9, 1/95)
- B.3 Threat to the Reactor Facility (Superseded by F-Series Procedures)
- B.4 Flood (REV 2, 8/97)

C. FUEL HANDLING PROCEDURES

- C.1 Irradiated Fuel Handling (REV 4, 2/85)
- C.2 Fuel Loading (REV 4, 4/83)
- C.3 Fuel Inventory Procedure (REV 4, 8/97)
- C.4 Assembly and Disassembly of Irradiated Fuel Elements (REV 0, 9/84)

TABLE VI-2 (CONTINUED)

LISTING OF APPROVED UFTR STANDARD OPERATING PROCEDURES (as of August 31, 1998)

D. RADIATION CONTROL PROCEDURES

D.1 UFTR Radiation Protection and Control (REV 5, 12/93)
D.2 Radiation Work Permit (REV 10, 3/87)
D.3 Primary Equipment Pit Entry (REV 3, 5/95)
D.4 Removing Irradiated Samples From UFTR Experimental Ports (REV 6, 5/95)
D.5 UFTR Reactor Waste Shipments: Preparations and Transfer (REV 1, 4/92)
D.6 Control of UFTR Radioactive Material Transfers (REV 0, 12/88)

E. MAINTENANCE PROCEDURES

E.1 Changing Primary Purification Demineralizer Resins (REV 4, 8/95)
E.2 Alterations to Reactor Shielding and Graphite Configuration (REV 3, 5/87)
E.3 Shield Tank and Shield Tank Recirculation System Maintenance (REV 2, 4/83)
E.4 UFTR Nuclear Instrumentation Calibration Check (REV 1, 4/90)
E.5 Superseded
E.6 Argon-41 Concentration Measurement (REV 1, 9/93)
E.7 Measurement of Temperature Coefficient of Reactivity (REV 0, 5/85)
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F.2 Bomb Threat (Confidential, except for UFTR Form SOP-F.2A)
F.3 Theft of (or Threat of the Theft of) Special Nuclear Material (Confidential, except for UFTR Form SOP-F.3A)
F.4 Civil Disorder (Confidential)
F.5 Fire or Explosion (Confidential)
F.6 Industrial Sabotage (Confidential)
F.7 Security Procedure Controls (REV 2, 10/89)
F.8 UFTR Safeguards Reporting Requirements (REV 1, 12/97)

VII. RADIOACTIVE RELEASES AND ENVIRONMENTAL SURVEILLANCE

This chapter summarizes the gaseous, liquid, and solid radioactive releases from the UFTR facility for this reporting year. Argon-41 is the primary gaseous release. Finally, this chapter includes a summary of personnel exposures at the UFTR facility.

A. Gaseous (Argon-41)

The gaseous releases from the UFTR facility for this reporting year are summarized in Table VII-1. The basis for the gaseous activity release values is indicated in Table VII-2. These values are obtained by periodic measurements of stack concentrations as required by Technical Specifications following UFTR SOP-E.6, "Argon-41 Concentration Measurements."

TABLE VII-1

UFTR GASEOUS RELEASE SUMMARY

Month	Release	Monthly Average Concentration
September 1997	5.1699×10^{6} μCi/Month	1.5662×10^{-9} μCi/ml
October 1997	6.7138×10^{6} μCi/Month	2.0339×10^{-9} μCi/ml
November 1997	6.4712×10^{6} μCi/Month	1.9604×10^{-9} μCi/ml
December 1997	2.7831×10^{6} μCi/Month	0.8431×10^{-9} μCi/ml
January 1998	4.9463×10^{6} μCi/Month	1.5144×10^{-9} μCi/ml
February 1998	2.0964×10^{6} μCi/Month	0.6418×10^{-9} μCi/ml
March 1998	7.4527×10^{6} μCi/Month	2.2812×10^{-9} μCi/ml
April 1998	0.9024×10^{6} μCi/Month	2.7629×10^{-9} μCi/ml
May 1998	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
June 1998	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
July 1998	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
August 1998	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml

TOTAL ARGON-41 Releases for the Reporting Year: 36.5358 Ci

YEARLY AVERAGE ARGON-41 Release Concentration: 1.1337×10^{-9} μCi/ml

UFTR Technical Specifications require average Argon-41 release concentration averaged over a month to be less than 1.0×10^{-8} μCi/ml. All such monthly values are well below this limiting release concentration with an average monthly release concentration of 1.1337×10^{-9} μCi/ml. Even with the newest 10 CFR Part 20 values reducing the Argon-41 release concentration limit to 1.0×10^{-8} μCi/ml in January, 1994, there has been no problem expected as the highest monthly value listed in Table VII-1 is less than 28% of the allowable limit and the second highest is less than 23% of the allowable limit.

Total releases and average monthly concentrations are based upon periodic Argon-41 release concentration measurements made at equilibrium full power (100 kW) conditions. The results for these experimental measurements used in calculating the gaseous Argon-41 release data are summarized in Table VII-2. Entries in Table VII-2 represent the average results of analyses of a minimum of three (3) samples per UFTR SOP-E.6 using a new gas standard obtained in response to NRC Inspection Report No. 88-01.

TABLE VII-2

UFTR GASEOUS RELEASE DATA TABLE

Month(s)	Releases per Unit Energy Generation	Instantaneous Argon-41 Concentration at Full Power [1]
Sep. 1997 - Dec. 1997	3200.95 μCi/kW-hr	6.982×10^{-8} μCi/ml
Jan. 1998 - June 1998	3072.49 μCi/kW-hr	6.773×10^{-8} μCi/ml
July 1998 - Aug. 1998	3072.49 μCi/kW-hr[2]	6.773×10^{-8} μCi/ml [2]

[1]Values used to assure average release concentration meets 10 CFR 20 limits.
[2]These values are the same as the previous period because the experimental measurements were not conducted during this time period due to maintenance and eventual disassembly of the core that precluded measurements (MLP 98-15).

B. Liquid Waste from the UFTR/Nuclear Sciences Complex

The effluent discharged into the holding tanks comes from 20 laboratories within the Nuclear Sciences Center as well as the UFTR complex. The UFTR normally releases about one (1) liter of primary coolant per week to the holdup tanks as waste from primary coolant sampling. A total of 52 weekly samples were taken during this reporting year; the average activity for these coolant samples was 1.19×10^{-7} μCi/ml (β-γ) and 1.54×10^{-8} μCi/ml (α) for this 1996-1997 reporting period. There were two discharges from the holding tanks this reporting period. On 9/25/97, and 9/26/97 a total of 84,500 liters were discharged. The tank contained 0.24 μCi of Total activity, 0.33 μCi of Dissolved Activity, and less than 0.04 μCi Activity of Suspended solids. These were the first discharges from the hold-up tanks since July 13, 1995.

C. Solid Waste Shipped Off-site

The UFTR facility made no shipments of solid waste during this reporting year. The last shipment was made on December 10, 1985 through ADCO Services, Inc. and consisted of one 55-gallon drum containing radioactive scrap metal parts as well as paper, plastic, and other reactor-related waste materials associated primarily with the work to restore proper functioning of the UFTR control blade drive systems. The activity of the shipment was approximately 3.125 Curies with the activity primarily attributed to Cobalt-60. Though a similar shipment of two drums was planned for the last seven reporting years and again this reporting year to remove all of the products resulting from the control blade restoration and maintenance project of 1985-1986, this shipment has not occurred to date. No date has been set for this shipment though it is expected to occur sometime during the next reporting year as waste from several other small maintenance projects is consolidated for shipment to clear space for waste expected to be generated during the UFTR conversion from HEU to LEU fuel expected within two years. The new Standard Operating Procedure UFTR SOP-D.5, "UFTR Reactor Waste Shipments: Preparations and Transfer" originally generated in the 1986-1987 reporting year and revised in April, 1992 will be used to assure proper control of the waste shipment as will guidance provided in several NRC Information Notices published in the last several years.

D. Environmental Monitoring

The UFTR maintains continuous thermoluminescent dosimeter monitoring in areas adjacent to and in the vicinity of the UFTR complex. The TLD cumulative totals for this reporting year from September, 1997 to August, 1998 are summarized in Table VII-3A. As can be noted, the values for the 12 months of the reporting period are either minimal or low in all cases. Overall, the values in Tables VII-3A and VII-3B show minimal environmental radiation dose from UFTR operations. The recorded TLD exposures are essentially background to within the accuracy of the monitoring instruments.

The accumulation of exposure recorded by month of exposure on the TLDs is presented in Table VII-3B. The values recorded in Tables VII-3A and VII-3B are considered to support the conclusion of minimal environmental exposures from UFTR operations. TLD Number 2 received higher than average exposure (Jun 98, Jul 98, Aug 98) due to its monitoring location above the area where work was being performed on the exposed reactor core during that time period (MLP 98-15).

TABLE VII-3A

CUMULATIVE RESULTS OF ENVIRONMENTAL MONITORING SEPTEMBER 1, 1996 TO AUGUST 31, 1997

TLD Designation	Total Exposure (mrem) [1]	Month(s) of Exposure
1	50	12/97, 10/98, 6/98
2	170	11/97, 12/97, 3/98, 6/98, 7/98, 8/98
3	M	--
4	M	--
5	20	3/98, 6/98
6	20	2/98, 3/98,
7	M	--
8	M	--
9	M	--
10	30	11/97, 3/98
11	M	--
12	40	11/97, 1/98

[1]M denotes minimal (<10 mrem) exposure.

TABLE VII-3B

THERMOLUMINESCENT DOSIMETER EXPOSURE RECORD BY MONTH OF EXPOSURE [1]

TLD Number	Sep 97 (mrem)	Oct 97 (mrem)	Nov 97 (mrem)	Dec 97 (mrem)	Jan 98 (mrem)	Feb 98 (mrem)	Mar 98 (mrem)	Apr 98 (mrem)	May 98 (mrem)	Jun 98 (mrem)	Jul 98 (mrem)	Aug 98 (mrem)
1	M	M	M	20	M	M	10	M	M	20	M	M
2	M	M	10	10	M	M	30	M	M	10	20	90
3	M	M	M	M	M	M	M	M	M	M	M	M
4	M	M	M	M	M	M	M	M	M	M	M	M
5	M	M	M	M	M	M	10	M	M	10	M	M
6	M	M	M	M	M	10	10	M	M	M	M	M
7	M	M	M	M	M	M	M	M	M	M	M	M
8	M	M	M	M	M	M	M	M	M	M	M	M
9	M	M	M	M	M	M	M	M	M	M	M	M
10	M	M	10	M	M	M	20	1M	M	M	M	M
11	M	M	M	M	M	M	M	M	M	M	M	M
12	M	M	30	M	10	M	M	M	M	M	M	M

[1]M denotes minimal (<10 mrem) exposure.

E. Personal Radiation Exposure

UFTR-associated personnel exposures greater than minimum detectable during the reporting period are summarized in this section. During the 1997-1998 reporting year major maintenance in the core area involved relatively large dose commitments (MLP 98-15). Maintenance and experimental work in and out of the Reactor core requiring significant exposure commitment was minimized as much as possible.

Table VII-4 lists the permanent whole-body badge exposures recorded above background for the reporting year for personnel employed directly at the UFTR. These exposures are summarized for all badged personnel on an annual basis. The higher exposures received by G. Macdonald and R. Salazar were a result of the work in the reactor core area.

TABLE VII-4

ANNUAL UFTR PERSONNEL EXPOSURE

Name	Position	Permanent Film Badge Exposure (mrem) [1]
J. Powers	Senior Reactor Operator	10
J. Wolf	Senior Reactor Operator	20
W. Vernetson	Senior Reactor Operator	<10
R. Salazar	Reactor Operator Trainee	50
G. Macdonald	Reactor Operator Trainee	130

[1]The exposure recorded here is for deep/whole-body dose.

Table VII-5 lists the permanent whole-body badge exposures recorded above background for the reporting year for non-permanent personnel employed at the UFTR. These exposures are summarized for all badged non-permanent UFTR personnel on an annual basis with no further breakdown because all exposures are well below 100 mrem for the year.

TABLE VII-5

ANNUAL NON-PERMANENT UFTR PERSONNEL EXPOSURE

Name	Position	Permanent Film Badge Exposure (mrem) [1]
B. Uhlmer	NAA Lab/Radiation Control Technician	10
S. Iverstine	NAA Lab/Reactor Facility Technician	10
A. Knight	NAA Lab/Reactor Facility Technician	10

[1]The exposure recorded here is for deep/whole-body dose.

Table VII-6 lists the prompt reading dosimeter exposure measurement for visitors, students, or other non-permanent UFTR personnel. No individual had a non-zero prompt reading dosimeter exposure measurement over the entire reporting period as indicated in Table VII-6.

TABLE VII-6

EXPOSURE RECORDS FOR NON-PERMANENT UFTR PERSONNEL AS RECORDED BY PROMPT-READING DOSIMETERS

Personnel[1]	Date	Exposure (mrem) [1]	Comments
--	--	--	--

[1]All exposures readings are for whole-body exposures.

It should be noted that tours of reactor facilities are strictly controlled and limited during periods when the reactor is running or ports are open or other opportunities for significant radiation fields are present. Therefore, the lack of visitor exposure is expected and in agreement with ALARA guidelines.