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February 21, 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 1998-99 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

cc: J. Wolf

Sworn and subscribed this 21st day of February 2001

Elizabeth F. Bruce
Notary Public

Elizabeth F. Bruce
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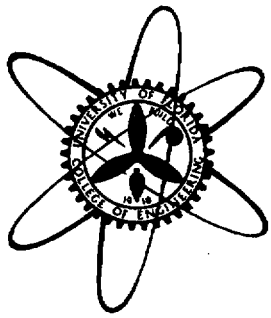
Report: DOE/NE/38152-3

UNIVERSITY OF FLORIDA TRAINING REACTOR ANNUAL PROGRESS REPORT

SEPTEMBER 1, 1998 – AUGUST 31, 1999



Submitted by
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February 2000

U.S. Department of Energy
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UNIVERSITY OF FLORIDA
TRAINING REACTOR
ANNUAL PROGRESS REPORT

SEPTEMBER 1, 1998 – AUGUST 31, 1999

Submitted By
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Gainesville, Florida

February 2000

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1998-99 ANNUAL REPORT

I. INTRODUCTION

A. Overall Utilization

The University of Florida Training Reactor's overall utilization for the past reporting year (September 1998 through August 1999) continued to be at historically high levels of quality usage, limited only by unavailability of the reactor or necessary personnel, although the extended outage for investigating the reactivity anomaly carried over from the previous year until a return to normal operations on August 17, 1999. 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 4.01% primarily due to an over eleven month outage to continue investigating a core reactivity anomaly and eventually restore the reactor to normal operations. 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. Availability for this year would be unaffected due to overlapping with the large outage.

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 1970s and most usage indicators remaining high 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). This acting manager was replaced with the other part-time licensed SRO on May 13, 1999 to facilitate return to normal operations. 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 1996-97 reporting year has continued to present a challenge throughout the reporting year for research usage of the facility though an acting NAA Laboratory manager was appointed in May 1999. Facility operations for all usages especially external users under the DOE Reactor Sharing Program are delineated in Section III indicating the diversity of usage.

The yearly total energy generation of 3.429 Megawatt-hours for the 1998-99 reporting year represents a decrease of 70.48% from the previous reporting year. However, although this value ranks far last in energy generation in the last ten years, this is simply because of the lengthy outage. So this years' energy generation would rank last in the first 14 years of UFTR operational history licensed at 100 kW, or any other period 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 outage to address the reactivity anomaly, though usually it is 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 in progress at year's end after awaiting recovery from the outage as well as the forced outage time increasing significantly from the previous year, from over 131 days to over 350 days, extending almost to year's end for investigating the reactivity anomaly. The planned unavailability was reduced somewhat from just over 13 days to just ⅜ day with the only credited contribution due to replacing the stack dilute fan coupling in August 1999 after returning to normal operations.

The run time, time when the reactor is running at any power level, has decreased by over 64% 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 eleven months of the year. On a positive note, this decrease coupled with a slight increase in experiment time (11.16%) 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. In many years, 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, though this was not the case this 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 some 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 66 hours of experiment time this year including some time to address security and fire alarms and the effects of building experiments on the fuel storage facility but with no visit for NRC inspection of the SNM-1050 license.

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 history of the facility. 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 than usual. As noted previously, the primary forced outage was for addressing the anomalous loss of reactivity resulting in a lengthy forced outage (350 days) extending from the beginning of the reporting year with the reactor defueled and partially disassembled through completion of disassembly, reassembly, refueling and return to normal operations on August 17, 1999. With the largest outage accounting for over 350 days forced down time, no other forced outage was significant in length, though some of the failures and maintenance activities contributed to extending the forced outage 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, 1995-96, 1996-97 or 1997-98 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 1996-97 reporting year.

As indicated above, the total run time for the facility was decreased over 64% 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 throughout the year 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 perform training 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 six 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 eleven 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 was 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 University Reactor 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. The oversize monitor on the computer is an excellent teaching and training tool. In this year the facility also received fourteen self-reading pocket dosimeters plus a hand-held self-powered charger.

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.

During the 1998-99 reporting year, with the reactor outage for normal operations extending to mid-August 1999, little NAA could be accomplished other than training students which was extensive. During this year, much troubleshooting was undertaken to assure the three HPGe detectors as well as associated hardware and software were operating properly as there were a number of problems corrected by in-house staff with occasional input from EG&G ORTEC consultants. Mr. Sam Iverstine was appointed Acting Manager of the NAA Laboratory on May 26, 1999 in hopes of developing better laboratory operations and solidifying progress made over the year.

Upgraded ORTEC Gammavision software for NAA applications was acquired and implemented in October 1998. Equipment acquisitions during June and July 1999 included a vacuum indicator, two vacuum desiccators, vacuum desiccator plate, and one pair of safety glasses. New cryoprotective gloves were also acquired. A new frame was built and an updated Chart of Nuclides posted as well. In addition, the hot cave west remote manipulator arm was overhauled extensively as implementation of an automatic sample changer was also progressing. Finally, a new laser printer was obtained in August 1999 to replace a failed one.

In a letter dated June 30, 1998 in the previous reporting year, the facility was informed that it had been recommended to receive funding for an on-line stack radiation monitoring system and a new high purity germanium detector system and associated electronics under the DOE University Reactor Instrumentation (URI) Program grant. Although efforts were nearing completion to acquire these two items at years end, a no-cost grant extension was as ORTEC (now PerkinElmer) was proving difficult both in its ability to supply the items and in supplying what had been quoted in the case of the stack monitoring system. The UFTR facility has also been approved to receive a number

of items under the FY 1999 URI grant including an emergency response kit with extra friskers), a specialized computer for central records storage, twenty-four self-reading pocket dosimeters, two digital pocket dosimeters, and $4,000 toward the purchase of portable shield material. It is hoped to obtain this material early in the 1999-00 reporting year with the grant running from June 28, 1999 to June 27, 2000 as some work already has been accomplished toward acquiring the specialized computer.

As part of the effort to remove the underground wastewater holdup tanks, they were disconnected in May 1999 under 10 CFR 50.59 Evaluation and Determination Number 99-04 (Modification/Upgrade of Effluent Discharge System for Reactor Building). They were replaced with a 1,000 gallon aboveground outside tank plus a 150 gallon inside tank in the reactor cell. The 1,000 gallon tank was bought with COE support which also paid for the disconnect of the old tanks as the most significant facility improvement in progress for the 1998-99 reporting year.

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 1998-99 reporting year was the fifteenth consecutive year in which the UFTR was supported as part of the Reactor Sharing Program; even better, the support was at an increased support level after decreases for several years.

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, 38 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 before the end of the year despite the lengthy reactor outage. 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 to $30,000 for the 1995-96 reporting year, further significant expansion of this usage was enthusiastically undertaken. Despite a decrease of 20% down to $24,000 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, all users were accommodated as much as possible relative to the reactor unavailability. With a further increase to $47,000 for the 1999-00 reporting year and with 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 two 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 several years ago) 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. The 1997-98 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 current year saw work continue on the automation of the k_0-standardization method and several training projects in performance of INAA. 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.

The 1996-97 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 last year included stoichiometric measurements of Al/Na ratios in various compounds. Other continued research projects last 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. All of these projects are expected to continue with the return to normal operations for the new year. 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 with the letter already underway in August 1999. 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 DOE-sponsored 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 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 in the 1996-97 year are primarily to demonstrate capabilities to support proposals seeking external support as an outgrowth of the 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 DOE University Reactor Instrumentation (URI) Program was not renewed for the 1994-95, 1995-96,1996-97 or 1997-98 reporting years, 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.

As noted earlier, the DOE URI grants were re-instituted for the 1998-99 reporting year. Negotiations were continuing at year's end to obtain the two items (high purity germanium detector with associated electronics and a stack radiation monitoring system) funded in the 1998-99 reporting year and efforts have begun to obtain the items funded for the 1999-00 year to include an emergency response kit with extra frisker, a specialized computer for central records storage, 24 SRPDs, two digital pocket dosimeters and $4,000 worth of portable shielding with acquisition efforts beginning at the end of the 1998-99 reporting year. Indications are that the DOE URI grant program will continue in the next year which is a positive indicator for facilitating facility usage.

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 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 the 1997-98 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 several years, though data to date has been sufficient to support periodic 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 University Reactor 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 six 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.

During the 1998-99 reporting year, with the reactor outage for normal operations extending to mid-August 1999, little NAA could be accomplished other than training students which was extensive. During this year, much troubleshooting was undertaken to assure the three HPGe detectors as well as associated hardware and software were operating properly as there were a number of problems corrected by in-house staff with occasional input from EG&G ORTEC consultants. Mr. Sam Iverstine was appointed Acting Manager of the NAA Laboratory on May 26, 1999 in hopes of developing better laboratory operations and solidifying progress made over the year. Upgraded ORTEC Gammavision software for NAA applications was acquired and implemented in October 1998. Equipment acquisitions during June and July 1999 included a vacuum indicator, two vacuum desiccators, vacuum desiccator plate, and one pair of safety glasses.

New cryoprotective gloves were also acquired. A new frame was built and an updated Chart of Nuclides posted as well. In addition, the hot cave west remote manipulator arm was overhauled extensively as implementation of an automatic sample changer was also progressing. Finally, a new laser printer was obtained in August 1999 to replace a failed one.

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 1997-98 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 proven to be valuable, reliable staff additions. They were both expected to be licensed soon after ending the outage in the 1998-99 reporting year.

During the 1998-99 reporting year, little operations training could be accomplished toward licensing the two SRO-trainees in place since the 1997-98 reporting year. Two SROs were employed throughout the year; however, one worked little until being appointed Acting Reactor Manager in place of the other effective May 13, 1999 to facilitate recovery operations. Unfortunately, the person replaced as reactor manager then graduated and left the facility with his last work day August 5, 1999, leaving only two licensed operators at year's end. An additional SRO-trainee was hired in March 1999 but family and personal problems unfortunately resulted in his resignation in May 1999. At year's end, with the reactor back to normal operations, it is expected that both of the long-time SRO-trainees can be licensed by the end of 1999 to support the many facility activities being planned. As the new NAA Laboratory personnel get experience with sample processing, the availability of both types of personnel should improve in the next reporting year to support the multitude of planned and in some cases delayed research and educational activities.

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. Although there were no changes to Tech Specs, there were changes to many other documents as well as other activities involving much administrative commitment of resources. The total time devoted to NRC communications was at one of the highest levels in recent years, especially with the need to keep NRC informed of activities to address the reactivity anomaly during the 1998-99 reporting year.

During the 1998-99 reporting year, Revision 11 to the UFTR Safety Analysis Report (FSAR) was initiated as a result of changes in personnel monitoring badges supplied to the University by the NVLAP-accredited supplier (Landauer). By memorandum dated December 10, 1998 and received on December 16, 1998, the UFTR facility was informed by the Radiation Control Office that the University's dosimeter company, NVLAP-certified Landauer, Inc., was switching from film badges to Luxel dosimeters for personnel monitoring badges. Various information was used to support 10 CFR 50.59 Evaluation and Determination Number 98-10 (Personnel Monitoring Device Change from Film/TLD Badges to Luxel Dosimeters) for the change in dosimetry and the associated change in the UFTR FSAR as well as various procedural changes to refer to personnel monitoring badges instead of film badges. This change was implemented in late February and submitted to NRC with a cover letter dated February 19, 1999. This Revision 11 change was fully reviewed by UFTR management and by the Reactor Safety Review Subcommittee to assure no unreviewed safety question was involved and so is not considered to relax the requirements for assuring protection of the health and safety of the public and of the reactor facility. The change simply updates the FSAR to reflect the existing facility and its operations by updating the allowable types of personnel monitoring badges to be worn by those working in the reactor. This change was incorporated into

all facility copies of the UFTR FSAR in February 1999 to close out this change. There have been no other subsequent revisions of the UFTR FSAR. However, with completion of most neutronics and thermal-hydraulics analyses to support the HEU-to-LEU conversion, other FSAR updates are planned as necessary to keep the FSAR current and to support the planned HEU-to-LEU fuel conversion and subsequent preparations for relicensing the UFTR.

During the 1998-99 reporting year, Revision 11 to the approved UFTR Emergency Plan was submitted to NRC with an explanatory cover letter dated February 18, 1999. These changes are considered relatively minor in nature and are the result of reviews of the Plan and UFTR plans for and responses to simulated emergencies. Most are simple changes to account for name changes or correct typographical errors. All these 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 telephone conversation on February 25, 1999, NRC Senior Project Manager Ted Michaels indicated that, based on our review and no reduced effectiveness of our Emergency Plan, Revision 11 could be implemented subject to our schedule with no prior NRC approval needed. This implementation was in progress at the end of February. During March 1999, Revision 11 was supplied to all offsite holders of the Plan with a cover letter and instructions on maintaining a complete copy. With a letter dated April 16, 1999 and received on April 23, 1999 from Senior Project Manager Ted Michaels, the NRC indicated that based on the licensee evaluation that the changes do not decrease the Plan effectiveness and it continues to meet the requirements of 10 CFR 50, Appendix E, no NRC approval is needed. However, he indicated initial NRC review of the changes shows they are in accordance with 10 CFR 50.54(q) so implementation of the changes will be subject to inspection to confirm that the changes do not decrease effectiveness of the Plan. The facility copies of the Plan were updated on July 29, 1999.

Physical Security Plan Revision 14 was submitted to NRC on October 9, 1997 via letter dated October 7, 1997 referencing an attached letter dated September 25, 1997 describing changes submitted per 10 CFR 50.54(p). Most of the changes were administrative in nature. There had been no response from NRC; however, NRC inspector Stephen Holmes indicated on October 8, 1998 that no approval would be given for changes reviewed by the licensee as not reducing Security Plan effectiveness per 10 CFR 50.54(p). Therefore, the changes were incorporated into the Security Plan on October 23/26, 1998 to close out implementation of Revision 14.

No new Standard Operating Procedures (SOPs) were generated during the 1998-99 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. Although there were no revisions generated during the 1998-99 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, to implement FSAR Revision 11, 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). There were eleven of these Temporary Change Notices in the 1998-99 year.

The existing operator requalification and recertification program training cycle for the University of Florida Training Reactor was scheduled to end in June 1999. Therefore, renewal of the approved plan for the July 1, 1999 through June 30, 2001 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 14, 1999. In effect, the revised plan is essentially the same as that used for the previous two-year training cycle with the removal of the duplicate training on standard operating procedures the only significant change. In recent years the procedures for the UFTR have not changed significantly and when they do, special training is conducted to assure all operations staff are cognizant of the change. For this reason there is no need to have procedure training conducted in February of one year and then April of the next. Therefore, the second training lecture and examination on standard operating procedures was deleted from the training schedule. This renewed plan is intended to cover the UFTR operator requalification and recertification program from July 1999 through June 2001. Subsequently, in a letter from the NRC Project Manager dated June 15, 1999 and received on June 21, 1999, the NRC indicated that the revisions do not alter the intent of the approved Plan and therefore are acceptable. A copy of the revised Plan implemented beginning July 1, 1999 is available for reference purposes at the UFTR facility.

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 $2.584 million as of June 1999. 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 1999 to meet the requirements of 10 CFR 50.64(c)(2). Therefore, the commitment of time and resources to address NRC requirements has been at least as extensive and probably more so in the 1998-99 reporting year for responses and communications with NRC as in most or even any 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 safety and others requiring a response such as the UF Natural Disaster Plan update 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 and IAEA fuel surveys. The RSRS audit and the EH&S safety inspection each required considerable facility resources for adequate responses.

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. Some progress was made in completing the HEU to LEU analysis during the latter half of the 1997-98 reporting year by visiting professor Dr. Marc Caner from the SOREQ Institute. During the 1998-99 reporting year, Dr. Caner provided some information on reactivity coefficients and completed his reactor physics analyses for the HEU-to-LEU conversion. A draft copy of his work to date on conversion dated September 23, 1998 was received on September 28, 1998. A "final" copy of his work to date was received on December 16, 1998. During March 1999, the internal review was completed and the report finalized with this work generally agreeing with earlier reactor physics analyses. Several discussions have occurred since as Dr. Caner provided proposed Tech Spec changes in June and left all his work well documented before he finally left on July 20, 1999 to return to the SOREQ Institute.

During the 1998-99 reporting year, there was no activity to return the SNM-1050 SPERT fuel as efforts to get the Department of Energy to take this fuel back have been unsuccessful to date. It is hoped that renewed efforts spearheaded by the Radiation Control Office will be able to get this fuel removed to allow cancellation of the SNM-1050 license and decommissioning of the facility during the next reporting year (1999-00). There is some expectation for success as the DOE now has a program for accepting back such material. In a related area there was considerable administrative activity. The largest external project accomplished during the 1998-99 reporting year was to oversee and assist with delivery of two 600 Ci Cobalt-60 sources which were accepted into the reactor cell making use of the overhead crane. In addition to receiving the two fresh Co-60 sources, two depleted sources (<150 Ci each) were processed, repackaged and shipped back to the vendor. This required an amendment to the UFTR Quality Assurance Program No. 0578 to make it very general. Proposed Revision 4 to the QA Program was sent to NRC with a letter dated March 29, 1999. Subsequently, Quality Assurance Program Approval for Radioactive Material Packages No. 0578, Revision No. 4 was approved by NRC letter dated May 19, 1999. It is hoped this renewed QA Program Revision 4 will also be useable for shipping the SNM-1050 licensed fuel when the time comes. The spent Co-60 sources were shipped out in May 1999 with no problems encountered.

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. 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 hoped to get a graduate student 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 the 11½ month outage related to addressing the reactivity anomaly and core disassembly which lasted for 350 days from the beginning of the reporting year. The total outage time spent on maintenance activities was the largest ever and much larger than in any recent year, essentially entirely attributable to the reactivity anomaly though exacerbated by other failures and limited personnel to address recovery operations. As a result, the main outage was lengthened in part because of unavailability of personnel to address the failure on a full time basis. There was little "planned" unavailability throughout the year though some of the forced outage certainly coincided with such activities as completing the annual calibration check of the nuclear instrumentation (A-2 Surveillance) in August 1999 (10 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 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 thirteen reporting years (1986-1999). The DOE-sponsored 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 $47,000 for the next year after an increase for 1995-96 ($30,000) and then a decrease for 1996-97 ($24,000) and 1997-98 ($22,000) before reaching $32,000 in 1998-99 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 1999-00 reporting year are very 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

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 1998 – August 1999)
J. Powers	-	Student Senior Reactor Operator and Acting Reactor Manager (1/2 time) (September 1998 – May 12, 1999)
	-	Student Senior Reactor Operator (1/2 time) (May 13, 1999 – August 5, 1999)
J. Wolf	-	Student Senior Reactor Operator (1/20 time) (September 1998 – May 12, 1999)
	-	Student Senior Reactor Operator and Acting Reactor Manager (9/10 time) (May 13, 1999 – August 1999)
R. Salazar	-	Student Technician and Senior Reactor Operator Trainee (2/3 time) (September 1998 – August 1999)
G. Macdonald	-	Technician and Senior Reactor Operator Trainee (1/2 time) (September 1998 – August 1999)
T. Colbert	-	Student Technician and Senior Reactor Operator Trainee (1/2 time) (March 1999 – May 1999)
S. Iverstine[1]	-	Student Radiation Control Technician (1/50 time) (September 1998 – August 1999)
B. Uhlmer[2]	-	Student Technician/Radiation Control Technician (1/50 time) (September 1998 – August 1999)
D. Seifert	-	Secretary (3/4 time) (September 1998 – June1999)
	-	Secretary (full time) (July 1999 – August 1999)

[1]S. Iverstine worked periodically in the NAA Laboratory but remained qualified and occasionally served as a radiation control technician throughout the year.

[2]B. Uhlmer worked periodically 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 1998 – August 1999)
J. Parker	-	Radiation Control Technician (September 1998 – August 1999)

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. Several others with only infrequent contact at the UFTR are not listed though they are available for backup purposes or if an emergency should arise.

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) (September 1998 – June 1999)
	-	RSRS Chairman (Interim Dean, College of Engineering, and Professor, Department of Nuclear and Radiological Engineering) (July 1999 – August 1999)
W. G. Vernetson	-	Member (Director of Nuclear Facilities)
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)

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

D. Line Responsibility for UFTR Administration

J. V. Lombardi	-	President, University of Florida
W. M. Phillips	-	Dean, College of Engineering (September 1998 – June 1999)
M. J. Ohanian	-	Interim Dean, College of Engineering (July 1999 – August 1999)
J. S. Tulenko	-	Chairman, Department of Nuclear and Radiological Engineering
W. G. Vernetson	-	Director of Nuclear Facilities
J. Powers	-	Acting Reactor Manager (September 1998 – May 12, 1999)
J. Wolf	-	Acting Reactor Manager (May 13, 1999 – August 1999)

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 nearly year-long forced outage rate necessitating concentrating on educational usage of the facility without reactor operation. 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 as they were on hold awaiting return to normal operations, 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 first time in four years in a row, however, there was a Department of Energy University Reactor Instrumentation (URI) Grant to provide support for instrumentation upgrades during the year as notice of such was received in July 1998. A new URI grant for the next year was also received in May 1999.

As noted over the last fourteen years, the continuing refurbishment of the Neutron Activation Analysis (NAA) 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 thirteen 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 six 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 four 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 four 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 were 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.

During the 1998-99 reporting year, with the reactor outage for normal operations extending to mid-August 1999, little NAA could be accomplished other than training students which was extensive. During this year, much troubleshooting was undertaken to assure the three HPGe detectors as well as associated hardware and software were operating properly as there were a number of problems corrected by in-house staff with occasional input from EG&G ORTEC consultants. Mr. Sam Iverstine was appointed Acting Manager of the NAA Laboratory on May 26, 1999 in hopes of developing better laboratory operations and solidifying progress made over the year.

Upgraded ORTEC Gammavision software for NAA applications was acquired and implemented in October 1998. Equipment acquisitions during June and July 1999 included a vacuum indicator, two vacuum desiccators, vacuum desiccator plate, and one pair of safety glasses. New cryoprotective gloves were also acquired. A new frame was built and an updated Chart of Nuclides posted as well. In addition, the hot cave west remote manipulator arm was finally repaired in June and again in July 1999. During June, a representative from EG&G ORTEC was contacted and did provide information to allow successful running of the automatic sample changer software

in the Gammavision software. The multi-channel analyzers (MCAs) do not respond with a pulse to run the sample changer when the program tells them to so the NRE electronics engineer has been contacted for an MCA evaluation. Faster sample changer motors have also been acquired from the electronics engineer but have not yet been installed as the sample changer interface with software problem continues under investigation. Finally, a new laser printer was acquired in August 1999 to replace a failed one.

In a letter dated June 30, 1998 in the previous reporting year, the facility was informed that it had been recommended to receive funding for two of its requests (item 3 for an on-line stack radiation monitoring system and item 6 for a new high purity germanium detector system in the proposal totaling $62,400) under the DOE University Reactor Instrumentation Grant Program. The account of this funding was in place as of the end of August 1998 and due to end in early August 1999 so efforts were nearing completion to acquire these two items; however, in August 1999, a no-cost grant extension was obtained to extend the August 13, 1999 closeout date to November 13, 1999 as ORTEC (now PerkinElmer) was proving difficult both in its ability to supply the items and in supplying what had been quoted in the case of the stack monitoring system.

A copy of a certified letter from the DOE Idaho Operations Office dated May 3, 1999 and received on May 11, 1999 indicates the facility has been approved to receive a number of items under the FY 1999 University Reactor Instrumentation (URI) Grant for which a proposal was submitted in January 1999. The letter proposes negotiations for approval of item 1 (emergency response kit with extra friskers), item 2 (specialized computer for central records storage), item 3 (24 self-reading pocket dosimeters), two of the proposed six digital pocket dosimeters in item 6, and $4,000 toward the purchase of portable shield material (item 7) selected from our proposal, totaling $15,330. It is hoped to obtain this material in the near future as the money is now available with the grant running from June 28, 1999 to June 27, 2000 in the next reporting year as some work already has been accomplished toward acquiring the specialized computer by the end of the 1998-99 reporting year.

As part of the effort to remove the underground wastewater holdup tanks, they were disconnected in May 1999 under 10 CFR 50.59 Evaluation and Determination Number 99-04 (Modification/Upgrade of Effluent Discharge System for Reactor Building). They were replaced with a 1,000 gallon aboveground outside tank plus a 150 gallon inside tank in the reactor cell. The 1,000 gallon tank was bought with COE support which also paid for the disconnect of the old tanks as the most significant facility improvement in progress for the 1998-99 reporting year.

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 and throughout the 1998-99 reporting year, though the extended outage restricted activities.

During the 1997-98 reporting year, 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 last year (1997-98) to investigate the possibility of similar work though little has come of this inquiry to date, partly due to the extended outage. 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. This year there were no commercial research projects to utilize the beam transmission facilities nor for the production of Copper-64 for the Shands hospital positron-emission tomography (PET) scanners as both users inquired periodically but the extended outage prevented these usages. There was also some seed project trace analysis of CeO_2 to support the MOX program at Los Alamos in the 1997-98 reporting year as a funded program may be possible; however, again such usage was prevented by the extended outage to investigate the reactivity anomaly. 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 as a return to high availability is expected.

The largest external project accomplished during the 1998-99 reporting year was to oversee and assist with delivery of two 600 Ci Cobalt-60 sources which were accepted into the reactor cell making use of the overhead crane. In addition to receiving the two fresh Co-60 sources, two depleted sources (<150 Ci each) were processed, repackaged and shipped back to the vendor. This required an amendment to the UFTR Quality Assurance Program No. 0578 to make it very general. Proposed Revision 4 to the QA Program was sent to NRC with a letter dated March 29, 1999. Subsequently, Quality Assurance Program Approval for Radioactive Material Packages No. 0578, Revision No. 4 was approved by NRC letter dated May 19, 1999. It is hoped this renewed QA Program Revision 4 will also be useable for shipping the SNM-1050 licensed SPERT fuel when the time comes. The spent Co-60 sources were then shipped out in May 1999 with no problems encountered.

The level of administrative work dedicated to regulatory activities is expected to be at a similar or increased level during the next reporting year. The facility received only one NRC inspection during this reporting year—a regular scheduled health physics as well as safeguards and physical security inspection on October 7-9, 1998—there were no violations noted. Some considerable administrative effort was expended to address reassembly and recovery from the outage and complete all surveillances to facilitate return to normal operations on August 17, 1999 after addressing the reactivity anomaly for which the reactor was unavailable for the final four months of the 1997-98 reporting year and all but the last 15 days of the 1998-99 reporting year. 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 with no Tech Spec changes proposed since that time.

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 from May 1998 forward until mid-August 1999. Considerable time was also spent reviewing various other documents and working on the HEU to LEU conversion including the Emergency Plan Revision 11 which had been submitted with a letter dated February 18, 1999 as the NRC's verbal noncommittal acceptance of it was received on February 25, 1999 and then officially on April 23, 1999 with a letter dated April 16, 1999. Therefore, Revision 11 was implemented and distributed to all offsite holders of the Plan in March 1999 with the facility copies of the Emergency Plan finally updated to complete implementation of Revision 11 on July 29, 1999.

The facility also submitted one revision to the UFTR Final Safety Analysis Report during this year. Revision 11 of the UFTR FSAR consists of a change to a single page to account for changes in personnel monitoring badges to use Luxel dosimeters. This change was submitted to NRC with a cover letter dated February 19, 1999 with all facility copies of the FSAR then updated as of late February 1999 with no further communications with NRC concerning this change addressed under 10 CFR 50.59 Evaluation and Determination Number 98-10. Revision 14 of the Physical Security Plan was submitted to NRC in October 1997 with no response to date at the end of the 1997-98 reporting year. NRC Inspector Stephen Holmes indicated during his inspection on October 8, 1998 that no approval would be given for changes reviewed by the licensee as not reducing Security Plan effectiveness per 10 CFR 50.54(p). Therefore, the changes were incorporated in the Security Plan on October 23/26, 1998 to conclude implementation of this Revision 14 change. All this administrative effort involved considerable commitments of time and resources to keep license-related documents up to date.

The existing operator requalification and recertification program training cycle for the University of Florida Training Reactor was scheduled to end in June 1999. Therefore, renewal of the approved plan for the July 1, 1999 through June 30, 2001 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 14, 1999. In effect, the revised plan is essentially the same as that used for the previous two-year training cycle with the removal of the duplicate training on standard operating procedures the only significant change which is considered unnecessary since procedures do not change much. Therefore, the second training lecture and examination on standard operating procedures was deleted from the training schedule. This renewed plan is intended to cover the UFTR operator requalification and recertification program from July 1999 through June 2001. Subsequently, in a letter from the NRC Project Manager dated June 15, 1999 and received on June 21, 1999, the NRC

indicated that the revisions do not alter the intent of the approved Plan and therefore are acceptable so the new plan was implemented on July 1, 1999.

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 $2.584 million as of June 1999. 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 1999 to meet the requirements of 10 CFR 50.64(c)(2). Therefore, the commitment of time and resources to address NRC requirements has been at least as extensive and probably more so in the 1998-99 reporting year for responses and communications with NRC as in most or even any 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 safety and others requiring a response such as the UF Natural Disaster Plan update 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 and IAEA fuel surveys. The RSRS audit and the EH&S safety inspection each required considerable facility resources for adequate responses.

During the 1992-93 reporting year, considerable effort was spent in following up the decision made some five 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 in 1997-98 increased to over 61 hours and this year the effort has involved over 66 hours for periodic inspections and responses to security and fire alarms.

After the loss of the student performing the neutronics safety analysis for the UFTR HEU-to-LEU conversion at the end of the 1988-89 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 1998, 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 was now spending his sabbatical time since December 1997 on the project and work was progressing though confirming dimensions and materials to support the calculations had involved considerable time during July 1998 with Dr. Caner receiving a tour to observe the unstacked core on August 27, 1998 to support his work.

During the 1998-99 reporting year, Dr. Caner continued his work as he provided some information on reactivity coefficients on September 15, 1998. A draft copy of his work to date on conversion dated September 23, 1998 was received on September 28, 1998. A "final" copy of his work to date was received on December 16, 1998. During March 1999, the internal review was

completed and the report finalized. Several additional discussions occurred throughout the year as Dr. Caner provided proposed Tech Spec changes in June and left all his work well documented before he finally left on July 20, 1999. As required, the 1999 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 29, 1999 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 June 1999. The proposal cover letter and the updated schedule are available at the facility for anyone interested. Though too late to include in the proposal, a formal letter from John Gutteridge, Program Director, University Programs, in the DOE office of Nuclear Energy, Science and Technology, dated April 7, 1999 and received on April 12, 1999 indicated no conversion funding is available during fiscal year 1999 so there is no hurry or pressure to complete the conversion analysis package for submission to NRC.

Frequently there is a summary breakdown of reactor utilization for the reporting period. If given, the list would show UFTR utilization divided into over sixty different educational, research, training, tests, surveillances and facility enhancement operations and general tour/demonstration and educational activities. Included in on-campus usage are over a dozen different courses utilizing the facility, some for multiple usages, class projects, and experiments. The total reactor run time was only 68 hours as the reactor was not run until June 1999 with no return to normal operations until August 17, 1999. Various experiments, surveillances, maintenance and other projects used just over 2020 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 1998-99 represents another large decrease of about 64% from last year due primarily to the lengthy outage from normal operations to investigate the reactivity anomaly lasting until August 17 with running beginning in June to allow surveillances to be completed; 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, though the replacement of the part-time Acting Reactor Manager with another part-time individual contributed greatly to recovery operations beginning with his appointment on May 13, 1999. The significantly reduced value of run time is in agreement with the low availability of 4.01% as it is considerably below the 1993-94 availability (89.69%), 1994-95 availability (88.15%), 1995-96 availability (75.68%), and even the 1997-98 availability (58.29%) despite continuing to account for lost availability for administrative reasons. Otherwise, the availability value could be higher in most years, though this is all duplicate outage time this year.

With the extremely 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 small increase of 11.16% 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 due to the large number of hours to address the outage for the reactivity anomaly plus correct other failures

and problems coupled with all the time applied for normal maintenance and surveillances plus effective utilization of part-time personnel and expansion of activities involving only part-time use of the reactor as for extensive 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 66 hours for project work with the LEU SPERT fuel for checks at the Nuclear Research Building including responding to security alarms and other events.

With one large forced outage continuing from the beginning of the year and lasting nearly the entire year, the total time spent on maintenance activities related to forced outages is significantly increased. It is hoped the results of reactor inspection and other repairs concluded with reassembly of the core will facilitate renewed high utilization for education and research usages in the 1999-00 reporting year, but personnel limitations make this a difficult challenge.

The significant decrease in run time along with a small increase in experiment time are directly attributable to the combination of extremely low reactor availability (4.01%) 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 as the reactor is fully operational and in great demand for various delayed projects at the end of 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 only 4.01% 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 a significantly increased level of $47,000 for the next 1999-00 reporting year after four years at discouragingly lower levels—$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 but $32,000 for the 1998-99 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 of UFTR history, 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 the usage time covered by program funding at $32,000 this year and $47,000 for the 1999-00 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 concluding his work on reactor physics during the 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, including replacement of the two-pen recorder seven 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 the 1997-98 year, and then work this year to check out and reassemble the reactor per the reactivity anomaly plus installation of a Hall effect direct reading tachometer for dilute fan rpm indication, replacement of failed console period trip test switch, repair of well water flow meter including replacement of switches, upgrade of linear channel front-end amplifier, installation of well pump power bypass switch to address Tech Spec violation plus repair of failed Safety Channel 2 operational amplifiers, this high usage expected for the 1999-00 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 maintaining an effective recovery from the outage to address the reactivity anomaly and having adequate personnel available.

Table III-1 contains a breakdown delineating the 38 schools and other educational entities and their 108 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 for most of the year. 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 108 usages represent an increase from the 1997-98 year to help justify the small increase in grant funds; this is balanced by large increases in diversity and length of individual usages with the total of 127 participating faculty being one of the highest ever.

The total of 650 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 despite the lengthy outage from normal operations.

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 (2234 versus 2270, 2261 and 2604 the last three 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 3.429 MW-hrs during this twelve-month reporting period, down about 70.48% from last year due primarily to forced unavailability for the reactivity anomaly compounded by limited operator availability and other occasional equipment failures. Although the energy generation in this reporting year relative to previous years is not indicative of high facility usage, especially when compared to years prior to initiation of the DOE Reactor Sharing Grant in the 1983-84 reporting year, the energy generation will come with reactor availability. 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 4.01% 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 compounded by a number of failures and lack of personnel contributing to extending the outage. The large forced outage was for investigation of the reactivity anomaly extending to August 17, 1999 (350 days). No other forced outages were listed though there were several other failures during the year which contributed to extending the primary outage which made overall availability the lowest in the last twenty years at 4.01%. Though only quoted as 4.01% availability in Table III-4, this availability accounts for ⅜ day planned unavailability for replacing the dilute fan stack coupling as well as lost availability for administrative reasons (0.00 days) plus other hardware problems. At zero days of administrative shutdown (0.00%) for vacations, absences of personnel and evaluations of records, this contribution is zero because of overlap with the large extended outage to address the reactivity anomaly. If not counted, availability would not change this year since forced unavailability for maintenance was so 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 1987-88 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 4.01% in this table is based on days per year and is well below the average of nearly 80% over the previous seven years; normally, this value would also be higher if administrative shutdowns were not included. Indeed, availability was well above 90% for the first eight months of the previous 1997-98 reporting 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 in the 1997-98 reporting year and 350 days unavailability until near the end of the 1998-99 reporting year. 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% after having recovered from the lengthy outage; although funds were previously allocated under the DOE University 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, 1997-98 and now the 1998-99 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 was one trip on July 30, 1999 during the 1998-99 reporting year after no trips for the 1997-98 and 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 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 39 months to include all of the 1996-97, 1997-98 and 1998-99 reporting years until July 30, 1999 though the reactor was not operated after mid-May 1998 during the 1997-98 reporting year until after reassembly of the core in June 1999. The one trip in the 1998-99 reporting year was a Safety Channel 2 (loss of detector high voltage) trip and was evaluated as being due primarily to a somewhat more restrictive loss of voltage setting on the power supply for Safety Channel 2 combined with a very taxed electrical distribution system due to a heat wave. Nevertheless, the record for UFTR trip occurrences is considered very good.

Table III-5B 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. Of course, this year maintenance and core disassembly prevented such trips for most of the reporting year. 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. One of these occurrences was promptly reported as a discovery of a potential Tech Spec violation though some were called in relatively promptly simply to assure good NRC communications, especially entry 1 for the reactivity anomaly which was the subject of much communication with NRC.

All but one of these six occurrences involved some equipment failure, inadequacy or other event. The most significant occurrence was the reactivity anomaly (occurrence #1) which involved

unexplained changes in the critical position accounting for the continuation of the largest outage in several years last 1997-98 reporting year (122¼ days) and extending for 350 days into the this 1998-99 reporting year. One other event involved an equipment failure that resulted in an unscheduled shutdown (occurrence #5) due to failure of a smoke detector causing a fire alarm for a short outage though it coincided with occurrence #1 (⅛ day). The other important occurrence was discovery of an inadequate scram check necessitating installation of a well pump power bypass switch to address a promptly reported tech spec violation (occurrence #4) plus maintenance and checks to address a safety channel 2 trip (occurrence #6) which involved some outage time also concurrent with occurrence #1 (1½ days) to verify circuit adequacy. Occurrence #3 involved correcting some switched thermocouples monitoring two (southwest and south central) fuel boxes (~⅛ day) also concurrent with occurrence #1. The final occurrence involved the failure to complete the biennial evaluation of licensed operators within the requisite 30-month interval (occurrence #2) as the evaluations for the two operators involved were delayed due to oversight for nearly 32 months. Again, this involved no equipment failure.

In terms of effect, the most significant occurrences would be the efforts to address the reactivity anomaly (occurrence #1) because of the dose commitment involved and the fact it resulted in a lengthy and continuous forced outage (350 days). Of course the safety channel 2 trip (occurrence #6) as a challenge of the safety system is also important. In terms of forced outage time, occurrence #1 (350 days) was also the most significant of the unusual occurrences. Overall, none of these six 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 one (occurrence #4) officially reported promptly to the NRC as it involved installing a well pump power bypass switch to address a tech spec violation, 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 1998-99 reporting year have been maintained at an ALARA level despite rather large doses received due to the extensive work in the core area to address the reactivity anomaly. Even in the previous 1995-98 reporting years, doses were relatively low considering there were three 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), one in August 1996 to conduct the biennial inspection of incore fuel elements (B-2 Surveillance), and one in summer 1998 to investigate the reactivity anomaly. 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. Despite difficulties in getting DOE to accept the fuel, it is likely that this fuel will be shipped in the next (1999-00) reporting 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 4 will be available for this transfer to assure meeting all

shipping requirements as it was renewed and changed this year on May 19, 1999 to address shipping two depleted Co-60 sources back to the vendor. The submittal for renewal was dated March 29, 1999. The new Quality Assurance Program Approval dated and approved as of May 19, 1999 does not expire until May 31, 2003.

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 or other activities. 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 ALARA exposure of staff relative to the extended maintenance work in the core area and minimal exposure of visitors as delineated in Section VII.

TABLE III-1

REACTOR SHARING PROGRAM
SUMMARY OF USAGE OF UFTR FACILITIES
(September 1998 – September 1999)

School	Usages*	Faculty	Students
1. Avon Park High School (APHS)	1	1	1
2. Boy Scouts of America (Merit Badge Work)	1	3	15
3. Calvert High School (CHS)	1	1	1
4. Belleview Middle School (BMS)	2	4	46
5. Bradford County Middle School (BCMS)	1	2	28
6. Career Shadowing Days	2	2	8
7. Cocoa High School (CoHS)	1	0	2
8. College of Engineering Engineers' Fair	2	2	22
9. College of Engineering Recruiting Days	7	6	81
10. Eastside High School (EHS)	1	1	0
11. Ecole Nationale Superieure de Physique (ENSPG)	1	3	1
12. Eye on Engineering Workshop (EEW)	1	1	12
13. J.J. Finley School (JJFS)	1	1	1
14. Florida A&M University (FAMU)	4	1	2
15. FFFS Science Engineering & Humanities Symposium (High Schl)	2	8	35
16. Gainesville Community Christian Home School (GCCHS)	1	5	12
17. Gainesville Country Day School (GCDS)	1	4	24
18. George Mason University (GMU)	1	0	1
19. Hillsborough Community College (HCC)	1	1	13
20. Joy Explosion Christian Academy	1	6	32
21. John F. Kennedy Middle School (JFKMS)	1	2	13
22. North Marion High School (NMHS)	1	1	4
23. Palm Harbor University High School	1	1	1
24. PEEK High School Students Environmental Workshop	1	1	39
25. River Ridge High School (RRHS)	3	3	1
26. St. Johns Country Day School (SJCDS)	1	1	18
27. Santa Fe Community College (SFCC)	8	4	44
28. South Floyd County High School (SFCHS)	11	2	0
29. Spruce Creek High School (SCHS)	4	3	1
30. Starke Elementary School (SES)	1	7	32
31. Summer Science Research Training Program (High Schl)	11	8	121
32. Tallahassee Lincoln High School (TLHS)	1	1	3
33. Tampa Prep High School (TPHS)	1	1	9
34. Teacher Research Update Experience Program (HS Tchrs)	3	32	0
35. Union County High School (UCHS)	12	1	2
36. University of Miami (UM)	11	2	5
37. Wildwood High School (WHS)	1	2	20
38. Various External College Faculty (VECF)	3	3	0
TOTAL	**108**	**127**	**650**

* 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 1998 – August 1999)

Month	Energy Generation Monthly Ranking[2]	KW-Hrs	Hours at Full Power
September 1998	3	0.000	0.000
October 1998	3	0.000	0.000
November 1998	3	0.000	0.000
December 1998	3	0.000	0.000
January 1999	3	0.000	0.000
February 1999	3	0.000	0.000
March 1999	3	0.000	0.000
April 1999	3	0.000	0.000
May 1999	3	0.000	0.000
June 1999	3	0.000	0.000
July 1999	2	1,409.201	1.733
August 1999	1	2,019.334	19.867
YEARLY TOTAL		**3,428.535[3]**	**21.600**

1. The yearly total energy generation of 3.429 megawatt-hours for the 1998-99 reporting year represents a large 70.48% decrease from last year's total of 11.615 megawatt-hours, while the 21.60 hours at full power represents a similar 79.58% decrease from the previous yearly total of 105.769 hours. The values for the 1998-99 reporting year are so low versus recent years because of the year-long outage to address the reactivity anomaly plus various other equipment failures compounded by lack of a full-time Reactor Manager. More outage time this year, especially for the over eleven-month outage until August 17, 1999, resulted in reduced facility availability as forced unavailability was at its highest value in history at 350 days including the period of time to complete surveillances and finally to catch up on operations training prior to returning to normal operations on August 17. Without a full-time Reactor Manager, outage operations were very constrained by operator availability to address the outage and other equipment failures, though an appointment of a replacement part-time reactor manager on May 13, 1999 contributed greatly to the success of subsequent recovery operations.

2. This column showing the ranking of monthly energy generation is included for potential correlation with results of environmental monitoring in Chapter VII, though core disassembly and fuel movement during this year makes any such correlation doubtful in this reporting period.

3. The 3,428.5 kilowatt-hours energy generation is the lowest value for the past decade, ranking tenth for this period. Normally, these rankings show how growth in usage has been greatest and generally well maintained over the past decade since even the low value of energy generation in the previous 1997-98 reporting year would have been tenth during the first fourteen years of 100 kW UFTR operation despite a four-month outage at the end of the 1997-98 year that extended to include nearly the entire current reporting year.

TABLE III-3

MONTHLY REACTOR USAGE/AVAILABILITY DATA
(September 1998 – August 1999)

Month	Key-On Time	Exp. Time[1]	Run Time[2]	Availability[3]
September 1998	0.00 hrs.	131.75 hrs.	0.00 hrs.	0.00%
October 1998	0.50 hrs.	153.00 hrs.	0.00 hrs.	0.00%
November 1998	0.00 hrs.	149.17 hrs.	0.00 hrs.	0.00%
December 1998	1.50 hrs.	137.17 hrs.	0.00 hrs.	0.00%
January 1999	0.10 hrs.	152.08 hrs.	0.00 hrs.	0.00%
February 1999	0.20 hrs.	171.08 hrs.	0.00 hrs.	0.00%
March 1999	1.40 hrs.	196.17 hrs.	0.00 hrs.	0.00%
April 1999	0.50 hrs.	147.50 hrs.	0.00 hrs.	0.00%
May 1999	4.60 hrs.	164.25 hrs.	0.00 hrs.	0.00%
June 1999	14.70 hrs.	213.25 hrs.	7.47 hrs.	0.00%
July 1999	36.10 hrs.	240.67 hrs.	32.13 hrs.	0.00%
August 1999	33.10 hrs.	164.25 hrs.	28.40 hrs.	47.18%
YEARLY TOTAL	**92.70 hrs.**	**2,020.34 hrs.**	**68.00 hrs.**	**4.01%**

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 large decreases over the previous year, especially those related to reactor operations. Key-on time is down 57.40% while run time is down 64.11%, essentially due to the extended outage of 350 days exacerbated by unavailability of personnel such as reactor operators. Although two part-time SROs were licensed for the complete year, one had low work hours over the year until his appointment as Acting Reactor Manager was effective May 13, 1999; experiment time, however, is increased by 11.16% showing not only the large amount of hours to address the outage but a continued emphasis for class usage as the experiment time was well used for research preparations, training and education during this past year, especially related to reactor sharing visiting groups.

3. Monthly average availability is 0.33%; on a yearly basis, it is 4.01% as shown above and per Table III-4. As in the previous year, this availability accounts for lost availability for administrative reasons as well as for repair and maintenance related reasons. However, this unavailability has no contributions due to administrative unavailability this year since the forced unavailability at 350 days or 95.89% and planned unavailability at ⅜ day or 0.10% overlapped any administrative unavailability. The yearly availability is reduced from the previous six years (87.33%, 89.69%, 88.15%, 75.68%, 66.67% and 58.65%) to 4.01% for this reporting year with most of the unavailability due to a single continuous forced outage from normal operations for 350 days long during the year. Obviously, overall the availability represents a significant decrease in the average availability recorded for the past ten or more reporting years. This is due to having a single large forced outage for addressing the anomalous reactivity changes which involved 350 days forced unavailability with no other forced outage time being counted as they overlapped. Nevertheless, several other failures could have contributed significantly to forced outage time had the reactor been available when the failures occurred including replacement of failed console period trip test switch (66¾ days), repair and then replacement of switches for failed well water flow meter (26¼ days), installation of well pump power bypass switch to address Tech Spec violation (6 days) and repair of erratic linear channel front end amplifier (24 days). As in the previous year, there would have also been significant planned outages in this year as adjustments and reworking of the annual calibration of nuclear instrumentation (A-2 Surveillance) would have involved 14 days planned unavailability in July 1999 except again recovery operations were in progress. Other than these outages, the remainder of the year saw the usual variety of maintenance activities and equipment failures. With so many failures and repairs, it is hoped that quality maintenance will assure a return to high availability in the next reporting year.

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1998 – August 1999)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
September 1998	0.00%	30.00 days	Maintenance to investigate cause of reactivity anomaly (30 days). Maintenance to install hall effect direct reading tachometer for dilute fan rpm indication (0 days vs. ¼ day). Maintenance to refill primary coolant storage tank (0 days vs. ¼ day).
October 1998	0.00%	31.00 days	Maintenance to investigate cause of reactivity anomaly (31 days). Maintenance to refill shield tank (0 days vs. ⅜ day). Maintenance to remove mechanical tach rpm indicator piece movement for repair (0 days vs. ⅛ day).
November 1998	0.00 %	30.00 days	Maintenance to investigate cause of reactivity anomaly (30 days). Maintenance to reinstall mechanical tach rpm indicator piece movement following servicing (0 days vs. ⅛ day). Maintenance to inspect crane for possible missing lock washer (0 days vs. ⅛ day). Administrative shutdown for Thanks-giving Day holiday (0 vs. 2 days).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1998 – August 1999)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
December 1998	0.00 %	31.00 days	Maintenance to investigate cause of reactivity anomaly (31 days). Administrative shutdown for Christmas holiday (0 days vs. 3 days).
January 1999	0.00%	31.00 days	Maintenance to investigate cause of reactivity anomaly (31 days). Maintenance to repair or replace failed console period trip test switch (0 days vs. 16¾ days). Maintenance to refill shield tank (0 days vs. ¼ day) Administrative shutdown for New Year's holiday (0 days vs. 3 days).
February 1999	0.00%	28.00 days	Maintenance to investigate cause of reactivity anomaly (28 days). Maintenance to repair (now replace) failed console period trip test switch per 10 CFR 50.59 Evaluation Number 99-01 (0 days vs. 28 days).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1998 – August 1999)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
March 1999	0.00%	31.00 days	Maintenance to investigate cause of reactivity anomaly (31 days). Maintenance to replace the failed console period trip test switch (0 days vs. 22 days). Maintenance for evaluation to repair/replace failed/failing well water flow meter (0 days vs. 3 days). Maintenance to refill PC storage tank following leakage from reassembled system (0 days vs. ¼ day).
April 1999	0.00%	30.00 days	Maintenance to investigate cause of reactivity anomaly (30 days). Maintenance for evaluation to repair or replace a failed/failing well water flow meter and then remove and clean internals (0 days vs. 16 days). Maintenance to refill shield tank (0 days vs. ¼ day).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1998 – August 1999)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
May 1999	0.00%	31.00 days	Maintenance to investigate cause of the reactivity anomaly (31 days). Maintenance to switch incorrectly connected thermocouples for southwest and south center fuel box outlet lines and replace failed thermocouple in south center fuel box outlet line (0 days vs. ⅛ day). Maintenance to secure power supply and repair broken regulating blade position indicator lead (0 days vs. ⅛ day). Maintenance to repair/replace failed switches on secondary flow meter (0 days vs. 7¼ days). Maintenance to upgrade the linear channel front end amplifier to correct erratic linear channel per 10 CFR 50.59 Evaluation Number 99-03 (0 days vs. 14 days).
June 1999	0.00%	30.00 days	Maintenance to investigate cause of reactivity anomaly (30 days). Maintenance to upgrade the linear channel front end amplifier to correct erratic linear channel per 10 CFR 50.59 Evaluation Number 99-03 (0 days vs. 2⅜ days).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1998 – August 1999)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
June 1999 (continued)			Maintenance to repair roof leak (0 days vs. ⅛ day).
			Maintenance to replace ink pads in twelve-point temperature recorder (0 days vs. ⅛ day).
			Maintenance to refill shield tank (0 days vs. ⅛ day).
			Maintenance to perform annual preventive maintenance checks on overhead crane (0 days vs. ¼ day).
			Maintenance to repair failed switches on secondary flow meter (0 days vs. 10 days).
			Maintenance to install well pump power bypass switch and address Tech Spec violation (0 days vs. 6 days).
			Maintenance to replace failing smoke detector causing unscheduled shutdown due to spurious fire alarm (0 days vs. ⅛ day).
			Maintenance to repair high speed strip chart recorder for measuring control blade drop times (0 days vs. ½ day).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1998 – August 1999)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
July 1999	0.00%	31.00 days	Maintenance to investigate the cause of the reactivity anomaly (31 days). Maintenance to troubleshoot and repair failed Safety Channel 2 by replacing two operational amplifiers in the linear amplifier (0 days vs. 10 days). Maintenance to address Safety Channel 2 (full) trip (0 days vs. 1½ days). Maintenance to refill shield tank (0 days vs. ¼ day). Maintenance to replace primary coolant system demineralizer resins (0 days vs. ¾ day). Maintenance to refill primary coolant storage tank (0 days vs ⅛ day). Maintenance to adjust nuclear instrumentation voltages and set points, confirm values and verify no need to change out resistors and subsequently perform calorimetric calibration and confirmation of values (A-2 Surveillance) (0 days vs. 14 days).

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1998 – August 1999)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability
August 1999	0.47%	16.375 days	Maintenance to conclude outage to investigate cause of the reactivity anomaly (9 days). Delay of return to normal operations to complete overdue operations exams (7 days). Maintenance to continue addressing Safety Channel 2 trip (0 days vs. 1⅝ days). Maintenance to replace dilute fan stack coupling (⅜ day).

TOTAL ANNUAL UNAVAILABILITY (Availability at 4.01%):	350.375 days	=	95.99%
1. TOTAL FORCED UNAVAILABILITY:	350.000 days	=	95.89%
2. TOTAL PLANNED UNAVAILABILITY:	0.375 days	=	0.10%
3. TOTAL ADMINISTRATIVE UNAVAILABILITY:	0.000 days	=	0.00%

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.

NOTE 2. The 350.375 days unavailability was for a single continuous forced outage from normal operations (350.00 days, up from 131.375 days) and a planned outage (0.375 day, down from 13.375 days) due to maintenance for repairs, delay awaiting parts arrival, reactivity evaluations, etc., associated with the outage to address the reactivity anomaly with no additional days of administrative shutdown (0.00 day versus 6.00 days from overlap, down from 7.50 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. Again, the number of days is 0.00 versus 6.0 days due to overlap. With no full-time Reactor Manager for the year, the last category for administrative shutdowns remains excellent.

TABLE III-4

UFTR AVAILABILITY SUMMARY
(September 1998 – August 1999)

Month	Availability	Days Unavailable	Primary Cause of Lost Availability

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 has tended to go in cycles probably dependent on effectiveness of previous maintenance as the total unavailability has been 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), 144.250 days (39.66% unavailability), but now 350.375 days (95.99% unavailability). The lost availability for administrative reasons has shown dramatic drops from many earlier reporting years—from as many as 23.25 days, 23.50 days and 11.50 days to as few as 3.50 days, 5.00 days, 2.25 days, 4.50 days and 7.50 days in recent years, and now 0.00 day (versus 6.00 days without outages already causing unavailability).

TABLE III-5A

UNSCHEDULED TRIPS
(September 1998 – August 1999

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, 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. After having no unscheduled trips during the 1993-94 reporting year, the UFTR experienced two unscheduled trips during the 1994-95 reporting year as it did again in the 1995-96 reporting year. The UFTR experienced no unscheduled trips during the 1996-97 reporting year. It is also worth noting that the two trips described and evaluated in this table in the 1995-96 reporting year were the only unscheduled trips for over three reporting years until July 30, 1999 and only the second trip was evaluated to be due to equipment failure due to faults in the Safety Channel 2 loss of high voltage sensing circuit. Therefore, for the 1998-99 reporting year, there was only one trip evaluated as due primarily to a somewhat more restrictive loss of voltage setting on the power supply for Safety Channel 2 plus a very taxed electrical distribution system due to a heat wave. This single unscheduled trip is described and evaluated in the single entry in this table for the 1998-99 reporting year below.

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 ten years, these efforts clearly have represented time well spent with very few trips due to facility equipment failure in the last eight years and none during the past 1996-97 and 1997-98 reporting years until July 30, 1999.

Number	Date	Description of Occurrence
1.	30 Jul 99	While operating at 100 kW on July 30, 1999, following startup at 1021 hours for annual temperature coefficient of reactivity measurements (A-3 Surveillance) as well as radiation surveys in anticipation of returning to normal operations, the reactor tripped on a Safety Channel 2 scram (full trip) at 1234 hours at which time the reactor was also

TABLE III-5A

UNSCHEDULED TRIPS
(September 1998 - August 1999)

Number	Date	Description of Occurrence

secured. This was a full trip with all safety systems responding satisfactorily. Since power was not observed to exceed the 100 kW set point by the operator (SRO Jim Wolf), the trip was determined to have been caused by the Safety Channel 2 Loss of High Voltage trip circuit. Under MLP #99-33 key voltage points in the trip circuit were measured and verified normal after the trip occurred. A successful daily checkout was accomplished soon after the trip at 1441 hours.

Following the trip, set points were verified and the trip circuit was quantitatively tested and verified to be functioning more conservatively than required on loss of high voltage with only about 5% voltage reduction versus Tech Spec specification of 10% reduction allowed before causing a full trip on loss of high voltage. A similar trip in April 1996 (see MLP #96-12) showed a relatively large amount of noise at the inputs of the bistable circuit comparator. With this noise present, any additional noise such as spikes produced from line (main AC) transients would be likely to cause a spurious trip. Due to a heat wave during the week of July 26, 1999 and close to 100°F temperatures on July 30, 1999, the electrical distribution grid was taxed and transients were noted in sensitive equipment in adjacent buildings at about the same time supporting this evaluation.

Since this was a spurious trip, no system modifications were recommended unless the problem of such trips should become chronic. This trip was also not considered to be promptly reportable per Technical Specifications, Section 6.6.2 since it is from a known cause. After successful weekly and daily checkouts and closeout of MLP #99-33, restart was approved on August 2, 1999. The evaluation of this event is that it had no effect on reactor safety or the health and safety of the public. Completed UFTR Form SOP-0.6A (Unscheduled Reactor Trip Review and Evaluation) indicating all safety

TABLE III-5A

UNSCHEDULED TRIPS
(September 1998 - August 1999)

Number	Date	Description of Occurrence
		systems responded properly, along with a memorandum of evaluation on the event to reactor trip records plus the completed maintenance log page (MLP #99-33) including weekly and daily preoperational check sheets constitute Attachment III to the July 1999 facility monthly report. Following circuit analysis and successful weekly and daily preoperational checkouts on August 2, 1999, the maintenance log page was closed out for return to performing operations for surveillances in anticipation of returning to normal operations. Some additional follow-up discussions on loading and operation of the Safety Channel 2 high voltage and bistable trip were conducted on August 5, 1999.

TABLE III-5B

SCHEDULED TRIPS
(September 1998 – August 1999)

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. The year-long outage following this reporting year again precluded such training trips. It is expected these training trips may occur in the 1999-00 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
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TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

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 and one as a promptly reportable potential abnormal occurrence 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, with one of these occurring here this year (occurrence #4). Unscheduled trips are also addressed though they are also included in Table III-5A along with corrective and preventive maintenance and surveillances implemented in response to the trips; one of these also occurred during this reporting year (occurrence #5). One of the six occurrences described here was also considered a potential abnormal occurrence as a potential tech spec violation and treated as promptly reportable (occurrence #3).

All but one of these six occurrences involved some equipment failure, inadequacy or other event. The most significant occurrence was the reactivity anomaly (occurrence #1) which involved unexplained changes in the critical position accounting for the continuation of the largest outage in several years last 1997-98 reporting year (122¼ days) and extending for 350 days into the this 1998-99 reporting year. One other event involved an equipment failure that resulted in an unscheduled shutdown (occurrence #5) due to failure of a smoke detector causing a fire alarm for a short outage though it coincided with occurrence #1 (⅛ day). The other important occurrence was discovery of an inadequate scram check necessitating installation of a well pump power bypass switch to address a promptly reported tech spec violation (occurrence #4) plus maintenance and checks to address a safety channel 2 trip (occurrence #6) which involved some outage time also concurrent with occurrence #1 (1½ days) to verify circuit adequacy. Occurrence #3 involved correcting some switched thermocouples monitoring two (southwest and south central) fuel boxes (~⅛ day) also concurrent with occurrence #1. The final occurrence involved the failure to complete the biennial evaluation of licensed operators within the requisite 30-month interval (occurrence #2) as the evaluations for the two operators involved were delayed due to oversight for nearly 32 months. Again, this involved no equipment failure.

In terms of effect, the most significant occurrences would be the efforts to address the reactivity anomaly (occurrence #1) because of the dose commitment involved and the fact it resulted in a lengthy and continuous forced outage (350 days). Of course the safety channel 2 trip (occurrence #6) as a challenge of the safety system is also important. In terms of forced outage time, occurrence #1 (350 days) was also the most significant of the unusual occurrences. Overall, none of these six 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 one (occurrence #4) officially reported promptly to the NRC as it involved installing a well pump power bypass switch to address a tech spec violation, though all were reported for information purposes at some point. All were also reported in periodic updates to the NRC.

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence
1.	1 May 98	During March and April 1998, 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 April 23, 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 April 22, 1998 (Attachment VI to the April 1998 facility monthly report), 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 May 1, 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 May 1 and 4, 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 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.

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence

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 May 5, 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 May 6, 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 May 7, 1998 to verify the critical position had changed somewhat again from 484 units withdrawn but now reduced somewhat to 460 units withdrawn.

On May 12, 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

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence
		May 14, 1998 to verify the critical position which now remained at 460 units withdrawn on the Regulating blade. On May 19, 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 May 19, 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 May 20, 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 May 21, 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 (May 26-29) 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.

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence
		At the end of May 1998, 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 June 1, 1998. Subsequently, under modified SOP-C.1 and RWP #98-6-I, fuel in pit #23 was consolidated into pit #26 on June 2, 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 June 2, 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 June 3, 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 June 4, 1998. Subsequently, four fuel bundles were removed from the south central fuel box

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence

and one from the north central fuel box on June 5, 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 June 11, 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 June 18, 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 June 18, 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 June 22, 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 June 23, 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 June 26, 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

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence

down to outlet piping on June 26, 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 June 29, 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 July 10, 1998. The revised UFTR Respiratory Protection Program was ready for internal review and approval by July 24, 1998 but the RSRS Executive Committee was unable to meet for several days. On July 24, 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

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence

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 July 28, 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 July 30, 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 July 30, 1998 to get the review started with the formal submission by letter to the Document Control Desk then accomplished on August 3, 1998. The fax submission was Attachment II to the July 1998 facility monthly report.

At the beginning of August 1998, maintenance operations were awaiting NRC review of the Respiratory Protection Program Revision 2. On August 3, 1998, NRC Inspector Stephen Holmes of the Non-Power Reactor Directorate indicated he would visit for an inspection on August 13-14, 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 August 6 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

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reviewed and all documentation completed prior to Mr. Holmes arrival on August 13. Upon his arrival on August 13, 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 August 14, Mr. Holmes evaluated that the Program was ready for implementation on the afternoon of August 13, 1998. Therefore, the official implementing memorandum for the Program was issued on August 13, 1998 and is Attachment I to the August 1998 facility monthly report. 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 August 13 with observation by Mr. Holmes. Inspector Holmes held his exit interview on August 14 prior to leaving (see Attachment II to the August 1998 facility monthly report for a record of the exit interview 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 August 14 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 August 20, 1998, the SbBe source was removed and nuts from the three north side fuel boxes were removed, greatly reducing radiation levels and preventing water from entering the fuel boxes from this date on. To prevent bringing water into the core, the PC pump switch was removed and a precautionary posting was made on this date as well. On August 27, 1998, with all bolts and flanges removed from the north side of the core, workers were unable to remove any fuel boxes due to difficulty

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separating the flange's gasket from the fuel box. Subsequently, the northeast (NE) fuel box was removed on August 28, 1998 but the flange connections are very tight requiring considerable force to effect removal resulting in only one box being removed at month's end. At the end of August, it appeared that the other two north side fuel boxes would need to be removed to allow access to and removal of the Regulating blade and its shroud for detailed examination though in September the clearance was found to be sufficient for the shroud without removing the northwest fuel box.

During September 1998, the first efforts to remove the north central (NC) fuel box resulted in some damage to the upper lip of the fuel box. This damage is primarily cosmetic as the damage to the fuel box is not expected to affect its function. A memorandum describing the damage and its effect is Attachment II to the September facility monthly report. During efforts to remove the NC fuel box, it was decided to remove the center vertical graphite stringers to allow access to the regulating blade shroud; however, this was prevented by the rabbit system tube. Under RWP 98-9-I, the shielding around the rabbit system was removed and the rabbit system guide tube withdrawn sufficiently (about three feet) to allow removal of the shroud and direct access to the regulating blade and subsequently to the other control blade shrouds for removal. At this point, RWP 98-9-I was closed out on September 9, 1998. It should be noted that the primary RWP 98-8-I was reissued several times during the month as work progressed, though there was no use of respirators during the month.

By examining the regulating blade directly, the apparent separation of the regulating blade was found not to be present so this source was eliminated as a cause of the reactivity anomaly. The regulating blade itself was not able to be removed at this point with the decision made not to remove it at this point,

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though two small pieces of metal (0.1 gms total) were found on the graphite around the blade. At month's end, the source and nature of these small pieces have not been determined but they are definitely not the source of the reactivity problem. They may be aluminum scraps left from maintenance performed years ago.

After mid-September 1998, the NC fuel box was finally removed along with the Safety-3 control blade shroud. Comparison of the two blades shows no obvious mechanical defects. Subsequently, the southeast (SE) fuel box was removed and some work was undertaken to remove the Safety-2 control blade shroud. It was then noted that the south central (SC) fuel box would have to be removed to allow removal of the Safety-1 and Safety-2 control blade shrouds. At month's end the SC fuel box bolts have been removed and the fuel box is almost freed up for removal to allow direct access to the S-1 and S-2 shrouds for removal.

Early in October 1998, the SC fuel box was finally removed to the shield tank, the S-1 and S-2 safety control blade shrouds were unbolted and removed to reveal the S-1 and S-2 control blades which also appear to be in good shape. Spectral analysis of the metal shavings found on September 17 was inconclusive to this point but was continuing. A modification package (10 CFR 50.59 Evaluation and Determination Number 98-08) was developed, approved and implemented to allow temporary bypass of the control blade interlocks on October 22, 1998. The blades were timed and assured visually not to have any obvious movement problems with the interlocks bypass removed on the same day. This work is considered to have eliminated the control blades themselves as a source of any reactivity anomaly that could impact safety. On October 29, a shield block was placed over the core area to reduce sky shine hopefully to lower the recorded dose to the stack and cell environmental monitoring TLDs, the results of which have been over 300 mR per month since opening the core area and removing fuel.

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		During November 1998, preparations were made for fuel handling with fuel handling training conducted for those involved with three (3) bundles inspected on November 11 when operations were halted until the crane could be checked for a missing lock washer with five (5) more bundles inspected on November 18 and seven (7) more on November 19 controlled under RWP 98-11-I. In general, with minor defects, the fuel looks good with no real problems noted to this point. The report on the spectral analysis of the metal shavings was finally issued on November 5, 1998 (Attachment I to the November 1998 facility monthly report contains part of the report), but its results are not conclusive and the shavings are not considered to be related to the reactivity anomaly problem. It should be noted that the primary RWP 98-8-I was reissued a number of times during the month as was the RWP-98-11-I used to control fuel inspection. During December 1998, the remaining 7½ fuel bundles were inspected on December 4, controlled under RWP 98-11-I, to close out the B-2 Surveillance. No significant problems were noted per the report dated December 8, 1998 (Attachment I to the December 1998 facility monthly report). Subsequently, RWP 98-11-I was reissued until closed out on December 10. Following various extensive discussions, the control blade gear boxes were inspected with assistance from Professor G.J. Schoessow and found to be in good shape (also part of V-1 Surveillance). Subsequently, an inclinometer was obtained, the control blade interlocks were bypassed again on December 21 per 10 CFR 50.59 Evaluation and Determination Number 98-08, with each of the blades moved in steps with the blade position indication at the console found to agree and vary linearly with the physical blade position indicated by the inclinometer attached temporarily to each blade until all were tracked in this way. The memorandum comparing physical blade position in the core indicated by the inclinometer and the blade position

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indicated on the control blade position indicator at the console demonstrates good correspondence and linearity in the movement of the blades (part of V-1 Surveillance). This memorandum is Attachment II to the December 1998 facility monthly report. Subsequently, the regulating blade was removed reading ~100 mR/hr on contact and ~5 mR/hr at one foot with plans next to x-ray the plate to check on cadmium absorber integrity. A brief tabular summary of reactivity variations leading to the anomaly was also generated during this month and is included as Attachment III to the December 1998 facility monthly report. It should be noted that the primary RWP 98-8-I was reissued a number of times during the month of December 1998.

During January 1999, the remaining three safety blades were removed and all four control blades were x-rayed with no problems (Part of V-1 Surveillance) with the assistance of Dr. D.E. Hintenlang and his portable X-ray machine which was moved into the reactor cell temporarily on several occasions. The X-rays were also archived for future reference. In addition, replacement control blade shaft mounting bolts were obtained as was fuel box gasket material with old gasket material partially removed. In addition to planning on steps for recovery, the primary RWP 98-8-I was reissued a number of times during the month of January 1999.

During February 1999, RWP 98-8-I for reactor disassembly operations was reissued several times until finally closed out on February 24, 1999. Efforts in February concentrated on removing the old gasketing material from the fuel boxes under RWP 99-1-I first issued on February 12, 1999 and reissued to cover cleaning of the fuel boxes until closed on February 24, 1999. Other efforts during the month involved acquiring gasketing material and replacement bolts so the old, hot ones could be discarded as waste to limit dose commitment and

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		reviewing graphite drawings as preparations were made to reassemble the reactor under RWP 99-2-I first issued on February 24, 1999 with the northwest fuel box placed on February 26, 1999 and ready to be fastened. At the end of February 1999, maintenance reassembly operations were continuing with no source of the reactivity anomaly identified as this maintenance work had examined all key parts of the reactor and the system was being reassembled under RWP 99-2-I. Evaluation of the problem at this point was that the system appears to be in good shape with no specific cause of the reactivity anomaly identified with plans to reassemble and operate the reactor on the basis of this safety evaluation. During March 1999, the five removed fuel boxes, all four control blades and shrouds were reinstalled along with considerable graphite. Control blades were verified to move linearly using the inclinometer and dropped to assure movement with the drop times measured to be acceptable on March 11, 1999. The rabbit system is also reinstalled to allow graphite installation into the core. On March 26, all covers were replaced on the ex-core control blade pedestals and drives and the PC pump fuses replaced. The fuel box cross sections were also measured on March 30, 1999 for future reference in the HEU-to-LEU conversion work as additional graphite was added; subsequently, the water was turned on at 1058 hours on March 30. No leaks were immediately apparent. However, at 1535 hours the flow rate had dropped, there was a small amount of water in the pit, thought to be from the pump which was cavitating but later discovered to be from a small leak from the dump valve. The pump was secured, restarted for two minutes and then secured again as flow dropped to low levels. By March 31, no water was noted in the pit but low level (17¾ inches versus 20½ inches during the weekly checkout on March 29) in the PC storage tank was noted so it was refilled under MLP #99-09 and the pump

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run briefly (~one minute) to demonstrate its operability on March 31, 1999. The drop in PC tank level showed a probable small leak in the reassembled system. In addition to the maintenance efforts for recovery, the primary RWP 99-2-I was reissued a number of times during the month of March 1999.

During April 1999, the dump valve gland nut was tightened to correct the small leak from the dump valve on April 1, 1999 thought to be caused by the extended dry period involved during fuel box removal. On April 7, 1999, RWP 99-3-II was opened to control leak checks of the primary system using the borescope from the equipment pit with no results. On April 9, 1999, under RWP 99-2-I, in core checks determined the leak to be from the inlet flange of either the northwest or the north central fuel box. On April 14, 1999, all three north side fuel boxes were removed along with necessary graphite with the northwest box inlet flange-pipe connection suspected of leaking and gasket materials noted to be in good shape. Subsequently, on April 21, 1999, the northwest and north central fuel box inlet flange surfaces were recleaned. On April 23, the northwest fuel box inlet flanges were recleaned and on April 26, 1999, all three fuel boxes were reinstalled with no apparent leakage. Subsequently, on April 29, 1999 a small drop-type leak was noted at the outlet flange-pipe connection on the southwest fuel box with some leakage onto one small graphite stringer which was set out to dry. This outlet flange was recleaned and the southwest fuel box reinstalled with no leakage on April 29, 1999 as some graphite was also reinstalled. At month's end as efforts were begun to assemble instrumentation to be used for monitoring the planned approach-to-critical for reloading the fuel. RWP 99-3-II was worked only once in April and was not reissued. It was closed out on May 7, 1999. In addition to the maintenance efforts for recovery, the primary RWP 99-2-I controlling core reassembly was reissued a number of times during the month of April 1999.

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During May 1999, work continued as much of remaining graphite was stacked prior to May 7 after assuring no further leakage with closeout of RWP 99-3-II. In addition, three external nuclear instrumentation channels were set up and plateaus run on the BF_3 detectors. Following insertion of the PuBe source temporarily on May 6, 1999, sufficient neutron count rate was obtained on all four detector systems. Both the PuBe and SbBe sources were inserted continuously as of May 7, 1999 so blade checks could be completed so all preoperational checks are complete as of May 7, 1999 only lacking reactivity effects for blade movements. The center graphite was stacked on May 11, 1999 and the rabbit system was installed on May 13, 1999. May 13 and 14 involved work under RWP 99-4-I to clean up a number of slightly contaminated horizontal cell surfaces, probably caused by dropping a piece of portable lead shielding removed from the work area of the core. The rabbit system was checked to be operational on May 27, 1999 with some more shielding remaining to be stacked on the west side where it enters the reactor.

In anticipation of fuel loading, the quarterly scram checks (Q-1 Surveillance) were completed on May 17, 1999. The general UFTR surveillance/activity schedule for restoring the UFTR for return to normal operations was generated in a memorandum from UFTR Management on May 21, 1999 and approved at an RSRS Executive Committee meeting on that date. The schedule lists activities to be completed prior to fuel loading, fuel loading, activities after fuel loading but prior to initial startup to power, activities following startup to 1 watt, activities to be performed at 100 watts, 1 kW, 10 kW, 90 kW and 100 kW in a stepped return to normal operations. The full memorandum is Attachment I to the May 1999 facility monthly report. In addition, the planned core reloading returning all fuel to its original location following SOP-C.1 (Fuel Loading) with a reloading sequence plan and core load diagram is documented in

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another memorandum dated May 21, 1999. This memorandum is Attachment II to the May 1999 facility monthly report and was also reviewed at the May 21, 1999 RSRS Executive Committee meeting.

Subsequently, fuel handling training was conducted on May 26, 1999 for all operations staff plus RCT J. Parker and technician S. Iverstine plus the control blade surveillances (S-1 for drop times, S-5 for controlled insertion times and S-11 for clutch current bulb replacement) were all successfully completed on May 27, 1999. Unfortunately, continuing repairs on the linear channel front end amplifier circuit were not completed so no fuel was loaded in May 1999. The linear channel front end amplifier was finally repaired with installation of a duplicate 310K amplifier to replace a failed one on June 3, 1999.

During June 1999, several shield blocks were restacked and the unstacked shield blocks rearranged in preparation for fuel loading which was delayed due to maintenance efforts on the well water flow meter until June 10 and then by the need to address a technical specification violation for failure to measure adequately the secondary flow trip point. RWP 99-4-I for core reassembly activities was reissued several times but was finally terminated on June 18 and RWP 99-5-I was issued to control fuel loading which was accomplished on June 21 (8 fuel bundles loaded), June 22 (10 fuel bundles loaded) and June 24 (final 3½ fuel bundles loaded) with RWP 99-5-I finally terminated on June 25, 1999. Three external neutron monitoring channels along with the installed channel were used to monitor the approach-to-critical as fuel was loaded. Subsequently, RWP 99-6-I was issued on June 25 to control restacking and restoring shielding to normal including removing extra neutron detectors and replacing plugs in south, southwest and northeast beam ports on June 25. Subsequently, accomplishments included a complete successful weekly checkout, completion of restacking

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as well as painting and decontamination of shielding faces and upper deck which was continuing at month's end. Also completed was another measurement of the control blade drop times (S-1 Surveillance) and the controlled insertion times (S-5 Surveillance) after which a test startup to 1 kW was undertaken by the Facility Director with observation/active participation by the other two senior reactor operators. The startup showed a high regulating blade critical point relative to the last measurement taken in May 1998 prior to the extended shutdown and reactor disassembly.

During July, the new critical position was checked several times prior to setting the new normal and alternate safety blade positions with a memorandum dated July 17, 1999 which is Attachment IV to the July 1999 facility monthly report. This shows the normal safety blade positions as 800 units withdrawn and the regulatory blade at ~350 units withdrawn without accounting for experiment or temperature effects. Subsequently, after completion of the reactivity checks (S-2 Surveillance), new reactivity worth curves were generated and placed in use with a memorandum dated July 17, 1999 which is Attachment V to the July 1999 facility monthly report. Essentially, there is not a great deal of total control blade worth change except that the excess reactivity is now below 0.4% $\Delta k/k$ versus close to 1% $\Delta k/k$ prior to the reactivity anomaly occurrence as summarized on UFTR Form SOP-A.7B (Evaluation of UFTR Blade Drop Reactivity Data) showing 0.37% core excess reactivity. A copy of this form completed for the S-2 Surveillance is Attachment VI to the July 1999 facility monthly report. Nevertheless, such a difference, even if it were to appear all at once, is still well within the safety analysis envelope.

Also during July 1999, in addition to critical position checks, decontamination efforts were completed for the cell in general but especially on the upper deck, deck plates, hand rails and

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		tools, with scaffolding reinstalled on July 2 and the rabbit system shielding restacked on July 12, 1999. In addition, various other surveillances were completed during the month directed toward return to normal operations to include verification of a negative void coefficient (B-1 Surveillance), annual reactivity measurements (S-2 Surveillance), nuclear instrumentation calibration check and calorimetric heat balance (A-2 Surveillance), radiological survey of restricted areas (Q-5 Surveillance), measurement of Ar-41 stack effluent concentration (S-4 Surveillance) and part of the radiological survey of unrestricted areas (Q-4 Surveillance). The final surveillances to complete radiological surveys at full power (Q-4/Q-5 Surveillances) and measure the temperature coefficient of reactivity (A-3) would have been completed except for the Safety Channel 2 trip on July 30, 1999. Following closeout of MLP #99-33 to address the Safety Channel 2 trip and replacement of the failed deep well pump motor, the final surveillances to complete radiological surveys at full power (Q-4/Q-5 Surveillances) and measure the temperature coefficient of reactivity (A-3) were completed successfully. Subsequently, the maintenance log page was closed out on August 9, 1999 though some records review toward assuring complete documentation occurred on August 13, 1999. Following completion of the delayed annual operator operations examinations on August 16, the reactor was returned to normal operations following a status update of NRC via Marvin Mendonca early in the day on August 17, 1999.
2.	10 Feb 99	The Biennial Evaluation and Recertification of Licensed Operators (B-5 Surveillance) was performed on June 12, 1996 for SROs W. G. Vernetson, J. Wolf and D. Cronin and on June 29, 1996 for SRO D. Simpkins with the previous B-5 Surveillance performed for SROs W. G. Vernetson, D. Simpkins

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		and D. Cronin on January 25, 1994. The reason for performing the surveillance in June 1996 was apparently to meet the usual once-every-two- years-interval without taking credit for the delays in previous evaluations. However, for mistaken reasons the B-5 Surveillance was being tracked as due on December 31, 1998 for the current surveillance. As a result the usual 30-month interval would be expected to extend past February 1999. In early February when the B-5 Surveillance was in progress, a check of the records showed that the B-5 Surveillance had last been performed nearly 32 months previously. Therefore, completion of the B-5 Surveillance on February 10, 1999 exceeded the allowed interval since the last surveillance. One of the three SROs to be evaluated (J. Powers) met the required interval since his license was issued dated February 24, 1997. However, the allowable interval for the evaluations for W. G. Vernetson and J. Wolf was exceeded due to the oversight. Since the operations staff is small and there are lots of chances to observe operations activities, exceeding the interval is not considered to have had any safety impact on the reactor facility or the health and safety of the public. For corrective action, the status board is changed to show the due date for the next B-5 Surveillance to be June 30, 2000 to assure this oversight will not recur. A copy of the memorandum documenting this oversight delay in performing the biennial evaluation and recertification of licensed operators is available at the facility.
3.	6 May 99	During performance of maintenance for core reassembly under MLP #98-15 on May 6, 1999, the thermocouples were tested prior to fully stacking the remainder of the graphite and subsequent stacking of shield blocks, especially since the #1 thermocouple appeared to be not responding downscale. The thermocouples and immediate vicinity piping were heated using a heat gun and the 12-point temperature recorder was monitored

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for response. The #1 thermocouple did not respond to heat input. On May 7, 1999, MLP #99-12 was opened to address troubleshooting the #1 thermocouple. The placement of the thermocouples for their respective fuel boxes is #1 in southwest (SW) fuel box, #2 in south center box (SC) fuel box, etc. Under MLP #99-12, the testing was continued and it was noted that while heating the SW thermocouple (#1), there was no response on the 12-point recorder for #1, but the #2 position on the 12-point recorder did respond. The thermocouples (#1 and #2) were swapped and again tested. This time, the #1 thermocouple responded and was properly correlated with the #1 position on the 12-point recorder. It was concluded that the thermocouples were improperly installed (swapped) during the last full core area inspection or during the last thermocouple repair work. Furthermore, it was determined that the SW fuel box thermocouple (#1) was working properly, and the #2 thermocouple in the SC box was the actual failed thermocouple. The #2 thermocouple (SC fuel box) was then replaced with an identical spare and tested successfully for response to heat input, whereupon Maintenance Log Page #99-12 was closed out on May 12, 1999 with no further repairs necessary.

It was determined that this incorrect thermocouple placement (swapped positions) was not detected prior to May 6, 1999 due to the fact that the normal operating temperatures are so close to each other as to be difficult to distinguish one from the other. The reason for the discovery of the improper placement of the thermocouples at this time was due to the fact that the entire core area was accessible and testing of the individual thermocouples was possible, as a check was performed preliminary to fuel loading and the need was noted by the SRO-in-charge. After evaluation, it was determined that all of the temperature points were still being recorded as required and the minimum number of temperature monitoring points per UFTR Technical Specifications section 3.2.3 was still being met so this was not

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		a promptly reportable event. As such, the evaluation was that there was no effect on facility operation, safety of the operating staff, or on the health and safety of the public as noted in a memorandum on the event included as Attachment III to the May 1999 facility monthly report available at the facility.
4.	8 Jun 99	On May 24, 1999 a Maintenance Log Page (MLP #99-20) was opened to address a perceived failure of the reed switches on the secondary flowmeter. After extensive analysis of the scram circuitry, it was determined that the switches were functioning correctly. After the scram check procedure (Q-1 Surveillance) was thoroughly scrutinized and related to system functions, it was found further that the scram function had been operating correctly, but the instruction (Step 9 in the Q-1 Surveillance) used to verify the secondary coolant flow loss scram was flawed. This procedure (a surveillance data sheet within SOP-0.5, "UFTR Quality Assurance Program") was found to predate the installation of the city water flowmeter in November 1993. The old system prior to November 1993 used a pressure switch in the city water line to provide a go/no-go indication of flow. The procedure called for shutting the city water supply valve and supplying cooling water with the well pump since the two lines flow together. Logic was switched to city water so the well pump power loss scram would be overridden. Additionally, city water logic shifts the scram signal switch from the combined flowmeter to the city water pressure switch (i.e., the scram circuitry monitored at the pressure switch and not at the combined flowmeter). When the well pump was shut off, the flow (and pressure) in the line would fall off until the pressure switch would actuate, yielding the scram. This method would verify the operation of the scram circuitry in the control panel and had been considered adequate, but this method would not verify operation of the 60 gpm switch in the combined

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flowmeter, nor would it allow for verifying the 8 gpm and 60 gpm setpoints in the respective city water and well water secondary cooling modes.

In November 1993, the pressure switch was removed from the city water line and replaced with a flowmeter under MLP #93-43 and 10 CFR 50.59 Evaluation and Determination Number 93-09. At the time of the scram checks (Q-1 Surveillance), Step 9 was not changed to reflect removal of the pressure switch, though it probably should have been. It has been noted that the walk-through requirement for implementing procedure changes instituted in March 1997 as the result of a self-identified violation, would have caught this problem had it been in effect in 1993.

It should be noted that the city water flowmeter will read zero flow when the city water supply valve is shut, regardless of whether the well pump is running or not. When the scram check is conducted (in city water logic), the scram signal derives from the city water flowmeter; as a result the scram signal is always "in," giving the operator the false impression that the scram has occurred as expected.

For about the first year after the city water flowmeter was installed, it operated correctly giving operators scram signals as expected. Later, the city water flowmeter began to fail and would sometimes stick in the 30 gpm position (normal city water flow rate). If the scram check was performed with the city water flowmeter stuck in the 30 gpm position, the scram would not initiate regardless of whether or not the well pump was running. If the city water meter was stuck low, the scram would appear to function normally. If the city water meter was stuck high (30 gpm), the scram would appear to have failed. In these cases the scram was marked as unsatisfactory. However, since city water mode operation was not allowed, continued reactor

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operation was permitted. This was an oversight since without this step completed, there was no verification of a scram from loss of secondary coolant flow in the well water mode independent of loss of pump power.

It should be noted, however, that ever since the replacement of the city water pressure switch with the city water flowmeter, there has been no true verification of a low flow scram (in well water mode)—it only appeared to be functioning properly. The switch that controls the low flow scram signal in well water logic (switch on the combined flowmeter) had not been being tested under low flow conditions. Nor was the 8 gpm scram setpoint in city water logic quantitatively tested until the installation of the city water flowmeter in November 1993. Secondary low flow scrams are verified as part of the daily checkout but are performed with the well pump de-energized, making it impossible to determine whether the scram was initiated as a result of low flow or from a loss of pump power.

On June 8, 1999, the low flow scram was tested by placing scram logic in the well pump cooling mode and supplying cooling with the well pump. Under MLP #99-20, already opened for investigating the secondary flow meter operation and switches, the well water valve was then throttled to reduce flow. The scram was verified to initiate at the required 60 gpm as indicated on the combined flowmeter and the well warning light was verified to actuate at the required 140 gpm. Since at no time during normal reactor operation has the well warning light initiated, it is reasonable to assume that the well pump logic 60 gpm trip point was never approached and therefore, that the UFTR never failed to trip for a condition reaching or exceeding the Limiting Safety System Setting on the secondary flow in the well pump mode. Nevertheless, it was clear that a potential violation of Tech Specs had occurred over some relatively lengthy time period.

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The violation scenario was reviewed by the Reactor Safety Review Subcommittee (RSRS) Executive Committee on June 10, 1999 after extensive discussions among reactor staff including the Acting Reactor Manager and the Facility Director. The RSRS Executive Committee agreed that the applicable scram check procedure did not verify a low secondary cooling water flow trip independent of the loss of pump power trip and that a Tech Spec violation probably had occurred though with little or no safety implications. Changes in procedures to remedy the shortcoming were discussed. All concluded that the best way to check the low flow scram on the quarterly checks would be to throttle secondary coolant flow to create an actual low flow condition and quantitatively verify the low flow trip setpoint. The Executive Committee members agreed and recommended that this event should be treated as promptly reportable as it has been.

In response to the Tech Spec violation identified on June 8, 1999 regarding deficiencies in checking the secondary cooling water low flow trip, two system hardware changes have been implemented which required that two minor procedure changes be implemented in the UFTR SOP-A.1 (Daily Preoperational Checks) and in UFTR SOP-0.5 (Quality Assurance Program) in the surveillance data sheets for the Quarterly Scram Checks (Q-1 Surveillance). In conversations with Senior Project Manager Ted Michaels, it was agreed that assuring the secondary flow trip worked (go/no go) on the daily checkout and then obtaining a measured value of the flow trip on the quarterly checks would meet the intent of the Tech Specs.

The first part of the system modification implemented under 10 CFR 50.59 Evaluation and Determination Number 99-06 (Modifications for Improved Implementation of Secondary Flow Scram Checks) and MLP #99-21 was to install a well pump power trip bypass switch. To implement the necessary changes

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(September 1998 – August 1999)

Number	Date	Description of Occurrence

to the daily checkout procedure, the operator must be able to bypass the loss of well pump power trip. This bypass was accomplished by installing a bypass switch on the reactor console that temporarily (on demand only) shorts the well pump power relay contactors, effectively bypassing the trip. There was a spare switch in the motor control panel that was unused so it has been dedicated as the bypass switch. The switch is a momentary type switch; as such its function is only in effect when an operator is actively depressing the switch. This feature eliminates the possibility that the switch can be inadvertently left in the bypass position during normal reactor operation following completion of the daily checkout. During the daily checkout procedure, the operator depresses the switch to bypass the trip and holds the switch in place while the well pump is de-energized. The switch must be continuously depressed until the scram actuates, after which the operator releases the switch, automatically returning the well pump loss of power trip to permissive, and thereby verifying a low flow trip.

The second part of the system modification implemented under 10 CFR 50.59 Evaluation and Determination Number 99-06 and MLP #99-21 was to install a well water mode low flow trip bypass switch. Installation of this switch allows for bypassing the secondary low flow trip in the well water mode. Since this switch is to be utilized on a quarterly checkout, this switch is physically installed inside the console to prevent inadvertent actuation.

As indicated above, two minor procedure changes have been implemented in order to address better the intent of the Tech Specs. Procedures have been modified to allow for checking the low flow trip independently from the loss of well pump power trip per the first part of the modification. The trip is now to be checked qualitatively (go/no go) on the daily checkout

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence

(SOP-A.1) and quantitatively (setpoint verified) during the quarterly scram checks (SOP-0.5 under the Q-1 Surveillance).

The Executive Committee of the Reactor Safety Review Subcommittee (RSRS) reviewed this event on June 10, 1999 following internal review by Reactor Management and agreed that this event should be promptly reported to NRC as a potential Tech Spec violation based upon the failure to adequately measure the secondary flow trip point and that the trip occurred from lack of flow versus pump de-actuation as required in the Tech Specs. The Executive Committee also noted that the event had been reported by telephone briefly on June 8, 1999 and in a more detailed conversation on June 10, 1999 when the violation of a Technical Specification was agreed upon with Senior Project Manager Ted Michaels. Subsequently, a one-day notification letter was faxed on June 10, 1999. At this time the Committee also reviewed UFTR Management recommendations on the system hardware and procedure changes previously described. The Executive Committee members agreed there had been negligible impact on reactor safety or the health and safety of the public. Indeed, if the secondary trip did not exist, the high temperature, flow and other trips on the primary coolant system would assure no safety limit was ever approached.

Subsequently, the full RSRS reviewed this event again at a regular meeting on June 16, 1999, again noting that there was negligible impact on reactor safety or the health and safety of the public. The full RSRS also reviewed and approved 10 CFR 50.59 Evaluation and Determination Number 99-06 to implement the changes previously described. Under this modification, the changes outlined previously were implemented and tested to be satisfactory on June 17, 1999 under Maintenance Log Page #99-21 with requisite training conducted for licensed operators on June 17, 1999.

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence
		After determining that a possible Tech spec violation had occurred and following discussions between the Acting Reactor Manager and the Facility Director, NRC Headquarters was informed of this event per a brief telephone conversation between the Acting Reactor Manager and NRC Senior Project Manager Ted Michaels on June 8, 1999 relative to a potential violation of technical specifications. Another telephone call was placed on June 9; however, the project manager was not available, though a message was left. Subsequently, on June 10, 1999, the event was discussed in detail with Mr. Michaels whose evaluation was that a violation had occurred. The Tech Spec required one-day notification was submitted by fax on that date as well, since a decision was not reached on June 9 due to Mr. Michael's unavailability. The event was again discussed with Mr. Michael's on June 22 when the Tech Spec required 14-day report was due to be mailed explaining that all corrective actions had been fully implemented and receiving permission to delay this 14-day report one week in the interest of accuracy and completeness, especially since the violation itself had been completely addressed. The Reactor Safety Review Subcommittee met on June 16, 1999 and reviewed this occurrence and approved close out of this occurrence subject to successful checks following implementation of the 10 CFR 50.59 Evaluation and Determination changes under Maintenance Log Page #99-21. The RSRS agreed with actions taken and with the initial staff evaluation that the occurrence did represent a potential violation of the UFTR Technical Specifications and should be treated as promptly reportable which was accomplished. The RSRS also agreed with the earlier evaluation that the UFTR never failed to trip for a condition reaching or exceeding the Limiting Safety System Setting on the secondary flow in the well pump mode which is the mode in use for essentially all operations requiring

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence
		secondary flow. Reactor Management and the RSRS also agreed that this occurrence is not considered to have involved any reduction in reactor safety margins and it is not considered to have involved any significant effect, potential or real, on the health and safety of the public. With successful implementation of the changes to assure effective measurement of the secondary coolant flow trip, corrective action for this occurrence is now considered closed. A copy of the 14-day report dated June 29, 1999 was sent to the NRC pursuant to the reporting requirements of paragraph 6.6.2(3)(g) of the UFTR Technical Specifications and is Attachment II to the June 1999 facility monthly report which is available at the facility.
5.	22 Jun 99	During the taking of the neutron counts for all blades out following loading of the 11th and 12th fuel bundles during fuel reloading, the fire alarm sounded at 1236 hours. When the second person reported no obvious fire in Zones 1 and 2 but was unable to assure no fire elsewhere and with all other personnel gone to lunch, the operator at the console inserted all blades (considered an unscheduled shutdown) and secured the reactor at 1238 hours. Subsequently, PPD fire alarm technicians Rick Lund and Frank Petrone arrived along with UPD Officers Don E. Miles and D.A. Ellis at the Emergency Support Center and UPD Officer McElroy in the Journalism lot. A walk-through verified no fire in Zones 1, 2 or 3 and no alarm indications in the part of Zone 4 used as the Reactor Support Facility, though the fire alarm monitoring station showed that the fire indicator was in Zone 4. UPD Officer Miles plus the two fire alarm technicians and the SRO-on-call then accessed the materials science part of Zone 4 and found an alarmed smoke detector in the downstairs area with no smoke, fire or other obvious cause as the area was unoccupied at the time. Under MLP #99-23, the suspected spuriously alarmed smoke detector was replaced with a duplicate smoke detector by the PPD Alarm System

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence
		technicians with the system reset and checked operational with no further problems noted. Completed UFTR Form SOP-0.6B (Unscheduled Shutdown Review and Evaluation) is available at the facility and shows the only condition on restart of control blade withdrawal and fuel loading activities was replacement of the Zone 4 smoke detector and a successful daily preoperational checkout, both of which were accomplished (the smoke detector and fire alarm test at 1315 hours and the daily checkout at 1333 hours) so blades were then pulled beginning at 1335 hours to complete the neutron counts for having 12 fuel bundles loaded with no further problems noted. The evaluation of this event is that it had no effect on reactor safety or the health and safety of reactor personnel or the public.
6.	30 Jul 99	While operating at 100 kW on July 30, 1999, following startup at 1021 hours for annual temperature coefficient of reactivity measurements (A-3 Surveillance) as well as radiation surveys in anticipation of returning to normal operations, the reactor tripped on a Safety Channel 2 scram (full trip) at 1234 hours at which time the reactor was also secured. This was a full trip with all safety systems responding satisfactorily. Since power was not observed to exceed the 100 kW set point by the operator (SRO Jim Wolf), the trip was determined to have been caused by the Safety Channel 2 Loss of High Voltage trip circuit. Under MLP #99-33 key voltage points in the trip circuit were measured and verified normal after the trip occurred. A successful daily checkout was accomplished soon after the trip at 1441 hours. Following the trip, set points were verified and the trip circuit was quantitatively tested and verified to be functioning more conservatively than required on loss of high voltage with only about 5% voltage reduction versus Tech Spec specification of 10% reduction allowed before causing a full trip on loss of high voltage. A similar trip in April 1996 (see MLP #96-12) showed

TABLE III-6

LOG OF UNUSUAL OCCURRENCES
(September 1998 – August 1999)

Number	Date	Description of Occurrence
		a relatively large amount of noise at the inputs of the bistable circuit comparator. With this noise present, any additional noise such as spikes produced from line (main AC) transients would be likely to cause a spurious trip. Due to a heat wave during the week of July 26, 1999 and close to 100° F temperatures on July 30, 1999, the electrical distribution grid was taxed and transients were noted in sensitive equipment in adjacent buildings at about the same time supporting this evaluation. Since this was a spurious trip, no system modifications were recommended unless the problem of such trips should become chronic. This trip was also not considered to be promptly reportable per Technical Specifications, Section 6.6.2 since it is from a known cause. After successful weekly and daily checkouts and closeout of MLP #99-33, restart was approved on August 2, 1999. The evaluation of this event is that it had no effect on reactor safety or the health and safety of the public. Completed UFTR Form SOP-0.6A (Unscheduled Reactor Trip Review and Evaluation) indicating all safety systems responded properly, along with a memorandum of evaluation on the event to reactor trip records plus the completed maintenance log page (MLP #99-33) including weekly and daily preoperational check sheets constitute Attachment III to the July 1999 facility monthly report. Following circuit analysis and successful weekly and daily preoperational checkouts on August 2, 1999, the maintenance log page was closed out for return to performing operations for surveillances in anticipation of returning to normal operations. Some additional follow-up discussions on loading and operation of the Safety Channel 2 high voltage and bistable trip were conducted on August 5, 1999.

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 1998-99 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 1984-85 Reporting Year:

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

- Carried over from the 1991-92 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 1993-94 Reporting Year:

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

- Carried over from the 1996-97 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)
(Modification 99-02: Evaluation Completed 11 February 1999)

Following one spurious security alarm on November 10 and two alarms on November 11, 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 January 7, 1997 with all but one siren operational to meet requirements. Subsequently, the west lot siren was repaired on January 13 and both the west lot and journalism side siren horn drivers wiring was reterminated on January 14, 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 March 10, 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 March 10-21 with circuit mapping performed for troubleshooting on March 19 and the intermittent ground finally repaired on March 21, 1997, but without installation of the modification to separate grounds, basically returning the system to its state prior to March 10. Subsequently, the 4 Volt rechargeable batteries have been replaced on May 14, June 18, July 7, and July 24, 1997 (for prevention purposes on July 30, 1997), on August 29, and on September 29, 1997. Following a full S-7 Surveillance on October 24, 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 December 16, 1997 and again on January 9, February 10, March 10, April 8, and on May 6, 1998. Following a full S-7 Surveillance on May 27, 1998, the 4 Volt rechargeable batteries were replaced again on June 24, July 24, August 19, September 16 and October 13, 1998. Following a full S-7 Surveillance including replacement of rechargeable batteries on November 10, the 4 Volt rechargeable batteries were replaced again on December 7, 1998 and January 4, February 1 and March 2, 1999 with upgraded 4 Volt batteries installed on March 12, 1999 under 10 CFR 50.59 Evaluation Number 99-02 developed and approved in February to upgrade the 4 Volt rechargeable batteries for longer life. There had been no need for further replacement through the end of July 1999 though the full S-7 Surveillance was performed on July 2, 1999. Following the full S-7 Surveillance, when the 4 Volt batteries were not replaced, the 4 Volt rechargeable batteries were replaced again on August 24, 1999. MLP #96-30 remains open.

Controlling Documents: Maintenance Log Page #96-30 (Remains Open)
10 CFR 50.59 Evaluation Number 96-13
10 CFR 50.59 Evaluation Number 99-02

2. Conversion of Direct Reading Tachometer for Dilute Fan RPM from Optical Tach to Hall Effect Tachometer (Permanent – Closed Item)

(Modification 98-07: Evaluation and Determination Completed 11 September 1998

In August 1998, during a 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 optical tachometer and to implement a modification using a direct reading tachometer based on the hall effect. At the end of August, a modification package (10 CFR 50.59 Evaluation and Determination Number 98-7, "Conversion of Direct Reading Tachometer for Dilute Fan rpm from Optical Tach to Hall Effect Tachometer") had been developed including two page changes in SOP-A.1 (Preoperational Checks) allowing use of either type of direct reading tachometer (optical or hall effect) to meet tech spec requirements for dilute fan rpm monitoring. This package was approved at the RSRS meeting on September 11, 1998 followed by installation on September 21, 1998 and verification of rpm indication on September 22, 1998. Subsequently, implementation of the alternate direct reading tachometer to eliminate the problem with intermittent loss of rpm indication on this channel was culminated with generation of a memorandum of implementation dated September 23, 1998 with no further problems noted.

Controlling Documents: Maintenance Log Page #98-30
10 CFR 50.59 Evaluation and Determination Number 98-07

3. Temporary Bypass of Control Blade Withdrawal Interlocks to Allow Direct Observation of Movement with Reactor Secured (No Fuel Present) (Temporary – Closed Item)

(Modification 98-08: Evaluation and Determination Completed 16 October 1998)

During efforts to address the reactivity anomaly, the core was disassembled to assure there were no problems with the control blades, shrouds, fuel boxes, etc. per MLP #98-15. By mid-September 1998, the NC fuel box was finally removed along with the Safety-3 control blade shroud. Comparison of the regulating and S-3 control blades showed no obvious mechanical defects which had been a concern. Subsequently, the southeast (SE) fuel box was removed and some work was undertaken to remove the Safety-2 control blade shroud. It was then noted that the south central (SC) fuel box would have to be removed to allow removal of the Safety-1 and Safety-2 control blade shrouds. At month's end the SC fuel box bolts had been removed and the fuel box was almost freed up for removal to allow direct access to the S-1 and S-2 shrouds for removal.

Early in October 1998, the SC fuel box was finally removed to the shield tank, the S-1 and S-2 safety control blade shrouds were unbolted and removed to reveal the S-1 and S-2 control blades which also appear to be in good shape. Spectral analysis of the metal shavings found on September 17 was inconclusive to this point but was continuing. A modification package as 10 CFR 50.59 Evaluation and Determination Number 98-08 (Temporary Bypass of Control Blade Withdrawal Interlocks to Allow Direct Observation of Movement with Reactor Secured – No Fuel Present) was developed, approved and implemented to allow temporary bypass of the control blade interlocks on October 22, 1998. The blades were timed and assured visually not to have any obvious movement problems with the interlocks bypass removed on the same day. This work is considered to have eliminated the control blades themselves as a source of any reactivity anomaly that could impact safety. On October 29, a shield block was placed over the core area to reduce sky shine hopefully to lower the recorded dose to the stack and cell environmental monitoring TLDs, the results of which have been over 300 mR per month since opening the core area and removing fuel.

During November 1998, preparations were made for fuel handling with fuel handling training conducted for those involved with three (3) bundles inspected on November 11 when operations were halted until the crane could be checked for a missing lock washer with five (5) more bundles inspected on November 18 and seven (7) more on November 19 controlled under RWP 98-11-I. In general, with minor defects, the fuel was noted to be in good condition with no real problems noted to this point. The report on the spectral analysis of the metal shavings was finally issued on November 5, 1998, but its results are not conclusive and the shavings are not considered to be related to the reactivity anomaly problem. It should be noted that the primary RWP 98-8-I was reissued a number of times during the month as was the RWP-98-11-I used to control fuel inspection.

During December 1998, the remaining 7½ fuel bundles were inspected on December 4, controlled under RWP 98-11-I, to close out the B-2 Surveillance. No significant problems were noted per the report dated December 8, 1998. Subsequently, RWP 98-11-I was reissued until closed out on December 10. Following various extensive discussions, the control blade gear boxes were inspected with assistance from Professor G.J. Schoessow and found to be in good shape (also part of V-1 Surveillance). Subsequently, an inclinometer was obtained, the control blade interlocks were bypassed again on December 21 per 10 CFR 50.59 Evaluation and Determination Number 98-08, with each of the blades moved in steps with the blade position indication at the console found to agree and vary linearly with the physical blade position indicated by the inclinometer attached temporarily to each blade until all were tracked in this way. The memorandum comparing physical blade position in the core indicated by the inclinometer and the blade position indicated on the control blade position indicator at the console demonstrates good correspondence and linearity in the movement of the blades (part of V-1 Surveillance). Subsequently, the regulating blade was removed reading ~100 mR/hr on contact and ~5 mR/hr at one foot with plans next to x-ray the plate to check on cadmium absorber integrity. A brief tabular summary of reactivity variations leading to the anomaly was also generated during this month. It should be noted that the primary RWP 98-8-I was reissued a number of times during the month of December 1998

and there was no further need to bypass the control blade interlocks which were assured to be restored.

Controlling Documents: Maintenance Log Page #98-15
10 C CFR 50.59 Evaluation and Determination Number 98-08

4. Addition of Zone 2 Smoke Detector for Protection of Control Equipment (Monitoring Station Outside 108 NSC) (Permanent – Closed Item)

(Modification 98-09: Evaluation Completed 8 December 1998)

During one of the quarterly inspections of the four zone fire alarm monitoring system for the UFTR building, Physical Plant Division personnel noted that upgraded fire code specifications require that the monitoring station itself, located outside the building at the Emergency Support Center be monitored by the system. Following scoping of the system for equipment and material needs on December 9, 1998, under MLP #98-39 and 10 CFR 50.59 Evaluation Number 98-09, PPD alarm systems technician Wayne Gravely installed a smoke detector on Zone 2 (downstairs laboratories and offices) but physically located over the fire alarm monitoring station outside the Emergency Support Center to meet upgraded fire code requirements. The system was removed and then returned to service with no problems noted for installation of this modification completed on December 10, 1998.

Controlling Documents: Maintenance Log Page #98-39
10 CFR 50.59 Evaluation Number 98-09

5. Personnel Monitoring Device Change from Film/TLD Badges to Luxel Dosimeters (Permanent – Closed Item)

(Modification 98-10: Evaluation and Determination Completed 23 December 1998)

During the 1998-99 reporting year, Revision 11 to the UFTR Safety Analysis Report (SAR) was initiated as a result of changes in personnel monitoring badges supplied to the University by the NVLAP-accredited supplier (Landauer). By memorandum dated December 10, 1998 and received on December 16, 1998, the UFTR facility was informed by the Radiation Control Office that the University's dosimeter company, NVLAP-certified Landauer, Inc., was switching from film badges to Luxel dosimeters for personnel monitoring badges. The memorandum as well as the Luxel Dosimeter Information Sheet and a Radiation Dosimeter Fact Sheet were used to support 10 CFR 50.59 Evaluation and Determination Number 98-10 (Personnel Monitoring Device Change from Film/TLD Badges to Luxel Dosimeters) supporting the change in dosimetry and the associated change in the UFTR Safety Analysis Report as well as various procedural changes (TCNs for SOP-A.8, SOP-C.3, SOP-D.2, SOP-D.3, SOP-D.4 and SOP-D.5) to refer to personnel monitoring badges instead of film badges. During January 1999, the various procedural changes and the change to the FSAR were

developed for review and approval at the February 11, 1999 RSRS meeting after which they were implemented in late February 1999. The new radiation dosimetry report now reports data for the new Luxel dosimeter down to 1 millirem versus the previous 10 millirem limit.

This change was submitted to NRC with a cover letter dated February 19, 1999. Essentially, this change was made because the University-contracted NVLAP-approved supplier of personnel radiation monitoring badges has now changed from using film to using Luxel dosimeters in their badges. Other extra badges for some operators were already utilizing thermoluminescent dosimeters (TLDs). The change occurs in FSAR Section 12.3.4.4 on page 12-20 where the reference to operators and other personnel working in the reactor wearing "film badges" at all times is changed to read wearing "film, TLD, Luxel or other individual personnel monitoring badges" in the first two lines of the first paragraph. The change is general to allow various types of radiation sensitive materials to be used in personnel monitoring badges. Currently, the Luxel dosimeter is the primary material with supporting documentation showing this material to be superior to film; nevertheless, sufficient generality is incorporated in the new wording so that any change by the NVLAP-approved supplier, whoever it might be that is contracting with the University, would be allowable under the Safety Analysis Report. The usual vertical line in the page margin is used to delineate the change in the report so that it is easily located.

This Revision 11 change was fully reviewed by UFTR management and by the Reactor Safety Review Subcommittee to assure no unreviewed safety question was involved and so is not considered to relax the requirements for assuring protection of the health and safety of the public and of the reactor facility. The change simply updates the Safety Analysis Report to reflect the existing facility and its operations by updating the allowable types of personnel monitoring badges to be worn by those working in the reactor. A copy of the transmittal letter dated February 19, 1999 and mailed on February 22, 1999 and the revised FSAR page 12-20 is Attachment III to the facility monthly report which is available at the facility for those interested. To date there has been no formal response from the NRC nor is any expected as this does not constitute an unreviewed safety question. This change was closed out with incorporation of the revised page 12-20 into facility copies of the FSAR.

Controlling Documents: 10 CFR 50.59 Evaluation and Determination Number 98-10
FSAR Revision 11, 12/98, pp. 12-20

6. Equivalent Replacement for Period Trip Test Switch – 0.25 Watts Versus 2.0 Watts (Permanent – Closed Item)

(Modification 99-01: Evaluation Completed 11 February 1999)

The console period trip test switch had been becoming more difficult to get to respond reliably for some time. During the daily checkout on January 15, 1999, the console period trip test switch failed completely. There was no rush to repair it since the reactor was defueled and disassembled. Subsequently, under MLP #99-02, the drawings for this rheostatic switch were checked with plans made to remove the switch for replacement. On

February 1, 1999, the rheostatic switch was desoldered and removed for examination. Subsequently, on February 2, 1999 a number of voltage measurements were made and on February 3, 1999 a modification package 10 CFR 50.59 Evaluation No. 99-01 was developed for replacement of the 2 watt rheostatic switch with an equivalent 0.25 watt switch which was available in late February. The switch was subsequently installed on March 12, 1999 but responded erratically until the contacts were cleaned on March 22, 1999 to complete the maintenance with no further problems noted.

Controlling Documents: Maintenance Log Page #99-02
10 CFR 50.59 Evaluation Number 99-01

7. Upgrade of Security System Rechargeable Batteries (Permanent – Closed Item)

(Modification 99-02: Evaluation Completed 11 February 1999)

Modification 99-02 was worked under MLP #96-30 along with Modification 96-13. They are discussed in detail under item 1 above.

Controlling Documents: Maintenance Log Page #96-30 (Remains Open)
10 CFR 50.59 Evaluation Number 96-13
10 CFR 50.59 Evaluation Number 99-02

8. Linear Channel Front-End Amplifier Upgrade (Permanent – Postponed)

(Modification 99-03: Evaluation Completed 21 May 1999)

In May 1999, during a weekly and daily checkout, the linear channel was noted to be very erratic at the low end attributed to a failing linear channel front end amplifier. Under MLP #99-16, the linear channel front end amplifier was checked for a part number. Then the existing amplifier was researched and compared to specifications of a new amplifier from stock. Subsequently, the CIC current was measured and 10 CFR 50.59 Evaluation Number 99-03 (Linear Channel Front-End Amplifier Upgrade) was developed as the A2 amplifier was removed from the linear channel to take measurements and work continued to design and develop a new circuit board, fabricate a case for it and identify the pin connections. After fabricating the amplifier, OPA 627 was installed for testing and troubleshooting with some problems remaining to be corrected at the end of May. It was then decided to install the modification at a future date as an improvement when troubleshooting can be completed. Subsequently, troubleshooting identified a failed 310K amplifier so an identical replacement was ordered and installed in the picoammeter to correct the problem with no further problems noted and no need for the modification which was postponed indefinitely as MLP #99-16 was closed on June 3, 1999.

Controlling Documents: Maintenance Log Page #99-16
10 CFR 50.59 Evaluation Number 99-03

9. Modification/Upgrade of Effluent Discharge System for Reactor Building (Permanent – In Progress)

(Modification 99-04: Evaluation and Determination Completed 21 May 1999)

10 CFR 50.59 Evaluation and Determination Number 99-04 (Modification/Upgrade of Effluent Discharge System for Reactor Building) was approved for replacing the two underground waste water holdup tanks with aboveground tanks—one outside, two inside. Under MLP #99-19, PPD personnel excavated in the west lot to locate the line feeding the tank system beginning on May 24, 1999. On May 26, 1999, they broke the freshwater line used to flush the tanks so it was valved off. On May 28, 1999, they finally had the whole line excavated, temporarily cut it, got negative indications on swipes and reconnected the feed pipe to the tank as a lift station is needed to connect it directly to the sanitary sewer. A visit to Southern Precast, Inc. in Alachua also identified the 1,000 gallon tank to be placed outside aboveground. At the end of May, further operations awaited delivery of a lift station to be installed below ground in the west lot as two smaller indoor sink tanks were to be ordered also.

During June 1999, the rerouting activities were discussed with RCO D.L. Munroe along with release of the east holdup tank. Mr. Steve Middleton, PPD Maintenance and Construction Superintendent for Water Systems, visited on June 2 to check on the status. The situation was also discussed with PPD Project Engineer Bahar on June 4 as she visited to indicate how the lift station would be installed to protect lot access. The Manager of Specialty Products Division for Southern Precast, Inc., visited on June 4 with the specs for the 1,000 gallon aboveground storage tank and also to check accessibility of the west lot for delivery of the tank. The specs were then delivered to Ralph Haskew to order the tank through EH&S. Excavations to install the lift station were begun on June 16 but work was stopped by EH&S due to PPD worker safety concerns about unrestrained sides of the hole. Further excavations were then performed on June 18 as the lines were cut and the lift station installed on June 22. It was not anchored so overnight rain damaged the lines so the lift station was removed and reinstalled with negative swipe indications on June 23. An electrician along with supervisor Ron Sandoval and two assistants installed the "permanent" electrical connection for the lift station on June 24. Subsequently, Steve Middleton visited again and agreed that the electrical connection for the pump could be moved inside the lift station to avoid aboveground barriers limiting lot access. This electrical connection was moved to inside the lift station on June 28. Considerable research was undertaken and a 150-gallon indoor tank was ordered for the reactor cell and several liquid waste water collection drums were installed temporarily in the cell on June 25.

During July1999, approximately 295 gallons of waste water were collected and pumped to the in-ground holdup tank system. Some grading work was accomplished following installation of the lift station in June, with Steve Middleton checking the situation on July 2. After notification that the 1,000 gallon aboveground storage tank was available, Steve Middleton, supervisor Marty Wertz, foreman John Black and another PPD technician visited to scope out concrete replacement work with old concrete broken out with a visit by RCO

D.L. Munroe on July 8. Subsequently, replacement concrete was poured on July 9 with the west lot entrance gate rehung also. The 1,000 gallon tank was finally delivered and placed in the west lot on July 20, 1999. Subsequently, the 150-gallon indoor tank was delivered to the west lot on July 22 and moved inside for leak checks prior to set up on July 23, 1999. Both RCO D.L. Munroe and EH&S Director W.S. Properzio visited to check on both the inside 150 gallon and the outside 1,000 gallon tanks on July 29, 1999. Subsequently, a special remote video camera system was used to inspect the inside of the underground tanks on July 30 in anticipation of eventual decommissioning of the tanks.

During August 1999, approximately 700 gallons of waste water were collected and pumped to the inground holdup tank system. On August 28, 1999 telephone calls were made to and from Steve Middleton concerning completion of west lot work, a line was installed and sealed to direct cell AC condensate to the indoor 150 gallon tank on August 3–5, the indoor setup was cleaned up and arranged optimally around the tanks on August 12. In addition, a contractor visited to estimate costs for installation of plumbing from the cell to the aboveground tank in the west lot on August 26. Subsequently, a special remote video camera system was used again to inspect the inside of the underground tanks on August 31, 1999 in anticipation of eventual decommissioning of the tanks as MLP #99-19 remains open at year's end.

Controlling Documents: Maintenance Log Page #99-19 (Remains Open)
10 CFR 50.59 Evaluation and Determination Number 99-04

10. Replacement of Secondary Cooling System Flow Meter with Ultrasonic Flow Meter (Permanent – Postponed)

(Modification 99-05: Evaluation Completed 4 June 1999)

In May 1999, during a weekly checkout, the secondary flow meter was thought to be failed. Under MLP #99-20, the meter was cleaned and the switches thought to be failed. Discussions were then undertaken as to whether to order a replacement meter (apparently unavailable except as a special order item), order replacement switches, or install an alternate ultrasonic flow meter. At the end of May, the decision was still uncertain due to long lead times for a new meter. Therefore, during June 1999, 10 CFR 50.59 Evaluation Number 99-05 (Replacement of Secondary Cooling System Flow Meter with Ultrasonic Flow Meter) was developed and fully approved on June 4, 1999 to allow replacement of the vane type flow meter with an ultrasonic flow meter. The existing system employs an ERDCO vane type mechanical flow meter which utilizes magnets mounted on the indicator needle to actuate mercury reed switches (mounted on the meter face) to achieve signal switching for the secondary cooling system low flow scram trip and well warning light. The proposed new system per 10 CFR 50.59 Evaluation Number 99-05 consists of a Dynasonics Series 1500 ultrasonic flow meter to measure flow and produce a flow signal from ultrasonic transducers mounted on the outside wall of the secondary cooling piping. No alterations will be made to the existing piping system. Scram and warning signals will be generated by an in-house

developed comparator and switching circuit which will take the flow signal from the ultrasonic flow meter and compare the signal to reference (setpoint) voltages and actuate solid state relays. These relays will take the place of the mercury switches on the ERDCO meter. No other wiring and reactor protection circuitry will be altered.

Some measurements were taken and discussions were had with Dynasonics as transducers were installed (no system effect) and the transit meter was tested satisfactorily as efforts were made to get an independent measurement of secondary flow. The secondary flow meter circuit was then simulated and a circuit board constructed as system simulations indicated the original flow meter switches were working properly and were not failed at which point the secondary flow scram was operationally tested and the applicable Tech Spec, Safety Analysis Report and operating procedures were reviewed for a possible violation with respect to a failure to measure the secondary flow scram adequately discussed elsewhere in this report including item 11 in this section. Subsequently, the flow meter was cleaned and inspected and a magnet leaf spring was repaired. Subsequently, the well water flow was throttled to get the trip as expected which would not clear when flow was reestablished. The low flow scram relay was then replaced with a spare so it then cleared normally with no further problems noted on operation to close out MLP #99-20 on June 10, 1999 with the decision made to delay implementation of the modification.

Controlling Documents: Maintenance Log Page #99-20
10 CFR 50.59 Evaluation Number 99-05

11. Modifications for Improved Implementation of Secondary Flow Scram Checks (Permanent – Closed Item)

(Modification 99-06: Evaluation and Determination Completed 16 June 1999)

In May 1999, during a weekly checkout, the secondary flow meter was thought to be failed. Under MLP #99-20, the meter was cleaned and the switches thought to be failed so switches were ordered. Discussions were then undertaken as to whether to order a replacement meter (apparently unavailable except as a special order item), order replacement switches, or install an alternate ultrasonic flow meter. At the end of May, the decision was still uncertain due to long lead times for a new meter.

During June 1999, some measurements were taken and discussions were had with Dynasonics as transducers were installed (no system effect) and the transit meter was tested satisfactorily. Incorrect replacement switches were also returned as efforts were made to get an independent measurement of secondary flow. The secondary flow meter circuit was then simulated and a circuit board constructed as system simulations indicated the switches were working properly and were not failed at which point the secondary flow scram was operationally tested and the applicable Tech Spec, Safety Analysis Report and operating procedures were reviewed for a possible violation with respect to a failure to measure the secondary flow scram adequately. Subsequently, the flow meter was cleaned and inspected

and a magnet leaf spring was repaired as NRC Senior Project Manager Ted Michaels was informed of the possible Tech Spec violation. After continued testing and console manual review plus an RSRS Executive Committee meeting, the secondary flow trip point measurement was discussed in detail with Ted Michaels as it was decided that a violation was involved (see discussion of unusual occurrences in Table III-6). Subsequently, the well water flow was throttled to get the trip as expected which would not clear when flow was reestablished. The low flow scram relay was then replaced with a spare so it then cleared normally with no further problems noted on operation to closeout MLP #99-20 on June 10, 1999.

Controlling Documents: Maintenance Log Page #99-20
Maintenance Log Page #99-21
10 CFR 50.59 Evaluation and Determination Number 99-06
Standard Operating Procedures 0.5 and A.1

12. Modification for Equivalent Replacement of Safety Channel 2 Linear Amplifiers (Permanent – Closed Item)

(Modification 99-07: Evaluation Completed 28 July 1999)

In July 1999, during completion of final surveillances for recovery from the outage for checks related to the reactivity anomaly, following the power run for calorimetric heat balance (A-2 Surveillance) and adjustments to the nuclear instruments at power, the reactor was shut down for the post-calorimetric adjustments. During the adjustments, Safety Channel 2 failed after about 10 minutes. Since the failure was at shutdown, it was not considered reportable per Tech Specs. Under MLP #99-32, extensive circuit troubleshooting and testing were conducted on Safety Channel 2 to determine that the linear amplifier had two operational amplifiers that needed to be replaced. Therefore, 10 CFR 50.59 Evaluation Number 99-07 (Modification for Equivalent Replacement of Safety Channel Two Linear Amplifiers) was approved to allow replacement of two operational amplifiers with equivalent amplifiers since exact duplicate operational amplifiers are no longer available. Subsequently, the two operational amplifiers were installed in the linear amplifier card for Safety Channel 2 to restore verified proper operation of Safety Channel 2 with no further problems noted so that the A-2 Surveillance could be repeated which was accomplished successfully on July 27, 1999 with MLP #99-32 closed on July 26, 1999.

Controlling Documents: Maintenance Log Page #99-32
10 CFR 50.59 Evaluation Number 99-07

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 the 1997-98 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 of the year 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).

With no full-time Reactor Manager for the entire1998-99 reporting year plus the outage for the reactivity anomaly extending until return to normal operations on August 17 (regular operations began on August 9 but delayed operations training had to be conducted), neither of the two SRO-trainees was able to be licensed with most of the year's outage attributed to addressing the reactivity anomaly and returning the UFTR to normal operating status after completing all required surveillances as well as delayed annual reactor operations tests. Therefore, availability for the 1998-99 reporting year was further reduced to only 4.01% from 58.29% in the previous year. Basically, there were 348.625 days forced unavailability, 0.375 days planned unavailability (in August 1999) and no days administrative shutdown as such. Of course, this forced unavailability was essentially all to address investigation of the reactivity anomaly though a number of other events during the year could have impacted unavailability had the reactor been in an operational status.

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 quite 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 seven entries in Table V-2 which involved maintenance in progress at the end of the 1997-98 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. Four of these seven entries (MLP #98-15 to address core disassembly to investigate a reactivity anomaly that resulted in an increased regulating blade critical position, MLP #98-21 to control repairs of the PMC-4A portal monitor, MLP #98-23 first to attempt repair and then to replace a high volume air sampler, and MLP #98-30 first to attempt repair of the optical tachometer and finally to replace it with a much more reliable Hall effect (magnetic) direct reading tachometer to maintain a redundant capability to meet tech spec requirements for dilute fan rpm monitoring under 10 CFR 50.59 Evaluation and Determination Number 98-07) were closed out during the current 1998-99 reporting year. Nevertheless, 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, six Maintenance Log Pages remain open at the end of the current 1998-99 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 #99-11 to control repair of a survey meter, MLP #99-19 to control replacement of the below ground waste water holdup tanks, and MLP #99-22 involving replacement of a city water motor operated valve. It is expected that MLP #93-10,

MLP #94-14 and MLP #99-15 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. In addition, replacement of the below ground waste water holdup tanks with an aboveground tank under MLP #99-19 is also expected to take extensive time. However, MLP #96-30, MLP #99-11 and MLP #99-22 should all be closed out relatively early in the new reporting year, though these are all of low significance.

TABLE V-1

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

Date		Surveillance/Check/Test Description
1 Sep 98	S-12	Semiannual Review of Requalification Training Program Binders (Due 1 July 1998).
2 Sep 98	Q-9	Quarterly Calibration Check of AMS[4] Air Particulate Detector (Due 31 August 1998).
3 Sep 98	Q-6	Quarterly Check of Posting Requirements (Completion) (Due 31 August 1998).
15 Sep 98	Q-7	Quarterly Check of UFTR Building Fire Alarm System (Zone 3 – Upstairs Offices and Laboratories) (Due 9 September 1998).
16 Sep 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries) (Not Due).
18 Sep 98	Q-3	Quarterly Radiological Emergency Evacuation Drill (Due 30 September 1998).
24 Sep 98	Q-4	Quarterly Radiological Survey of Unrestricted Areas (Shutdown Conditions) (Due 31 August 1998).
24 Sep 98	Q-5	Quarterly Radiological Survey of Restricted Areas (Shutdown Conditions) (Due 31 August 1998).
25/27 Sep 98	S-10	Check and Update of Emergency Call Lists (Partial to Update Staff Telephone Number Changes and SRO-trainee G. Macdonald Security Access) (Not Due)
30 Sep 98	A-5	Annual Update of UFTR Decommissioning Cost Estimates (Due 31 July 1998).
8 Oct 98	S-10	Check and Update of Emergency Call Lists (Partial to Replace Latest Call Lists Updating Staff Telephone Number Changes and SRO-trainee G. Macdonald Security Access Following NRC Inspector Check) (Not Due).
9 Oct 98	Q-8	Quarterly Report of Safeguards Events (Due 1 October 1998).
12-13 Oct 98	S-6	Semiannual Inventory of Security Keys for UFTR and UFSA (Due 1 October 1998).
13 Oct 98	S-3	Semiannual Inventory of Special Nuclear Material (Due 1 October 1998).

TABLE V-1

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

Date		Surveillance/Check/Test Description
13 Oct 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4 Volt Rechargeable Batteries).
30 Oct 98	S-8	Semiannual Leak Check of PuBe and SbBe Neutron Sources (Due 23 October 1998).
2 Nov 98	Q-6	Quarterly Check of Posting Requirements (Partial to Replace Outdated NRC Form 3) (Not as Due).
5-30 Nov 98	B-2	Biennial Inspection of Incore Reactor Fuel Elements (Completion Requires Inspection of 1 More Fuel Bundle But All Bundles Are Being Inspected - Partial for 15 Bundles) (Due 28 February 1998).
10 Nov 98	S-7	Semiannual Check (Replacement) of Security System Batteries (Due 31 October 1998).
14-22 Nov 98	B-6	Biennial Evaluation of Emergency Plan (Partial with Completion of Some Documentation) (Not Due Until 1 December 1998).
23 Nov 98	Q-9	Quarterly Calibration Check of AIM3BL Air Particulate Detector (Due 27 November 1998).
25 Nov 98	Q-9	Quarterly Calibration Check of AMS^4 Air Particulate Detector (Due 30 November 1998).
25 Nov 98	Q-2	Quarterly Calibration Check of Area and Stack Radiation Monitors (Due 27 November 1998).
1 Dec 98	Q-5	Quarterly Radiological Survey of Restricted Areas (Shutdown Conditions) (Due 30 November 1998).
1-2 Dec 98	Q-4	Quarterly Radiological Survey of Unrestricted Areas (Shutdown Conditions) (Due 30 November 1998).
4 Dec 98	B-2	Biennial Inspection of Incore Reactor Fuel Elements (Completion of Remaining 7½ Fuel Bundles) (Due 28 February 1998).
7 Dec 98	S-7	Semiannual Check (Replacement) of Security System (Partial to Replace 4 Volt Rechargeable Batteries) (Not Due).

TABLE V-1

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

Date		Surveillance/Check/Test Description
10-31 Dec 98	V-1	Five Year Surveillance Inspection of Mechanical Integrity of Control Blade and Drive Systems (Partial to Include Ex-Core Gear Boxes, Visual and Inclinometer Checks on Blades and Drive Shafts Plus Removal of Regulating Blade for X-ray Check) (Not Due – Part of Maintenance Relative to Reactivity Anomaly).
12 Dec 98	B-6	Biennial Evaluation of Emergency Plan (Follow-up with Revision 11 Needed) (Due 1 December 1998).
17 Dec 98	Q-3	Quarterly Radiological Emergency Evacuation Drill (Large Drill Involving Outside Agencies) (Due 18 December 1998).
25 Nov 98	Q-6	Quarterly Check of Posting Requirements (Due 30 November 1998).
29 Dec 98	S-10	S-10 - Semiannual Check and Update of Emergency Call Lists (Partial - Check of All Contact Telephone Numbers) (Due 31 December 1998).
29 Dec 98	S-9	Semiannual Replacement of Well Pump Fuses (Due 31 December 1998).
4 Jan 99	S-7	Semiannual Check (Replacement) of Security System (Partial to Replace 4 Volt Rechargeable Batteries) (Not Due).
4-28 Jan 99	V-1	Five Year Surveillance Inspection of Mechanical Integrity of Control Blade and Drive Systems (Partial to Include Removal of S-1, S-2 and S-3 Control Blades and Performance of X-ray Checks on All Four Control Blades with Archiving of X-ray Results) (Not Due – Part of Maintenance Relative to Reactivity Anomaly).
6 Jan 99	S-10	S-10 - Semiannual Check and Update of Emergency Call Lists (Completion - Posting of New Call List #2, Verification of All Posted Call Lists and Delivery of All Call Lists to UPD) (Due 31 December 1998).

TABLE V-1

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

Date		Surveillance/Check/Test Description
6 Jan 99	Q-7	Quarterly Check of UFTR Building Fire Alarm System (Zone 4 - Annex) (Due 15 December 1998).
7 Jan 99	Q-8	Quarterly Report of Safeguards Events (Due 1 January 1999).
1 Feb 99	S-7	Semiannual Check (Replacement) of Security System (Partial to Replace 4 Volt Rechargeable Batteries) (Not Due).
1-11 Feb 99	B-5	Biennial Evaluation and Recertification of Licensed Operators (Due 31 December 1998). *(Note: Should have been due June 1998.)*
10 Feb 99	S-12	Semiannual Review of Requalification Training Program Binders (Due 1 January 1999).
10 Feb 99	V-1	Five Year Surveillance Inspection of Mechanical Integrity of Control Blade and Drive Systems (Partial to Include Paperwork Checks) (Not Due – Part of Maintenance Relative to Reactivity Anomaly).
22 Feb 99	Q-5	Quarterly Radiological Survey of Restricted Areas (Shutdown Conditions) (Due 28 February 1999).
23 Feb 99	Q-2	Quarterly Calibration Check of Area and Stack Radiation Monitors (Due 25 February 1999).
23 Feb 99	Q-9	Quarterly Calibration check of AIM3BL Air Particulate Detector (Due 23 February 1999).
25-26 Feb 99	Q-4	Quarterly Radiological Survey of Unrestricted Areas (Shutdown Conditions) (Due 28 February 1999).
26 Feb 99	Q-9	Quarterly Calibration check of AMS[4] Air Particulate Detector (Due 25 February 1999).
26 Feb 99	Q-6	Quarterly Check of Posting Requirements (Due 28 February 1999).

TABLE V-1

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

Date		Surveillance/Check/Test Description
2 Mar 99	S-7	Semiannual Check (Replacement) of Security System (Partial to Replace 4 Volt Rechargeable Batteries) (Not Due).
12 Mar 99	S-7	Semiannual Check (Replacement) of Security System (Partial to Replace 4 Volt Rechargeable Batteries with Upgraded Batteries Per 10 CFR 50.59 #99-02) (Not Due.)
18 Mar 99	A-1	Instrument and Test Equipment Calibration (Partial to Send Off Equipment for Calibration) (Due 31 January 1999).
22 Mar 99	Q-6	Quarterly Check of Posting Requirements(Partial to Update Some Postings) (Not Due).
29 Mar 99	A-4	Annual Check/Replacement of Fire Alarm System Monitoring Station Batteries (Due 10 March 1999).
29 Mar 99	Q-7	Quarterly Check of UFTR Building Fire Alarm System (Zone 1 - Reactor Cell and Control Room) (Due 31 March 1999).
7 Apr 99	S-6	Semiannual Inventory of Security Keys for UFTR and UFSA (Due 1 April 1999).
8 Apr 99	Q-3	Quarterly Radiological Emergency Evacuation Drill (Due 17 March 1999).
9 Apr 99	Q-8	Quarterly Report of Safeguards Events (No Events) (Due 1 April 1999).
9 Apr 99	A-1	Instrument and Test Equipment Calibration (Completion Upon Return of Two Instruments) (Due 31 January 1999).
12 Apr 99	S-3	Semiannual Inventory of Special Nuclear Material (Due 1 April 1999).
23 Apr 99	S-8	Semiannual Leak Check of PuBe and SbBe Neutron Sources (Due 30 April 1999).

TABLE V-1

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

Date		Surveillance/Check/Test Description
14 May 99	A-1	Instrument and Test Equipment Calibration (Sending of Simpson 269 Meter for Calibration Check) (Extra–Not Due).
17 May 99	Q-1	Quarterly Check of Scram Functions (Due 30 June 1998).*
27 May 99	Q-2	Quarterly Calibration Check of Area and Stack Radiation Monitors (Due 23 May 1999).
27 May 99	Q-9	Quarterly Calibration Check of AIM3BL Air Particulate Detector (Due 23 May 1999).
27 May 99	S-1	Measurement of Control Blade Drop Times (Due 31 October 1998).*
27 May 99	S-5	Measurement of Control Blade Controlled Insertion Times (Due 31 October 1998).*
27 May 99	S-11	Semiannual Replacement of Control Blade Clutch Current Light Bulbs (Due 31 October 1998).*
27-28 May 99	Q-9	Quarterly Calibration Check of AMS[4] Air Particulate Detector (Due 26 May 1999).
1/2 Jun 99	Q-6	Quarterly Check of Posting Requirements (Due 26 May 1999).
2 Jun 99	A-1	Instrument and Test Equipment Calibration (Sending of Simpson 269 Meter for Calibration Check) (Extra–Not Due).
15 Jun 99	Q-4	Quarterly Radiological Survey of Unrestricted Areas (Shutdown Conditions) (Due 25 May 1999).
15 Jun 99	Q-5	Quarterly Radiological Survey of Restricted Areas (Shutdown Conditions) (Due 22 May 1999).
18/21 Jun 99	A-6	Physical Inventory of Security-Related Locks/Cores (Due 31 March 1999).
21-24 Jun 99	B-2	Biennial Inspection of Incore Fuel Elements (Extra for Reloading – Not Due).
28/29 Jun 99	S-1	Measurement of Control Blade Drop Times (Extra Following Restacking Shielding).
29 Jun 99	S-5	Measurement of Control Blade Controlled Insertion Times (Extra Following Restacking Shielding).

TABLE V-1

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

Date		Surveillance/Check/Test Description
1 Jul 99	B-1	Biennial Check to Assure Negative UFTR Void Coefficient of Reactivity (Due 30 September 1998).*
2 Jul 99	S-7	Semiannual Check (Replacement) of Security System Batteries (Due 30 April 1999).
7-17 Jul 99	S-2	Annual Reactivity Measurements (Worth of Control Blades, Total Excess Reactivity, Reactivity Insertion Rate and Shutdown Margin) (Due 30 June 1998).*
12 Jul 99	Q-8	Quarterly Report of Safeguards Events (Due 1 July 1999).
14-27 Jul 99	A-2	UFTR Nuclear Instrumentation Calibration Check and Calorimetric Heat Balance (Due 28 February 1999).*
16 Jul 99	Q-5	Quarterly Radiological Survey of Restricted Areas (for Restart) (Due 31 May 1998).*
16-28 Jul 99	S-10	Semiannual Check and Update of Emergency Call Lists (Due 29 June 1999).
23 Jul 99	Q-3	Quarterly Radiological Emergency Evacuation Drill (Due 30 June 1999).
27 Jul 99	S-4	Measurement of Argon-41 Stack Concentration (Includes Measurement of Dilution Air Flow Rate—Previously A-2 Surveillance) (Due 30 June 1998).*
28 Jul 99	Q-7	Quarterly Check of UFTR Building Fire Alarm System (Zone 2 – Downstairs Offices and Labs) (Due 29 June 1999).
29 Jul 99	Q-6	Quarterly Check of Posting Requirements (Not Due–Partial to Post Updated Memoranda on Authorized Control Blade Positions and New Authorized Control Blade Worth Curves).
29 Jul 99	S-9	Semiannual Replacement of Well Pump Fuses (Due 29 June 1999).
30 Jul 99	Q-4	Quarterly Radiological Survey of Unrestricted Areas (for Restart) (Partial Due to Trip) (Due 31 May 1998).*
30 Jul 99	A-3	Annual Measurement of UFTR Temperature Coefficient of Reactivity (Unsuccessful–Interrupted Due to Trip) (Due 30 September 1998).*

TABLE V-1

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

Date		Surveillance/Check/Test Description
3 Aug 99	S-12	Semiannual Review of Requalification Training Program Binders (Due 1 July 1999).
5 Aug 99	A-3	Annual Measurement of UFTR Temperature Coefficient of Reactivity (Due 30 September 1998).*
5 Aug 99	Q-4	Quarterly Radiological Survey of Unrestricted Areas (for Restart) (Completion from July 30, 1999) (Due 31 May 1998).*
5 Aug 99	Q-5	Quarterly Radiological Survey of Restricted Areas (Extra Confirming Survey) (Not Due).
6 Aug 99	S-10	Semiannual Check and Update of Emergency Call Lists (Partial for Loss of SRO J. Powers) (Not Due)
11 Aug 99	Q-2	Quarterly Calibration Check of Area and Stack Radiation Monitors (Due 27 August 1999).
11 Aug 99	Q-9	Quarterly Calibration Check of AIM3BL Air Particulate Detector (Due 27 August 1999).
11 Aug 99	Q-1	Quarterly Check of Scram Functions (Due 17 August 1999).
13 Aug 99	B-4	Biennial Evaluation of UFTR Standard Operating Procedures (Preparation Activities) (Due 30 April 1999).
13 Aug 99	Q-9	Quarterly Calibration Check of AMS^4 Air Particulate Detector (Due 28 August 1999).
17 Aug 99	Q-6	Quarterly Check of Posting Requirements (Due 31 August 1999).
24 Aug 99	S-7	Semiannual Check (Replacement) of Security System Batteries (Partial to Replace 4V Rechargeable Batteries) (Not Due).

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. Many are so marked this year due to the extended outage to investigate the reactivity anomaly extending from the start of the year with regular operations not resumed until August 9, 1999 upon completion of all overdue surveillances and normal operations delayed until August 17, 1999 to allow completion of overdue annual operations tests.

TABLE V-1

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

Date	Surveillance/Check/Test Description

All required UFTR surveillances, checks and tests are up to date at the end of the reporting year. 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-3, Q-7 (Zone 3), A-5, B-3 and B-4 surveillances, all of which were subsequently completed within the required interval. In addition, this year there are no surveillances past due beyond the allowable interval at the end of the reporting year due to reactor unavailability or other consideration to complete the surveillance.

TABLE V-2

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 NES electronics engineer D. Ekdahl; 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 September 30, 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 had been performed since that time, especially since the recorder had been relatively problem free; however, during August 1999, the recorder was removed from storage, cleaned and partially checked out. (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 partially prepared. 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 November 10 and two alarms on November 11, 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 January 7, 1997 with all but one siren operational to meet requirements. Subsequently, the west lot siren was repaired on January 13 and both the west lot and journalism side siren horn drivers wiring was reterminated on January 14, 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 March 10, 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 March 10-21 with circuit mapping performed for troubleshooting on March 19 and the intermittent ground finally repaired on March 21, 1997, but without installation of the modification to separate grounds, basically returning the system to its state prior to March 10. Subsequently, the 4 Volt rechargeable batteries have been replaced on May 14, June 18, July 7, and July 24, 1997 (for prevention purposes on July 30, 1997), on August 29, and on September 29, 1997. Following a full S-7 Surveillance on October 24, 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 December 16, 1997 and again on January 9, February 10, March 10, April 8, and on May 6, 1998. Following a full S-7 Surveillance on May 27, 1998, the 4 Volt rechargeable batteries were replaced again on June 24, July 24, August 19, September 16 and October 13, 1998. Following a full S-7 Surveillance including replacement of rechargeable batteries on November 10, the 4 Volt rechargeable batteries were replaced again on

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
	December 7, 1998 and January 4, February 1 and March 2, 1999 with upgraded 4 Volt batteries installed on March 12, 1999 under 10 CFR 50.59 Evaluation Number 99-02 developed and approved in February to upgrade the 4 Volt rechargeable batteries for longer life. There had been no need for further replacement through the end of July 1999 though the full S-7 Surveillance was performed on July 2, 1999. Following the full S-7 Surveillance, when the 4 Volt batteries were not replaced, the 4 Volt rechargeable batteries were replaced again on August 24, 1999. (MLP #96-30 remains open.)
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 April 23, 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 April 22, 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 May 1, 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 May 1 and 4, 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

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description

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 May 5, 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 May 6, 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 May 7, 1998 to verify the critical position had changed somewhat again from 484 units withdrawn but now reduced somewhat to 460 units withdrawn.

On May 12, 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 May 14, 1998 to verify the critical position which now remained at 460 units withdrawn on the Regulating blade.

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description

On May 19, 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 May 19, 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 May 20, 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 May 21, 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 (May 26-29) 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

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Date	Maintenance Description

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 June 1, 1998. Subsequently, under modified SOP-C.1 and RWP #98-6-I, fuel in pit #23 was consolidated into pit #26 on June 2, 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 June 2, 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 June 3, 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 June 4, 1998. Subsequently, four fuel bundles were removed from the south central fuel box and one from the north central fuel box on June 5, 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 June 11, 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 June 18, 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 June 18, 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 June 22, 1998 because its small size (<2 inches long) made it difficult to

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Date	Maintenance Description

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 June 23, 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 June 26, 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 June 26, 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 June 29, 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 July 10, 1998. The revised UFTR Respiratory Protection Program was ready for internal review and approval by July 24, 1998 but the RSRS Executive Committee was unable to meet for several days. On July 24, 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

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Date	Maintenance Description

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 July 28, 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 July 30, 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 July 30, 1998 to get the review started with the formal submission by letter to the Document Control Desk then accomplished on August, 3, 1998.

At the beginning of August, maintenance operations were awaiting NRC review of the Respiratory Protection Program Revision 2. On August 3, 1998, NRC Inspector Stephen Holmes of the Non-Power Reactor Directorate indicated he would visit for an inspection on August 13-14, 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 August 6 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 August 13. Upon his arrival on August 13,

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
	Inspector 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 August 14, Mr. Holmes evaluated that the Program was ready for implementation on the afternoon of August 13, 1998. Therefore, the official implementing memorandum for the Program was issued on August 13, 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 August 13 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 August 14 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 August 20, 1998, the SbBe source was removed and nuts from the three north side fuel boxes were removed, greatly reducing radiation levels and preventing water from entering the fuel boxes from this date on. To prevent bringing water into the core, the PC pump switch was removed and a precautionary posting was made on this date as well. On August 27, 1998, with all bolts and flanges removed from the north side of the core, workers were unable to remove any fuel boxes due to difficulty separating the flange's gasket from the fuel box. Subsequently, the northeast fuel box was removed on August 28, 1998 but the flange connections are very tight requiring considerable force to effect removal resulting in only one box being removed at month's end. At the end of August, it appeared that the other two north side fuel boxes would need to be removed to allow access to and removal of the Regulating blade and its shroud for detailed examination though in September the clearance was found to be sufficient for the shroud without removing the northwest fuel box.

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
	During September, the first efforts to remove the north central (NC) fuel box resulted in some damage to the upper lip of the fuel box. This damage is primarily cosmetic as the damage to the fuel box is not expected to affect its function. During efforts to remove the NC fuel box, it was decided to remove the center vertical graphite stringers to allow access to the regulating blade shroud; however, this was prevented by the rabbit system tube. Under RWP 98-9-I, the shielding around the rabbit system was removed and the rabbit system guide tube withdrawn sufficiently (about three feet) to allow removal of the shroud and direct access to the regulating blade and subsequently to the other control blade shrouds for removal. At this point, RWP 98-9-I was closed out on September 9, 1998. It should be noted that the primary RWP 98-8-I was reissued several times during the month as work progressed, though there was no use of respirators during the month. By examining the regulating blade directly, the apparent separation of the regulating blade was found not to be present so this source was eliminated as a cause of the reactivity anomaly. The regulating blade itself was not able to be removed at this point with the decision made not to remove it at this point, though two small pieces of metal (0.1 gms total) were found on the graphite around the blade. At month's end the source and nature of these small pieces have not been determined but they are definitely not the source of the reactivity problem. They may be aluminum scraps left from maintenance performed years ago. After mid-September, the NC fuel box was finally removed along with the Safety-3 control blade shroud. Comparison of the two blades shows no obvious mechanical defects. Subsequently, the southeast (SE) fuel box was removed and some work was undertaken to remove the Safety-2 control blade shroud. It was then noted that the south central (SC) fuel box would have to be removed to allow removal of the Safety-1 and Safety-2 control blade shrouds. At month's end the SC fuel box bolts have been removed and the fuel box is almost freed up for removal to allow direct access to the S-1 and S-2 shrouds for removal. Early in October, the SC fuel box was finally removed to the shield tank, the S-1 and S-2 safety control blade shrouds were unbolted and removed to

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Date	Maintenance Description

reveal the S-1 and S-2 control blades which also appear to be in good shape. Spectral analysis of the metal shavings found on September 17 was inconclusive to this point but was continuing. A modification package as 10 CFR 50.59 Evaluation and Determination Number 98-08 (Temporary Bypass of Control Blade Withdrawal Interlocks to Allow Direct Observation of Movement with Reactor Secured – No Fuel Present) was developed, approved and implemented to allow temporary bypass of the control blade interlocks on October 22, 1998. The blades were timed and assured visually not to have any obvious movement problems with the interlocks bypass removed on the same day. This work is considered to have eliminated the control blades themselves as a source of any reactivity anomaly that could impact safety. On October 29, a shield block was placed over the core area to reduce sky shine hopefully to lower the recorded dose to the stack and cell environmental monitoring TLDs, the results of which have been over 300 mR per month since opening the core area and removing fuel.

During November 1998, preparations were made for fuel handling with fuel handling training conducted for those involved with three (3) bundles inspected on November 11 when operations were halted until the crane could be checked for a missing lock washer with five (5) more bundles inspected on November 18 and seven (7) more on November 19 controlled under RWP 98-11-I. In general, with minor defects, the fuel was noted to be in good condition with no real problems noted to this point. The report on the spectral analysis of the metal shavings was finally issued on November 5, 1998, but its results are not conclusive and the shavings are not considered to be related to the reactivity anomaly problem. It should be noted that the primary RWP 98-8-I was reissued a number of times during the month as was the RWP-98-11-I used to control fuel inspection.

During December 1998, the remaining 7½ fuel bundles were inspected on December 4, controlled under RWP 98-11-I, to close out the B-2 Surveillance. No significant problems were noted per the report dated December 8, 1998. Subsequently, RWP 98-11-I was reissued until closed out on December 10. Following various extensive discussions, the control blade gear boxes were inspected with assistance from Professor G.J. Schoessow and found to be in good shape (also part of V-1 Surveillance). Subsequently,

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Date	Maintenance Description

an inclinometer was obtained, the control blade interlocks were bypassed again on December 21 per 10 CFR 50.59 Evaluation and Determination Number 98-08, with each of the blades moved in steps with the blade position indication at the console found to agree and vary linearly with the physical blade position indicated by the inclinometer attached temporarily to each blade until all were tracked in this way. The memorandum comparing physical blade position in the core indicated by the inclinometer and the blade position indicated on the control blade position indicator at the console demonstrates good correspondence and linearity in the movement of the blades (part of V-1 Surveillance). Subsequently, the regulating blade was removed reading ~100 mR/hr on contact and ~5 mR/hr at one foot with plans next to x-ray the plate to check on cadmium absorber integrity. A brief tabular summary of reactivity variations leading to the anomaly was also generated during this month. It should be noted that the primary RWP 98-8-I was reissued a number of times during the month of December 1998 and there was no further need to bypass the control blade interlocks which were assured to be restored.

During January 1999, the remaining three safety blades were removed and all four control blades were x-rayed with no problems (Part of V-1 Surveillance) with the assistance of Dr. D.E. Hintenlang and his portable X-ray machine which was moved into the reactor cell temporarily on several occasions. The X-rays were also archived for future reference. In addition, replacement control blade shaft mounting bolts were obtained as was fuel box gasket material with old gasket material partially removed. In addition to planning on steps for recovery, the primary RWP 98-8-I was reissued a number of times during the month of January 1999.

During February 1999, RWP 98-8-I for reactor disassembly operations was reissued several times until finally closed out on February 24, 1999. Efforts in February concentrated on removing the old gasketing material from the fuel boxes under RWP 99-1-I first issued on February 12, 1999 and reissued to cover cleaning of the fuel boxes until closed on February 24, 1999. Other efforts during the month involved acquiring gasketing material and replacement bolts so the old, hot ones could be discarded as waste to limit dose commitment and reviewing graphite drawings as preparations were

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Date	Maintenance Description

made to reassemble the reactor under RWP 99-2-I first issued on February 24, 1999 with the northwest fuel box placed on February 26, 1999 and ready to be fastened.

At the end of February 1999, maintenance reassembly operations were continuing with no source of the reactivity anomaly identified as this maintenance work had examined all key parts of the reactor and the system was being reassembled under RWP 99-2-I. Evaluation of the problem at this point was that the system appears to be in good shape with no specific cause of the reactivity anomaly identified with plans to reassemble and operate the reactor on the basis of this safety evaluation.

During March 1999, the five removed fuel boxes, all four control blades and shrouds were reinstalled along with considerable graphite. Control blades were verified to move linearly using the inclinometer and dropped to assure movement with the drop times measured to be acceptable on March 11, 1999. The rabbit system is also reinstalled to allow graphite installation into the core. On March 26, all covers were replaced on the ex-core control blade pedestals and drives and the PC pump fuses replaced. The fuel box cross sections were also measured on March 30, 1999 for future reference in the HEU-to-LEU conversion work as additional graphite was added; subsequently, the water was turned on at 1058 hours on March 30. No leaks were immediately apparent. However, at 1535 hours the flow rate had dropped, there was a small amount of water in the pit, thought to be from the pump which was cavitating but later discovered to be from a small leak from the dump valve. The pump was secured, restarted for two minutes and then secured again as flow dropped to low levels. By March 31, no water was noted in the pit but low level (17¾ inches versus 20½ inches during the weekly checkout on March 29) in the PC storage tank was noted so it was refilled under MLP #99-09 and the pump run briefly (~one minute) to demonstrate its operability on March 31, 1999. The drop in PC tank level showed a probable small leak in the reassembled system. In addition to the maintenance efforts for recovery, the primary RWP 99-2-I was reissued a number of times during the month of March 1999.

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Date	Maintenance Description
	During April 1999, the dump valve gland nut was tightened to correct the small leak from the dump valve on April 1, 1999 thought to be caused by the extended dry period involved during fuel box removal. On April 7, 1999, RWP 99-3-II was opened to control leak checks of the primary system using the borescope from the equipment pit with no results. On April 9, 1999, under RWP 99-2-I, in core checks determined the leak to be from the inlet flange of either the northwest or the north central fuel box. On April 14, 1999, all three north side fuel boxes were removed along with necessary graphite with the northwest box inlet flange-pipe connection suspected of leaking and gasket materials noted to be in good shape. Subsequently, on April 21, 1999, the northwest and north central fuel box inlet flange surfaces were recleaned. On April 23, the northwest fuel box inlet flanges were recleaned and on April 26, 1999, all three fuel boxes were reinstalled with no apparent leakage. Subsequently, on April 29, 1999 a small drop-type leak was noted at the outlet flange-pipe connection on the southwest fuel box with some leakage onto one small graphite stringer which was set out to dry. This outlet flange was recleaned and the southwest fuel box reinstalled on April 29, 1999 as some graphite was also reinstalled. At month's end as efforts were begun to assemble instrumentation to be used for monitoring the planned approach-to-critical for reloading the fuel. RWP 99-3-II was worked only once in April and was not reissued. It was closed out on May 7, 1999. In addition to the maintenance efforts for recovery, the primary RWP 99-2-I controlling core reassembly was reissued a number of times during the month of April 1999.
	During May 1999, work continued as much of remaining graphite was stacked prior to May 7 after assuring no further leakage with closeout of RWP 99-3-II. In addition, three external nuclear instrumentation channels were set up and plateaus run on the BF_3 detectors. Following insertion of the PuBe source temporarily on May 6, 1999, sufficient neutron count rate was obtained on all four detector systems. Both the PuBe and SbBe sources were inserted continuously as of May 7, 1999 so blade checks could be completed so all preoperational checks are complete as of May 7, 1999 only lacking reactivity effects for blade movements. The center graphite was stacked on May 11, 1999 and the rabbit system was installed on May 13, 1999. May 13 and 14 involved work under RWP 99-4-I to clean up a number of slightly

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Date	Maintenance Description

contaminated horizontal cell surfaces, probably caused by dropping a piece of portable lead shielding removed from the work area of the core. The rabbit system was checked to be operational on May 27, 1999 with some more shielding remaining to be stacked on the west side where it enters the reactor.

In anticipation of fuel loading, the quarterly scram checks (Q-1 Surveillance) were completed on May 17, 1999. The general UFTR surveillance/activity schedule for restoring the UFTR for return to normal operations was generated in a memorandum from UFTR Management on May 21, 1999 and approved at an RSRS Executive Committee meeting on that date. The schedule lists activities to be completed prior to fuel loading, fuel loading, activities after fuel loading but prior to initial startup to power, activities following startup to 1 watt, activities to be performed at 100 watts, 1 kW, 10 kW, 90 kW and 100 kW in a stepped return to normal operations. In addition, the planned core reloading returning all fuel to its original location following SOP-C.1 (Fuel Loading) with a reloading sequence plan and core load diagram is documented in another memorandum dated May 21, 1999. This memorandum was also reviewed at the May 21, 1999 RSRS Executive Committee meeting.

Subsequently, fuel handling training was conducted on May 26, 1999 for all operations staff plus RCT J. Parker and technician S. Iverstine plus the control blade surveillances (S-1 for drop times, S-5 for controlled insertion times and S-11 for clutch current bulb replacement) were all successfully completed on May 27, 1999. Unfortunately, continuing repairs on the linear channel front end amplifier circuit were not completed so no fuel was loaded in May 1999. The linear channel front end amplifier was finally repaired with installation of a duplicate 310K amplifier to replace a failed one on June 3, 1999.

During June 1999, several shield blocks were restacked and the unstacked shield blocks rearranged in preparation for fuel loading which was delayed due to maintenance efforts on the well water flow meter until June 10 and then by the need to address a technical specification violation for failure to measure adequately the secondary flow trip point. RWP 99-4-I for core reassembly activities was reissued several times but was finally terminated

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on June 18 and RWP 99-5-I was issued to control fuel loading which was accomplished on June 21 (8 fuel bundles loaded), June 22 (10 fuel bundles loaded) and June 24 (final 3½ fuel bundles loaded) with RWP 99-5-I finally terminated on June 25, 1999. Three external neutron monitoring channels along with the installed channel were used to monitor the approach-to-critical as fuel was loaded. Subsequently, RWP 99-6-I was issued on June 25 to control restacking and restoring shielding to normal including removing extra neutron detectors and replacing plugs in south, southwest and northeast beam ports on June 25. Subsequently, accomplishments included a complete successful weekly checkout, completion of restacking as well as painting and decontamination of shielding faces and upper deck which was continuing at month's end. Also completed was another measurement of the control blade drop times (S-1 Surveillance) and the controlled insertion times (S-5 Surveillance) after which a test startup to 1 kW was undertaken by the Facility Director with observation/active participation by the other two senior reactor operators. The startup showed a high regulating blade critical point relative to the last measurement taken in May 1998 prior to the extended shutdown and reactor disassembly.

During July, the new critical position was checked several times prior to setting the new normal and alternate safety blade positions with a memorandum dated July 17, 1999. This shows the normal safety blade positions as 800 units withdrawn and the regulatory blade at ~350 units withdrawn without accounting for experiment or temperature effects. Subsequently, after completion of the reactivity checks (S-2 Surveillance), new reactivity worth curves were generated and placed in use with a memorandum dated July 17, 1999. Essentially, there is not a great deal of total control blade worth change except that the excess reactivity is now below 0.4% $\Delta k/k$ versus close to 1% $\Delta k/k$ prior to the reactivity anomaly occurrence as summarized on UFTR Form SOP-A.7B (Evaluation of UFTR Blade Drop Reactivity Data) showing 0.37% core excess reactivity. Nevertheless, such a difference, even if it were to appear all at once, is still well within the safety analysis envelope.

Also during July 1999, in addition to critical position checks, decontamination efforts were completed for the cell in general but especially

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Date	Maintenance Description
	on the upper deck, deck plates, hand rails and tools, with scaffolding reinstalled on July 2 and the rabbit system shielding restacked on July 12, 1999. In addition, various other surveillances were completed during the month directed toward return to normal operations to include verification of a negative void coefficient (B-1 Surveillance), annual reactivity measurements (S-2 Surveillance), nuclear instrumentation calibration check and calorimetric heat balance (A-2 Surveillance), radiological survey of restricted areas (Q-5 Surveillance), measurement of Ar-41 stack effluent concentration (S-4 Surveillance) and part of the radiological survey of unrestricted areas (Q-4 Surveillance). The final surveillances to complete radiological surveys at full power (Q-4/Q-5 Surveillances) and measure the temperature coefficient of reactivity (A-3) would have been completed except for the Safety Channel 2 trip on July 30, 1999. Following closeout of MLP #99-33 to address the Safety Channel 2 trip and replacement of the failed deep well pump motor, the final surveillances to complete radiological surveys at full power (Q-4/Q-5 Surveillances) and measure the temperature coefficient of reactivity (A-3) were completed successfully. Subsequently, the maintenance log page was closed out on August 9, 1999 though some records review toward assuring complete documentation occurred on August 13, 1999. Following completion of the delayed annual operator operations examinations on August 16, the reactor was returned to normal operations following a status update of NRC via Marvin Mendonca early in the day on August 17, 1999. (On 9 Aug 99, MLP #98-15 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 alarm as intended. Several replacement detectors have been ordered along with a high voltage card with continuation of maintenance efforts to await arrival of the GM detectors and high voltage

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Date	Maintenance Description
	card. The portal monitor remains 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 was functioning adequately. The 900 volt corona tube was finally replaced on September 8 and the system set up for bench testing. Subsequently, the #2 card was replaced with a spare on September 18, 1998 with the calibration of the entire system then checked successfully on September 22, 1998 as it was returned to full service with no further problems noted. (On 22 Sep 98, MLP#98-21 was closed.)
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 the end of July, the decision had still not been made on whether or not to repair this air sampler since another one was available and 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. This new high volume air sampler arrived in September. An adapter was developed by Radiation Control Technician J. Parker and the new air sampler calibration checked and put into service with no further problems noted. (On 22 Sep 98, MLP #98-23 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

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Date	Maintenance Description
	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 optical tachometer and to implement a modification using a direct reading tachometer based on the hall effect. At the end of August, 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") had been developed including two page changes in SOP-A.1 (Preoperational Checks) allowing use of either type of direct reading tachometer (optical or hall effect) to meet tech spec requirements for dilute fan rpm monitoring. This package was approved at the RSRS meeting on September 11, 1998 followed by installation on September 21, 1998 and verification of rpm indication on September 22, 1998. Subsequently, implementation of the alternate direct reading tachometer to eliminate the problem with intermittent loss of rpm indication on this channel was culminated with generation of a memorandum of implementation dated September 23, 1998 with no further problems noted. (On 23 Sep 98, MLP #98-30 was closed.)
28 Sep 98	During the abbreviated weekly checkout, the level of the primary coolant storage tank was noted to be down. Under MLP #98-31, sixty (60) gallons of demineralized water was added to the PC storage tank to restore the level with no problems noted. (28 Sep 98, MLP #98-31 was closed.)
30 Sep 98	During the critique for the quarterly radiological emergency evacuation drill on September 18, 1998, it was noted that one of the chargers for the radios in the Auxiliary Emergency Support Center was not charging properly. Subsequently, under MLP #98-32, the failing charger was transferred to the electronics shop for troubleshooting to await maintenance. In October, the charger was evaluated and determined to be working properly. The reason for the apparent problem is attributed to the fact that the radio charger is

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Date	Maintenance Description
	designed to take a charge only after being sufficiently discharged. It appears no additional charging was needed at the time the charging attempt was made. Subsequently, the charger was returned to service with no further problems noted. (On 30 Oct 98, MLP #98-32 was closed.)
5 Oct 98	During the weekly checks, the shield tank water level was noted to be reduced due to more rapid evaporation with the cover removed. Under MLP #98-33, seventy (70) gallons of demineralized water were added to the shield tank to restore the water level with no problems noted. (On 5 Oct 98, MLP #98-33 was closed.)
26 Oct 98	During the weekly checks, the shield tank water level was noted to be reduced due to more rapid evaporation with the cover removed. Under MLP #98-34, eighty (80) gallons of demineralized water were added to the shield tank to restore the water level with no problems noted. (On 26 Oct 98, MLP #98-34 was closed.)
27 Oct 98	During a walk-through, the cable connector for the rabbit system RM-20-1/361 survey meter was noted to be missing. Under MLP 398-35, the cable connector was reattached with no further problems noted. (On 27 Oct 98, MLP #98-35 was closed.)
29 Oct 98	On several occasions the mechanical tachometer RPM indicator was noted to be somewhat lower (20-40 RPM) than usual with tapping on the meter face restoring the indication. Under MLP #98-36, the problem was potentially isolated to the indicator piece movement which was removed for troubleshooting and repair. Following cleaning and servicing, the meter face with piece movement was reinstalled with the indication reading at 520 RPM on November 2, 1998. Following several days of reliable constant indication, the RPM was verified at 535 RPM on November 5 using the strobotac and the meter adjusted to read 535 RPM also to agree with the

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Date	Maintenance Description
	direct reading tach indication with no further problems noted. (On 5 Nov 98, MLP #98-36 was closed.)
3 Nov 98	Previously during core maintenance work, the teletector 6112B survey meter was noted to be indicating incorrectly with the radiation control technician noting calibration check was not possible. Subsequently, under MLP #98-37, the teletector 6112B was removed to the electronics shop for troubleshooting and repair. Following its return for repair on December 10, it was sent to Radiation Control where it was successfully calibration checked and then returned for return to service on December 14, 1998 with no further problems noted. (On 14 Dec 98, MLP #98-37 was closed.)
12 Nov 98	During fuel inspection activities on November 11, 1998, as the fuel transfer cask was being moved, a lock washer fell off. At this point fuel inspection activities were suspended. Under MLP #98-38, PPD technician Mike Thomas performed an inspection and found no washers missing and another identical washer sitting loose on top of the crane, probably from some activity years ago but not part of the crane, so the technician indicated the crane was fine. The crane was returned to service with no further problems noted. (On 12 Nov 98, MLP #98-38 was closed.)
10 Dec 98	Following scoping of the system for equipment and material needs on December 9, 1998, under MLP #98-39 and 10 CFR 50.59 Evaluation Number 98-09, PPD alarm systems technician Wayne Gravely installed a smoke detector on Zone 2 but over the fire alarm monitoring station to meet upgraded fire code requirements. The system was removed and then returned to service with no problems noted for installation of this modification. (On 10 Dec 98, MLP #98-39 was closed.)
15 Jan 99	During the weekly checks, the shield tank water level was noted to be reduced due to more rapid evaporation with the cover removed. Under MLP #99-01, 119 gallons of demineralized water were added to the shield tank to

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Date	Maintenance Description
	restore the water level with no problems noted. (On 15 Jan 99, MLP #99-01 was closed.)
22 Jan 99	The console period trip test switch had been becoming more difficult to get to respond reliably for some time. During the daily checkout on January 15, 1999, the console period trip test switch failed completely. There was no rush to repair it since the reactor was defueled and disassembled. Subsequently, under MLP #99-02, the drawings for this rheostatic switch were checked with plans made to remove the switch for replacement. On February 1, 1999, the rheostatic switch was desoldered and removed for examination. Subsequently, on February 2, 1999 a number of voltage measurements were made and on February 3, 1999 a modification package 10 CFR 50.59 Evaluation No. 99-01 was developed for replacement of the 2 watt rheostatic switch with an equivalent 0.25 watt switch which was available in late February. The switch was subsequently installed on March 12, 1999 but responded erratically until the contacts were cleaned on March 22, 1999 with no further problems noted. (On 22 Mar 99, MLP #99-02 was closed.)
1 Feb 99	During the weekly checkout, the resistivity of the demineralized water supply from the city water line was noted to be getting low. Under MLP #99-03, the city water ion exchange resins were replaced to restore the source of high resistivity makeup water with no problems noted. (On 1 Feb 99, MLP #99-03 was closed.)
23 Mar 99	During a demonstration, the E-140/1048 GM survey meter was noted to be responding erratically. Under MLP #99-04, a new cable was made and the switch was cleaned to restore proper operation with the meter returned to service with no further problems noted. (On 26 Mar 99, MLP #99-04 was closed.)

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Date	Maintenance Description
29 Mar 99	For some time, the well water flow meter had been responding sluggishly. Finally, it was considered to be failed due to being unreliable. Under MLP #99-05, replacement meters were investigated during March and early April to decide whether repair, replacement or removal to a different location with replacement might be the optimal choice. Finally it was decided to address the existing meter which was removed, cleaned of internal mud, returned to service and tested satisfactorily with no other immediate problems noted. (On 16 Apr 99, MLP #99-05 was closed.)
29 Mar 99	For several days, the city water selector switch pushbutton had been inoperable apparently due to a failed pushbutton. Under MLP #99-06, the problem was investigated to identify the malfunction as a failed socket which was finally repaired on April 12, 1999 with no further problems noted. (On 12 Apr 99, MLP #99-06 was closed.)
31 Mar 99	Maintenance Log Page #99-07 was not used as work initially intended to be controlled under MLP #99-07 during March 1999 was actually controlled under the more extensive MLP #98-15. (MLP #99-07 was not used.)
31 Mar 99	During the weekly checkout, the resistivity of the demineralized water supply from the city water line was noted to be getting low. Under MLP #99-08, the city water ion exchange resins were replaced to restore the source of high resistivity makeup water with no problems noted. (On 31 Mar 99, MLP #99-08 was closed.)
31 Mar 99	During the weekly checkout, the PC tank level indicated an acceptable level of 20½ inches. During the test, under MLP #98-15, for leak-tightness of the primary system after reassembly on March 30, the pump was noted to be cavitating with low flow and somewhat less than a cupful of leaked water in the pit thought to be from a leaking pump or dump valve. Subsequently, after securing the system, the PC tank level was noted to be at only 17¾ inches. Due to this leakage, under MLP #99-09, 76 gallons of demineralized water

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	were added to the PC tank to restore the tank level to acceptable level of 28 inches with no problems noted in this area when the pump was briefly restarted. (On 31 Mar 99, MLP #99-09 was closed.)
5 Apr 99	During the weekly checks, the shield tank water level was noted to be reduced due to more rapid evaporation with the cover removed. Under MLP #99-10, 150 gallons of demineralized water were added to the shield tank to restore the water level with no problems noted. (On 5 Apr 99, MLP #99-10 was closed.)
16 Apr 99	During emergency equipment training it was noted that the RO-7 survey meter was out of service and no manual is available to guide repair. Under MLP #99-11, the meter was removed to the electronics shop for investigation and evaluation for possible repair though failure to locate a manual for it may make repairs difficult. It is not yet repaired as of the end of August 1999. (MLP #99-11 remains open.)
7 May 99	During maintenance activities to complete central island graphite stacking and insert the neutron sources, a drip roof leak of water into the cell was noted just outside the control room. Under MWO #47948, PPD technician Richard Thomas visited to note the leak location on May 7, 1999 while it was raining. Subsequently, on May 10, 1999 while it was dry, he visited briefly to scope out the problem on the roof. After giving the roof another day to dry, he repaired the area around the south scupper on May 11, 1999. He then leak checked the repaired area on May 12, 1999 with no further problems noted. (On 12 May 99, MWO #47948 was closed.)
7 May 99	During performance of maintenance for core reassembly under MLP #98-15 on May 6, 1999, the thermocouples were tested prior to fully stacking the remainder of the graphite and subsequent stacking of shield blocks, especially since the #1 thermocouple appeared to be not responding downscale. The thermocouples and immediate vicinity piping were heated using a heat gun

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and the 12-point temperature recorder was monitored for response. The #1 thermocouple did not respond to heat input. On May 7, 1999, MLP #99-12 was opened to address troubleshooting the #1 thermocouple. The placement of the thermocouples for their respective fuel boxes is #1 in southwest (SW) fuel box, #2 in south center box (SC) fuel box, etc. Under MLP #99-12, the testing was continued and it was noted that while heating the SW thermocouple (#1), there was no response on the 12-point recorder for #1, but the #2 position on the 12-point recorder did respond. The thermocouples (#1 and #2) were swapped and again tested. This time, the #1 thermocouple responded and was properly correlated with the #1 position on the 12-point recorder. It was concluded that the thermocouples were improperly installed (swapped) during the last full core area inspection or during the last thermocouple repair work. Furthermore, it was determined that the SW fuel box thermocouple (#1) was working properly, and the #2 thermocouple in the SC box was the actual failed thermocouple. The #2 thermocouple (SC fuel box) was then replaced with an identical spare and tested successfully for response to heat input, whereupon Maintenance Log Page #99-12 was closed out on May 12, 1999 with no further repairs necessary.

It was determined that this incorrect thermocouple placement (swapped positions) was not detected prior to May 6, 1999 due to the fact that the normal operating temperatures are so close to each other as to be difficult to distinguish one from the other. The reason for the discovery of the improper placement of the thermocouples at this time was due to the fact that the entire core area was accessible and testing of the individual thermocouples was possible, as a check was performed preliminary to fuel loading and the need was noted by the SRO-in-charge. After evaluation, it was determined that all of the temperature points were still being recorded as required and the minimum number of temperature monitoring points per UFTR Technical Specifications section 3.2.3 was still being met so this was not a promptly reportable event. As such, the evaluation was that there was no effect on facility operation, safety of the operating staff, or on the health and safety of the public as noted in a memorandum on the event included in the May 1999 facility monthly report. (On 12 May 99, MLP #99-12 was closed.)

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11 May 99	During console checkouts it had been noticed that the temperature recorder was printing very lightly to the point of being illegible. Under MLP #99-12, the ink pads in the twelve-point temperature recorder were replaced. The recorder continued to print lightly but over several days the printing became darker to correct the problem of illegibility with no further problems noted in this area. (On 19 May 99, MLP #99-13 was closed.)
12 May 99	Prior to performing a weekly checkout, abnormal readings were noted for some points on the twelve-point temperature recorder. Under MLP #99-14, thermocouple leads #7 (core inlet) and #9 (heat exchanger inlet) were disconnected and reconnected with no effect. Heat applied to thermocouple #7 also had no effect. After discussions, it was suspected the temperature monitor print head had been inadvertently rotated when the ink pads were replaced under MLP #99-13. Therefore, the temperature monitor print head was manually rotated six points to provide normal temperature readings at all points to correct the apparent problem with no further problems noted. (On 12 May 99, MLP #99-14 was closed.)
17 May 99	During the weekly checks, the shield tank water level was noted to be reduced due to more rapid evaporation with the cover removed. Under MLP #99-15, 80 gallons of demineralized water were added to the shield tank to restore the water level with no problems noted. (On 17 May 99, MLP #99-15 was closed.)
18 May 99	During the weekly and daily checkout, the linear channel was noted to be very erratic at the low end attributed to a failing linear channel front end amplifier. Under MLP #99-16, the linear channel front end amplifier was checked for a part number. Then the existing amplifier was researched and compared to specifications of a new amplifier from stock. Subsequently, the CIC current was measured and 10 CFR 50.59 Evaluation Number 99-03 (Linear Channel Front-End Amplifier Upgrade) was developed as the A2 amplifier was removed from the linear channel to take measurements and work continued to design and develop a new circuit board, fabricate a case

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	for it and identify the pin connections. After fabricating the amplifier, OPA 627 was installed for testing and troubleshooting with some problems remaining to be corrected at the end of May. It was then decided to install the modification at a future date as an improvement when troubleshooting can be completed. Subsequently, troubleshooting identified a failed 310K amplifier so an identical replacement was ordered and installed in the picoammeter to correct the problem with no further problems noted and no need for the modification which was postponed indefinitely. (On 3 Jun 99, MLP #99-16 was closed.)
18 May 99	As the front end linear amplifier part number was being checked under MLP #99-16, a power supply dropped and broke an electrical lead for the regulating blade position indicator. Under MLP #99-17, the power supply was secured in place to preclude falling and the regulating blade position indicator lead was reterminated and tested satisfactorily with no further problems noted. (On 18 May 99, MLP #99-17 was closed.)
18 May 99	On May 18, 1999, PPD mechanical equipment technician Mike Williams visited to schedule annual preventive maintenance on the overhead crane for later in the day. Under MLP #99-18 and Mr. Williams' direction, Bob Wensitis and Marc Newman of Jacksonville Hoist and Crane performed annual checks on the crane. They noted that the east travel stop actuator is sagging so a precautionary note was placed on the crane control box to alert crane operators to use caution. Mr. Williams returned on May 19, 1999 to put an inspection sticker on the crane indicating acceptance with no further problems noted. (On 18 May 99, MLP #99-18 was closed.)
24 May 99	Previously, 10 CFR 50.59 Evaluation and Determination Number 99-04 (Modification/Upgrade of Effluent Discharge System for Reactor Building) was approved for replacing the two underground waste water holdup tanks with aboveground tanks—one outside, two inside. Under MLP #99-19, PPD personnel under supervisor Ron Sandoval excavated in the west lot to locate the line feeding the tank system beginning on May 24, 1999. On May 26,

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Date	Maintenance Description

1999, they broke the freshwater line used to flush the tanks so it was valved off by Danny Grant. On May 28, 1999, they finally had the whole line excavated, temporarily cut it, got negative indications on swipes and reconnected the feed pipe to the tank as a lift station is needed to connect it directly to the sanitary sewer. A visit to Al Hawley at Southern Precast, Inc. in Alachua also identified the 1,000 gallon tank to be placed outside aboveground. At the end of May, further operations awaited delivery of a lift station to be installed below ground in the west lot as two smaller indoor sink tanks were to be ordered also.

During June 1999, the rerouting activities were discussed with RCO D.L. Munroe along with release of the east holdup tank. Mr. Steve Middleton, PPD Maintenance and Construction Superintendent for Water Systems, visited on June 2 to check on the status and apologize for the problems to date. The situation was also discussed with PPD Project Engineer Bahar on June 4 as she visited to indicate how the lift station would be installed to protect lot access. Al Hawley, Manager of Specialty Products Division for Southern Precast, Inc., visited on June 4 with the specs for the 1,000 gallon aboveground storage tank and also to check accessibility of the west lot for delivery of the tank. The specs were then delivered to Ralph Haskew to order the tank through EH&S. Excavations to install the lift station were begun on June 16 but work was stopped by EH&S due to PPD worker safety concerns about unrestrained sides of the hole. Further excavations were then performed on June 18 as the lines were cut and the lift station installed on June 22. It was not anchored so overnight rain damaged the lines so the lift station was removed and reinstalled with negative swipe indications on June 23. An electrician along with supervisor Ron Sandoval and two assistants installed the "permanent" electrical connection for the lift station on June 24. Subsequently, Steve Middleton visited again and agreed that the electrical connection for the pump could be moved inside the lift station to avoid aboveground barriers limiting lot access. This electrical connection was moved to inside the lift station on June 28. Considerable research was undertaken and a 150-gallon indoor tank was ordered from Tank Depot, Inc. for the reactor cell and several liquid waste water collection drums were installed temporarily in the cell on June 25.

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
	During July, approximately 295 gallons of waste water were collected and pumped to the in-ground holdup tank system. Some grading work was accomplished following installation of the lift station in June, with Steve Middleton checking the situation on July 2. After notification that the 1,000 gallon aboveground storage tank was available, Steve Middleton, supervisor Marty Wertz, foreman John Black and another PPD technician visited to scope out concrete replacement work with old concrete broken out under Mr. Black's direction with a visit by RCO D.L. Munroe on July 8. Subsequently, Mr. Black and assistants prepared for and poured replacement concrete on July 9 with Russell Barrs visiting on July 9 to rehang the west lot entrance gate. The 1,000 gallon tank was finally delivered and placed in the west lot by Al Hawley and a truck/crane operator on July 20, 1999. Subsequently, the 150-gallon indoor tank obtained from Tank Depot, Inc. was delivered to the west lot on July 22 and moved inside for leak checks prior to set up on July 23, 1999. Both RCO D.L. Munroe and EH&S Director W.S. Properzio visited to check on both the inside 150 gallon and the outside 1,000 gallon tanks on July 29, 1999. Subsequently, RCO D.L. Munroe and NRE Professor G.R. Dalton utilized a special remote video camera system to inspect the inside of the underground tanks on July 30 in anticipation of eventual decommissioning of the tanks.
	During August, approximately 700 gallons of waste water were collected and pumped to the inground holdup tank system, on August 28, 1999 telephone calls were made to and from Steve Middleton concerning completion of west lot work, a line was installed and sealed to direct cell AC condensate to the indoor 150 gallon tank on August 3–5, the indoor setup was cleaned up and arranged optimally around the tanks on August 12. In addition, Emil Hodge of W. W. Gay, Inc. visited to estimate costs for installation of plumbing from the cell to the aboveground tank in the west lot on August 26. Subsequently, RCO D.L. Munroe and NRE Professor G.R. Dalton utilized a special remote video camera system to inspect the inside of the underground tanks on August 31, 1999 in anticipation of eventual decommissioning of the tanks. (MLP #99-19 remains open.)

TABLE V-2

CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
24 May 99	During the weekly checkout, the secondary flow meter was again thought to be failed. Under MLP #99-20, the meter was cleaned and the switches thought to be failed so switches were ordered. Discussions were then undertaken as to whether to order a replacement meter (apparently unavailable except as a special order item), order replacement switches, or install an alternate ultrasonic flow meter. At the end of May, the decision was still uncertain due to long lead times for a new meter. During June, some measurements were taken and discussions were had with Dynasonics as transducers were installed (no system effect) and the transit meter was tested satisfactorily. Incorrect replacement switches were also returned as efforts were made to get an independent measurement of secondary flow. The secondary flow meter circuit was then simulated and a circuit board constructed as system simulations indicated the switches were working properly and were not failed at which point the secondary flow scram was operationally tested and the applicable Tech Spec, Safety Analysis Report and operating procedures were reviewed for a possible violation with respect to a failure to measure the secondary flow scram adequately. Subsequently, the flow meter was cleaned and inspected and a magnet leaf spring was repaired as NRC Senior Project Manager Ted Michaels was informed of the possible Tech Spec violation. After continued testing and console manual review plus an RSRS Executive Committee meeting, the secondary flow trip point measurement was discussed in detail with Ted Michaels as it was decided that a violation was involved (see discussion of unusual occurrences in Table III-6). Subsequently, the well water flow was throttled to get the trip as expected which would not clear when flow was reestablished. The low flow scram relay was then replaced with a spare so it then cleared normally with no further problems noted on operation. (On 10 Jun 99, MLP #99-20 was closed.)
11 Jun 99	When work on the well water flow meter under MLP #99-20 finally indicated a violation of technical specifications on measuring the secondary flow limiting safety setting, efforts were directed toward correcting this violation under MLP #99-21. As indicated, the low flow scram was tested by placing scram logic in the well pump cooling mode and supplying cooling with the

TABLE V-2

CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description

well pump. The well water valve was then throttled to reduce flow. The scram was verified to initiate at the required 60 gpm as indicated on the combined flowmeter and the well warning light was verified to actuate at the required 140 gpm. Since at no time during normal reactor operation had the well warning light initiated, it was reasonable to assume that the well pump logic 60 gpm trip point was never approached and therefore, that the UFTR never failed to trip for a condition reaching or exceeding the Limiting Safety System Setting on the secondary flow in the well pump mode. Nevertheless, it was clear that a potential violation of Tech Specs had occurred over some relatively lengthy time period.

In response to the Tech Spec violation identified on June 8, 1999 regarding deficiencies in checking the secondary cooling water low flow trip, two system hardware changes were implemented which required that two minor procedure changes be implemented in the UFTR SOP-A.1 (Daily Preoperational Checks) and in UFTR SOP-0.5 (Quality Assurance Program) in the surveillance data sheets for the Quarterly Scram Checks (Q-1 Surveillance) all under 10 CFR 50.59 Evaluation and Determination Number 99-06 (Modifications for Improved Implementation of Secondary Flow Scram Checks) approved at an RSRS meeting on June 16 following extensive analysis into which hardware and procedure changes were needed. In conversations with Senior Project Manager Ted Michaels, it was agreed that assuring the secondary flow trip worked (go/no go) on the daily checkout and then obtaining a measured value of the flow trip on the quarterly checks would meet the intent of the Tech Specs.

The first part of the system modification implemented under 10 CFR 50.59 Evaluation and Determination Number 99-06 and MLP #99-21 was to install a well pump power trip bypass switch. To implement the necessary changes to the daily checkout procedure, the operator must be able to bypass the loss of well pump power trip. This bypass was accomplished by installing a bypass switch on the reactor console that temporarily (on demand only) shorts the well pump power relay contactors, effectively bypassing the trip. A spare switch in the motor control panel that was unused has been dedicated as the bypass switch. The switch is a momentary type switch so its function is only in effect when an operator is actively depressing the switch.

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description

This feature eliminates the possibility that the switch can be inadvertently left in the bypass position during normal reactor operation following completion of the daily checkout. During the daily checkout procedure, the operator depresses the switch to bypass the trip and holds the switch in place while the well pump is de-energized. The switch must be continuously depressed until the scram actuates, after which the operator releases the switch, automatically returning the well pump loss of power trip to permissive, and thereby verifying a low flow trip.

The second part of the system modification implemented under 10 CFR 50.59 Evaluation and Determination Number 99-06 and MLP #99-21 was to install a well water mode low flow trip bypass switch. Installation of this switch allows for bypassing the secondary low flow trip in the well water mode. Since this switch is to be utilized on a quarterly checkout, this switch is physically installed inside the console to prevent inadvertent actuation.

As indicated above, two minor procedure changes were implemented to address better the intent of the Tech Specs. Procedures have been modified to allow for checking the low flow trip independently from the loss of well pump power trip per the first part of the modification. The trip is now to be checked qualitatively (go/no go) on the daily checkout (SOP-A.1) and quantitatively (setpoint verified) during the quarterly scram checks (SOP-0.5 under the Q-1 Surveillance).

As indicated, the Reactor Safety Review Subcommittee met on June 16, 1999 and reviewed this occurrence and approved close out of this Tech Spec violation occurrence subject to successful checks following implementation of the 10 CFR 50.59 Evaluation and Determination Number 99-06 changes under Maintenance Log Page #99-21. The RSRS agreed with actions taken and with the initial staff evaluation that the occurrence did represent a potential violation of the UFTR Technical Specifications and should be treated as promptly reportable which was accomplished. The RSRS also agreed with the earlier evaluation that the UFTR never failed to trip for a condition reaching or exceeding the Limiting Safety System Setting on the secondary flow in the well pump mode which is the mode in use for essentially all operations requiring secondary flow. Reactor Management and

TABLE V-2

CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
	the RSRS also agree that this occurrence is not considered to have involved any reduction in reactor safety margins and it is not considered to have involved any significant effect, potential or real, on the health and safety of the public. With successful implementation of the changes to assure effective measurement of the secondary coolant flow trip, this occurrence is now considered closed. A copy of the 14-day report dated June 29, 1999 was sent to the NRC pursuant to the reporting requirements of paragraph 6.6.6(3)(g) of the UFTR Technical Specifications. Since full implementation of the modifications under MLP #99-21 on June 17, 1999, there have been no further problems as corrective action for this violation is considered closed. (On 17 Jun 99, MLP #99-21 was closed.)
21 Jun 99	During the weekly checkout it was noted that the city water motor-operated valve would not shut. MLP #99-22 was opened for investigating this problem since this alternate coolant mode is seldom used. To date, no work has been undertaken. (MLP #99-22 remains open.)
22 Jun 99	During the taking of neutron counts for all blades out following loading of the 11th and 12th fuel bundles during fuel reloading under MLP #98-15, the fire alarm sounded at 1236 hours. When the second person reported no obvious fire in Zones 1 and 2 but was unable to assure no fire elsewhere and with all other personnel gone to lunch, the operator at the console inserted all blades (considered an unscheduled shutdown) and secured the reactor at 1238 hours. Subsequently, PPD fire alarm technicians Rick Lund and Frank Petrone arrived along with UPD Officers Don E. Miles and D.A. Ellis at the Emergency Support Center and UPD Officer McElroy in the Journalism lot. A walk-through verified no fire in Zones 1, 2 or 3 and no alarm indications in the part of Zone 4 used as the Reactor Support Facility, though the fire alarm monitoring station showed that the fire indication was in Zone 4. UPD Officer Miles plus the two fire alarm technicians and the SRO-on-call then accessed the materials science part of Zone 4 and found an alarmed/failed smoke detector in the downstairs area with no smoke, fire or other obvious cause as the area was unoccupied at the time. Under MLP #99-23, the suspected spuriously alarmed smoke detector was replaced with a duplicate

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
	smoke detector by the PPD Alarm System technicians with the system reset and checked to be operational with no further problems noted. UFTR Form SOP-0.6B (Unscheduled Shutdown Review and Evaluation) shows the only condition on restart of control blade withdrawal and fuel loading activities was replacement of the Zone 4 smoke detector and a successful daily preoperational checkout, both of which were accomplished (the smoke detector and fire alarm test at 1315 hours and the daily checkout at 1333 hours) so blades were then pulled beginning at 1335 hours to complete the neutron counts for having 12 fuel bundles loaded with no further problems noted. (On 22 Jun 99, MLP #99-23 was closed.)
24 Jun 99	During a walk-through, it was noted that the rabbit system RM-20/361 monitoring survey meter would alarm when the audible volume dial was set above ~50% of full scale. Under MLP #99-24, this monitoring survey meter was delivered to the NRE electronics engineer by technician S. Iverstine for evaluation and repair. Subsequently, the meter was repaired and returned to the reactor by the electronics engineer on July 9 whereupon it was transported to radiation control for a calibration check. After a successful calibration check, the meter was returned by RCT J. Parker on July 22, 1999 when it was returned to service with no further problems noted. (On 22 Jul 1999, MLP #99-24 was closed.)
28 Jun 99	During performance of the control blade drop time measurements, the high speed strip chart recorder was noted to have lost power. Under MLP #99-25, the problem was traced to a low level of chart paper which was determined to be adequate by resetting the paper shortage lever as more strip chart paper was ordered for future needs. The control blade drop time measurements were completed with no further problems noted. (On 29 Jun 99, MLP #99-25 was closed.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
29 Jun 99	During the weekly checkout, the city water ion exchange resins for the demineralized water makeup system were noted to be depleted. Under MLP #99-26, the resins were replaced to restore the source of high resistivity water for reactor systems use with no problems noted. (On 29 June 99, MLP #99-26 was closed.)
1 Jul 99	During the weekly checks, the shield tank water level was noted to be reduced due to more rapid evaporation with the cover removed. Under MLP #99-27, 70 gallons of demineralized water were added to the shield tank to restore the water level with no problems noted. (On 1 Jul 99, MLP #99-27 was closed.)
13 Jul 99	For some time the primary coolant system ion exchange resins were noted to be reaching a point needing replacement. Since the reactor was to be run at power for the first time in over a year, it was decided to insure optimal effectiveness to remove any impurities released into the system. Under MLP #99-28 and RWP #99-7-I, the primary coolant ion exchange resins were replaced to assure maintenance of high resistivity levels in the primary coolant with no problems noted and RWP #99-7-I closed out on July 13, 1999. (On 13 Jul 99, MLP #99-28 was closed.)
13 Jul 99	During the weekly checkout, the coolant level in the primary coolant storage tank was noted to be low so MLP #99-29 was opened to address the situation. Subsequently, under MLP #99-29, forty-eight (48) gallons of demineralized water were added to the primary coolant storage tank to restore the water level with no problems noted. (On 15 Jul 99, MLP #99-29 was closed.)
13 Jul 99	During a walk-through check, a small crack was discovered in one of the rabbit system tubes at the NAA Laboratory receiving station. Under MLP #99-30, the tubing was reterminated to eliminate the crack to assure system integrity with no further problems noted. (On 13 Jul 99, MLP #99-30 was closed.)

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Date	Maintenance Description
14 Jul 99	During performance of the pre-calorimetric portion of the A-2 Surveillance (UFTR Nuclear Instrumentation Calibration Check and Calorimetric Heat Balance), certain voltages and set points were noted to require minor adjustments as expected. Under MLP #99-31, various voltages and set points were adjusted to assure proper nuclear instrumentation calibration with failure of Safety Channel 2 during the post-calorimetric adjustments negating the surveillance. Subsequently, after repair of Safety Channel 2 (MLP #99-32), the various voltage checks and adjustments as well as the calorimetric run were repeated and the A-2 Surveillance was successfully completed on July 27, 1999. (On 27 Jul 99, MLP #99-31 was closed.)
16 Jul 99	During completion of final surveillances for recovery from the outage for checks related to the reactivity anomaly, following the power run for calorimetric heat balance (A-2 Surveillance) and adjustments to the nuclear instruments at power, the reactor was shut down for the post-calorimetric adjustments. During the adjustments, Safety Channel 2 failed after about 10 minutes. Since the failure was at shutdown, it was not considered reportable per Tech Specs. Under MLP #99-32, extensive circuit troubleshooting and testing were conducted on Safety Channel 2 to determine that the linear amplifier had two operational amplifiers that needed to be replaced. Therefore, 10 CFR 50.59 Evaluation Number 99-07 (Modification for Equivalent Replacement of Safety Channel Two Linear Amplifiers) was approved to allow replacement of two operational amplifiers with equivalent amplifiers since exact duplicate operational amplifiers are no longer available. Subsequently, the two operational amplifiers were installed in the linear amplifier card for Safety Channel 2 to restore verified proper operation of Safety Channel 2 with no further problems noted so that the A-2 Surveillance could be repeated which was accomplished successfully on July 27, 1999. (On 26 Jul 99, MLP #99-32 was closed.)
30 Jul 99	While operating at 100 kW on July 30, 1999, following startup at 1021 hours for annual temperature coefficient of reactivity measurements (A-3 Surveillance) as well as radiation surveys in anticipation of returning to normal operations, the reactor tripped on a Safety Channel 2 scram (full trip)

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Date	Maintenance Description

at 1234 hours at which time the reactor was also secured. This was a full trip with all safety systems responding satisfactorily. Since power was not observed to exceed the 100 kW set point by the operator (SRO Wolf), the trip was determined to have been caused by the Safety Channel 2 Loss of High Voltage trip circuit. Under MLP #99-33 key voltage points in the trip circuit were measured and verified normal after the trip occurred. A successful daily checkout was accomplished soon after the trip at 1441 hours.

Following the trip, set points were verified and the trip circuit was quantitatively tested and verified to be functioning more conservatively than required on loss of high voltage with only about 5% voltage reduction versus Tech Spec specification of 10% reduction allowed before causing a full trip on loss of high voltage. A similar trip in April 1996 (MLP #96-12) showed a relatively large amount of noise at the inputs of the bistable circuit comparator. With this noise present, any additional noise such as spikes produced from line (main AC) transients would be likely to cause a spurious trip. Due to a heat wave during the week of July 26, 1999 and close to 100°F. temperatures on July 30, 1999, the electrical distribution grid was taxed and transients were noted in sensitive equipment in adjacent buildings at about the same time supporting this evaluation.

Since this was a spurious trip, no system modifications were recommended unless the problem of such trips should become chronic. This trip is also not considered to be promptly reportable per Technical Specifications, Section 6.6.2 since it is from a known cause. After successful weekly and daily checkouts and closeout of MLP #99-33, restart was approved on August 2, 1999. The evaluation of this event is that it had no effect on reactor safety or the health and safety of the public. Completed UFTR Form SOP-0.6A (Unscheduled Reactor Trip Review and Evaluation) indicating all safety systems responded properly, along with a memorandum of evaluation on the event to reactor trip records plus the completed maintenance log page (MLP #99-33) including weekly and daily preoperational check sheets are included in the July 1999 facility monthly report for anyone interested. Following circuit analysis and successful weekly and daily preoperational checkouts on August 2, 1999, the maintenance log page was closed out for return to performing operations for surveillances in anticipation of returning to normal

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description
	operations. Some additional follow-up discussions on loading and operation of the Safety Channel 2 high voltage and bistable trip were conducted on August 5, 1999. (On 2 Aug 99, MLP #99-33 was closed.)
2 Aug 99	During the weekly checkout, the deep well secondary coolant pump failed to run apparently due to overloading and a possible short in the motor determined under MLP #99-34. Following in-house analysis and troubleshooting of the pump power circuit, the system was inspected by John Hare and two technicians of Hare Well Drilling Inc. on August 3, 1999. Subsequently, on August 5, 1999, John Hare and three assistants replaced the secondary well pump motor due to a ground in one of the phases. Following a checkout to assure proper operation and completion of the preoperational checkouts, the reactor was returned to recovery operations under MLP #98-15 with no further problems noted. (On 5 Aug 99, MLP #99-34 was closed.)
9 Aug 99	During the weekly checkout, the blower pump on the AIM3BL air particulate detector was found to be failed. Under MLP #99-35, the pump was disassembled and checked. Subsequently, a supplier was located and new carbon replacement vanes were ordered. When received, the new vanes were installed and the pump reassembled and verified to be operating properly with no further problems noted. (On 25 Aug 99, MLP #99-35 was closed.)
10 Aug 99	During the weekly checkout, the dilute fan coupling was noted to be in need of replacement. Under MLP #99-36, PPD technician W. Hill visited to inspect the coupling and take measurements on August 23. Later, PPD technicians Bill Mikulski and Ronny Thompson visited to scope out the work needed; they then returned on August 24, 1999 to replace the coupling with no problems noted. (On 24 Aug 99, MLP #99-36 was closed.)

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CHRONOLOGICAL TABULATION OF UFTR PREVENTIVE/CORRECTIVE MAINTENANCE

Date	Maintenance Description

MLP #93-10 remains open from 5 April 1993 (New Temperature Recorder).
MLP #94-14 remains open from 16 March 1994 (New Area Radiation Monitoring System).
MLP #96-30 remains open from 11 November 1996 (Security system Batteries).
MLP #99-11 remains open from 16 April 1999 (RO-7) (Survey Meter).
MLP #99-19 remains open from 24 May 1999 (Replacement of Waste Water Tanks).
MLP #99-22 remains open from 21 June 1999 (City Water Motor Operated Valve).

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 1998-99 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. Since that time there have been no further Tech Spec changes or requests for changes.

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 Final Safety Analysis Report

FSAR Revision 5 was submitted to NRC and inserted in the UFTR Safety Analysis Report (FSAR) 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 FSAR 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 FSAR 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 FSAR 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.

During the 1998-99 reporting year, Revision 11 to the UFTR Safety Analysis Report (FSAR) was initiated as a result of changes in personnel monitoring badges supplied to the University by the NVLAP-accredited supplier (Landauer). By memorandum dated December 10, 1998 and received on December 16, 1998, the UFTR facility was informed by the Radiation Control Office that the University's dosimeter company, NVLAP-certified Landauer, Inc., was switching from film badges to Luxel dosimeters for personnel monitoring badges. The memorandum as well as the Luxel Dosimeter Information Sheet and a Radiation Dosimeter Fact Sheet were used to support 10 CFR 50.59 Evaluation and Determination Number 98-10 (Personnel Monitoring Device Change from Film/TLD Badges to Luxel Dosimeters) supporting the change in dosimetry and the associated change in the UFTR Safety Analysis Report as well as various procedural changes (Temporary Change Notices, or TCNs, for SOP-A.8, SOP-C.3, SOP-D.2, SOP-D.3, SOP-D.4 and SOP-D.5) to refer to personnel monitoring badges instead of film badges. During January 1999, the various procedural changes and the change to the FSAR were developed for review and approval at the February 11, 1999 RSRS meeting after which they were implemented in late February 1999. The new radiation dosimetry report now reports data for the new Luxel dosimeter down to 1 millirem versus the previous 10 millirem limit.

This change was submitted to NRC with a cover letter dated February 19, 1999. Essentially, this change was made because the University-contracted NVLAP-approved supplier of personnel radiation monitoring badges has now changed from using film to using Luxel dosimeters in their badges. Other extra badges for some operators were already utilizing thermoluminescent dosimeters (TLDs). The change occurs in FSAR Section 12.3.4.4 on page 12-20 where the reference to operators and other personnel working in the reactor wearing "film badges" at all times is changed to read wearing "film, TLD, Luxel or other individual personnel monitoring badges" in the first two lines of the first paragraph. The change is general to allow various types of radiation sensitive materials to be used in personnel monitoring badges. Currently, the Luxel dosimeter is the primary material with supporting documentation showing this material to be superior to film; nevertheless, sufficient generality is incorporated in the new wording so that any change by the NVLAP-approved supplier, whoever it might be that is contracting with the University, would be allowable under the Safety Analysis Report. The usual vertical line in the page margin is used to delineate the change in the report so that it is easily located.

This Revision 11 change was fully reviewed by UFTR management and by the Reactor Safety Review Subcommittee to assure no unreviewed safety question was involved and so is not considered to relax the requirements for assuring protection of the health and safety of the public and of the reactor facility. The change simply updates the Safety Analysis Report to reflect the existing facility and its operations by updating the allowable types of personnel monitoring badges to be worn by those working in the reactor. A copy of the transmittal letter dated February 19, 1999 and mailed on February 22, 1999 and the revised FSAR page 12-20 is Attachment III to the facility February 1999 monthly report which is available at the facility for those interested. To date there

has been no formal response from the NRC nor is any expected as this does not constitute an unreviewed safety question. This change was incorporated into all facility copies of the UFTR FSAR in February 1999 to close out this change.

There have been no other subsequent revisions of the UFTR FSAR. However, with completion of most neutronics and thermal-hydraulics analyses to support the HEU-to-LEU conversion, other FSAR updates are planned as necessary to keep the FSAR 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 1998-99 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 (1997-98) 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 (1998-99) 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 no revisions to SOPs generated during this reporting year versus two last year (1997-98), three in 1996-97 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 in the 1994-95 reporting year. The basic reasons for any SOP revisions are explained in the following paragraphs with a copy of each revision available at the UFTR facility for review if desired.

Although there were no revisions generated during the 1998-99 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, to implement FSAR Revision 11, 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 comparison with the previous three reporting years when twenty-nine (29) TCNs were issued in 1995-96, eleven (11) in 1996-97, and then eight (8) TCNs in 1997-98, a total of fifteen (15) TCNs were issued this 1998-99 reporting year to correct minor discrepancies or better express the unchanged intent of eleven (11) different procedures including SOP-0.1, SOP-0.5, SOP-A.1, SOP-A.8, SOP-C.2, SOP-C.3, SOP-D.2, SOP-D.3, SOP-D.4, SOP-D.5 and SOP-E.4, with only SOP-0.5 (QA Program) changed more than once. It should be noted that all of the TCNs for SOP-0.5 simply updated surveillance data sheets; the other TCNs usually affected one or at most two or three 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.

During the 1998-99 reporting year, Revision 11 to the approved UFTR Emergency Plan was submitted to NRC with an explanatory cover letter dated February 18, 1999. These changes are considered relatively minor in nature and are the result of reviews of the Plan and UFTR plans for

and responses to simulated emergencies. Most are simple changes to account for name changes or correct typographical errors.

Revision 11 consists of a set of updates and revisions to twenty-three (23) pages: title page, ii, iii, 1-3, 1-12, 2-2, 3-2, 3-7, 3-8, 7-1, 7-2, 7-3, 7-4, 7-5, 7-6, 7-7, 7-8, 8-1, 8-4, 8-5, 9-1, 10-1 and 10-3, as well as Appendix II - Agreement Letters. The new pages are marked with the usual vertical lines for easy location of specific changes. In this letter, the page number and line references are to those in your current copy of the Emergency Plan.

First, the title page is updated to reflect inclusion of Revision 11 and the Table of Contents is updated on page ii to reflect and add the inadvertently omitted record of the REV 8, 12/92 change for tracking purposes on the bottom of the page. Also on page ii, the location of section 3.8 is updated to appear on page 3-8 due to page reformatting. On page iii, the locations of many of the sections in Chapter 7 are updated due to page reformatting that occurred with the retype of the entire chapter. Also on page iii, the title of section 7.2.4 is changed from "Protection Actions" to "Protective Actions" to match the section 7.2.4 in Chapter 7. In addition, the typographical error "ssessment" in the title of section 7.4.2 is corrected to be "Assessment."

Second, there are a number of changes on two pages in Chapter 1. On page 1-3, section 1.3.2, paragraph 2 in line 1, designation of the "reactor room or cell (area 101)" is changed to "reactor room or cell (Rooms 5 and 6)" to reflect renumbered reactor building rooms from several years ago. Similarly, in paragraph three, line five, "reactor cell (area 101)" becomes "reactor cell (Room 5)," in line eight "radiochemistry laboratory (area 104)" becomes "radiochemistry laboratory (Room 3)" and in line 10 "offices (area 201)" becomes "offices (Room 103)." On page 1-12, section 1.5, paragraph 3, at the end of line 2 in subparagraph (1), the word "place" is a typographical error and is corrected to be "plate."

Third, on page 2-2, in the definition of Facility Director, the reference to "his" designate is updated to "a" designate to eliminate a gender specification. In the definition of Offsite, the word "Offsite" is changed to be underlined as "Offsite" for consistency of presentation. In the definition of Operations Boundary, a sentence is added to clarify that the *"operations boundary includes the west fenced lot as necessary."* This addition allows for evolutions such as fuel and waste shipments as well as potential accidents where this lot is subject to operations control for these evolutions. This is also a designation that has been traditionally understood for such evolutions.

Fourth, there are a number of changes on three pages in Chapter 3. In Figure 3.1 on page 3-2, the UFTR Organization Chart is updated to correct a typographical error carried over from Revision 10, 2/97 to change "Radiation Control Office" at Level 3 in Figure 3.1 to "Radiation Control Officer" to agree with Figure 6.1 in the UFTR technical specifications.

On page 3-7, in section 3.6, line 1 is updated to reflect the name change from "Nuclear Engineering Sciences Department" to "Nuclear and Radiological Engineering Department" to reflect the name change from late 1996 that was inadvertently omitted in the Revision 10, 2/97 change to the Emergency Plan. Also in section 3.6, in line 4 the reference to "Gainesville fire department" is changed to "City of Gainesville Fire/Rescue Department," and the reference to "Alachua ambulance

service" is changed to "Alachua County Ambulance Service" as the proper designations. These updates required additional space on page 3-7 with subsequent reformatting of section 3.8 from the bottom of page 3-7 to the top of page 3-8. On page 3-8, the first section to appear at the top of the page is now 3.8, "Emergency Coordinator."

Fifth, all pages in Chapter 7 are being replaced with Revision 11. All pages reflect reformatting changes where certain sections or partial sections now appear on the next page; four of the older version pages include specific updates and/or corrections referenced as follows: On page 7-2, in section 7.1.2.1.1, the reference to "parking lot" at the end of the first partial paragraph is changed to "service drive" since the referenced area outside the southwest door of the Nuclear Sciences Center is a service drive, not a parking lot. Also on page 7-2, in section 7.1.2.2, the first sentence is reworded to say "*the use of* respiratory *protection* equipment and protective clothing shall be *considered* whenever airborne contamination is suspected . . . *and then used as appropriate*," instead of requiring its use to reflect better the requirements of the new 10 CFR Part 20 where internal and external dose are considered equivalent and overall dose is to be minimized. Also in section 7.1.2.2, in line 4 the reference to the "City of Gainesville Fire Department" is changed to "City of Gainesville Fire/Rescue Department" as the proper designation. In addition, section 7.1.2.2, line 3 and section 7.1.2.4, line 5 are updated so the words "Decon Room" and "Decontamination Room" are changed to "Emergency Support Center" to reflect better the proper designation for the facility that serves as the response center location for addressing emergencies.

On page 7-3, section 7.1.2.4, paragraph (a) is updated so the words "of" at the end of line 1 and "rate" in line 3 are removed as typographical errors. In line 2 of that same paragraph, the reference to "his" delegate is updated to "a" delegate to eliminate a gender specification. Also on page 7-3, section 7.1.2.4, paragraph (b), line 2 and section 7.2.1, paragraph 1, lines 5 and 6 are updated so the words "Decontamination Room" are replaced with "Emergency Support Center (Decontamination Room)" to reflect better the proper designation of the response center location for addressing emergencies. Additionally, on page 7-3, section 7.1.2.4, paragraph (d) is updated to change the word "is" in line 2 to "are" to correct a grammatical error and the word "enclosed" in line 3 is changed to "included" as it more accurately describes material located in Appendix I.

On page 7-4, section 7.2.4, line 5 is updated to change the words "protection actions" to "protective actions" as the proper term to be used. In section 7.3.1, lines 4 and 5 the instructions to "(Dial 2-1111), identify himself" are changed to "(call 2-1111, identify self" to update terminology, remove inappropriate parenthesis and eliminate a gender specific reference. In addition, in section 7.3.1, lines 6 and 7 are updated to correct the phrase "in the Decontamination Room" to be "at the Emergency Support Center" since the referenced call lists are posted not only in the Decontamination Room but also at other locations outside the Decontamination Room and in the adjacent Auxiliary Support Center Room, all as part of the Emergency Support Center.

On page 7-6, section 7.3.4, in the last line of paragraph 1, "operating boundary" is corrected to be "operations boundary" to reflect the proper term used to designate the area within which the Facility Director has direct authority over all activities. Also on page 7-6, paragraph 4, lines 3 and 4 are updated to reflect the name change from "Nuclear Engineering Sciences Department" to "Nuclear and Radiological Engineering Department" to reflect the name change from late 1996 that

was inadvertently omitted in the Revision 10, 2/97 change to the Emergency Plan. Additionally, on page 7-6, section 7.4.1, line 4 of paragraph 1 is updated to change the word "He" to "The Emergency Director" to eliminate a gender specific reference.

Sixth, there are changes on three pages in Chapter 8. On page 8-1, in section 8.1, for Location 2, the reference to "Parking Lot" in the first line is changed to "Service drive" since the referenced area outside the southwest door of the Nuclear Sciences Center is a service drive, not a parking lot.

On page 8-4, section 8.3.2, line 1 of paragraph 1 is updated to change the phrase "Nuclear Sciences Center Decontamination Room" to "Emergency Support Center (Decontamination Room)" as the proper designation for the location where first aid is normally available.

On page 8-5, section 8.4, in the first line of paragraph 1 the phrase "Decontamination Room (Room 108 NSC)" is changed to "Emergency Support Center (Room 108 NSC)" as the proper reference to where the telephone is located for primary communications during emergencies. In addition, in line 3 of paragraph 2, the reference to "main Nuclear Engineering office" is corrected to read "the Nuclear and Radiological Engineering Department main office" again to reflect the 1996 department name change that was inadvertently omitted in the Revision 10, 2/97 change to the Emergency Plan.

Seventh, on page 9-1, section 9.0, line 2 of paragraph 3 is updated to change the phrase "Decontamination Room (Room 108 NSC)" to "Emergency Support Center (Room 108 NSC)" as the proper designation for the location to which evacuations are made and from which emergencies are addressed.

Eighth, there are changes on two pages in Chapter 10. On page 10-1, section 10.1.1, lines 4 and 5 of paragraph 1 are updated to reflect the name change from "Nuclear Engineering Sciences Department" to "Nuclear and Radiological Engineering Department" to reflect the name change from late 1996 that was inadvertently omitted in the Revision 10, 2/97 change to the Emergency Plan. Also in section 10.1.1, in lines 5 and 6 the reference to "Occupational Health and Safety" personnel is changed to "Environmental Health and Safety" as the proper campus entity and in lines 11 and 12 the reference to the "City of Gainesville Fire Department" is changed to the "City of Gainesville Fire/Rescue Department" as the proper designation. In addition, in section 10.1.2, second paragraph, line 5, the reference to the Office of Environmental Health and Safety is updated to the "Division of Environmental Health and Safety" to reflect campus administrative reorganization of some years ago where this division includes the Radiation Control Office and in the last line on the page, the reference to the "City of Gainesville Fire Department" is changed to the "City of Gainesville Fire/Rescue Department" as the proper designation.

On page 10-3, Table 10.1 is updated so the last entry in column 1 is changed from referring to "Environmental Devices (Film Badges and TLDs)" to referring to "Environmental Monitoring Devices (TLDs, Luxel or Other Dosimeters)" to reflect a change from film badges and TLDs to only TLDs documented as allowed in Revision 3, 1987 of the UFTR Safety Analysis Report where film badges were allowed to be removed from usage as environmental dosimeters due to their frequent

damage due to high temperature and humidity versus TLDs which are the dosimeter devices of choice for environmental monitoring. The alternative possibility of using Luxel or other dosimeters is added to reflect a pending implementation of Luxel dosimeters in 1999.

Finally, Appendix II of the UFTR Emergency Plan is updated by removing the two older versions of agreement letters for the Alachua County Office of Emergency Management and Shands Teaching Hospital and Clinics, Inc. and replacing them with two more recent letters.

All these changes have been 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. A copy of the cover letter dated February 18, 1999 and mailed on February 22, 1999 as well as the complete text of Revision 11 to the Emergency Plan is Attachment IV to the February 1999 facility monthly report for easy reference.

In a telephone conversation on February 25, 1999, NRC Senior Project Manager Ted Michaels indicated that, based on our review and no reduced effectiveness of our Emergency Plan, Revision 11 can be implemented subject to our schedule with no prior NRC approval needed. This implementation was in progress at the end of February.

During March 1999, Revision 11 was supplied to all offsite holders of the Plan with a cover letter and instructions on maintaining a complete copy. The cover letter is Attachment III to the March 1999 facility monthly report. Gainesville Fire Rescue acknowledged receipt of Revision 11 by letter dated March 25, 1999 and received on April 1, 1999. With a letter dated April 16, 1999 and received on April 23, 1999 from Senior Project Manager Ted Michaels, the NRC indicated that based on the licensee evaluation that the changes do not decrease the Plan effectiveness and it continues to meet the requirements of 10 CFR 50, Appendix E, no NRC approval is needed. However, he indicated initial NRC review of the changes shows they are in accordance with 10 CFR 50.54(q) so implementation of the changes will be subject to inspection to confirm that the changes do not decrease effectiveness of the Plan. The NRC letter is Attachment IV to the April 1999 facility monthly report. The facility copies of the Plan were expected to be updated during April, May and then June 1999 but this was delayed until July 29, 1999 when all facility copies were updated to close out this revision in the current reporting year.

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 per a letter from Luis A. Reyes, Region II Regional Administrator dated August 1, 1997 and communications with Project Managers Marvin Mendonca and Ted Michaels at the Non-Power Reactor Directorate. The cover page is Attachment III to the October 1997 facility monthly report. There had been no response from NRC; however, NRC inspector Stephen Holmes indicated on October 8, 1998 that no approval would be given for changes reviewed by the licensee as not reducing Security Plan effectiveness per 10 CFR 50.54(p). Therefore, the changes were incorporated into the Security Plan on October 23/26, 1998 to close out implementation of Revision 14.

G. Biennial Reactor Operator Requalification and Recertification Program

When the operator requalification and recertification program training cycle for the UFTR was scheduled to end in June 1997, the 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 a 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 used for the previous two-year training cycle with only the name of the Department of Nuclear Engineering Sciences changed to Department of Nuclear and Radiological Engineering 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 did not alter the intent of the approved Plan and therefore were 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 annual report. This program was not changed during the 1997-98 reporting year.

The existing operator requalification and recertification program training cycle for the University of Florida Training Reactor was scheduled to end in June 1999. Therefore, renewal of the approved plan for the July 1, 1999 through June 30, 2001 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 14, 1999. In effect, the revised plan is essentially the same as that used for the previous two-year training cycle with the removal of the duplicate training on standard operating procedures the only significant change. In recent years the procedures for the UFTR have not changed significantly and when they do, special training is conducted to assure all operations staff are cognizant of the change. For this reason there is no need to have procedure training conducted in February of one year and then April of the next. Therefore, the second training lecture and examination on standard operating procedures was deleted from the training schedule. This renewed plan is intended to cover the UFTR operator requalification and recertification program from July 1999 through June 2001. Subsequently, in a letter from the NRC Project Manager dated June 15, 1999 and received on June 21, 1999, the NRC indicated that the revisions do not alter the intent of the approved Plan and therefore are acceptable. A copy of the revised Plan is available for reference purposes at the UFTR facility.

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. 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. These respirators were used only a couple of times as airborne contamination levels were very low. There have been no further changes to the UFTR Respiratory Protection Program in the 1998-99 reporting year.

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.

During the 1998-99 reporting year, Dr. Caner provided some information on reactivity coefficients and completed his reactor physics analyses for the HEU-to-LEU conversion. A draft copy of his work to date on conversion dated September 23, 1998 was received on September 28, 1998. A "final" copy of his work to date was received on December 16, 1998. During March 1999, the internal review was completed and the report finalized with this work generally agreeing with earlier reactor physics analyses. Several discussions have occurred since as Dr. Caner provided proposed Tech Spec changes in June and left all his work well documented before he finally left on July 20, 1999 to return to the SOREQ Institute.

As required, the 1999 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 29, 1999 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 would now be scheduled for June 1999. The updated schedule is Attachment I to the March 1999 facility monthly report. Though too late to include in the proposal, a formal letter from John Gutteridge, Program Director, University Programs, in the DOE office of Nuclear Energy, Science and Technology, dated April 7, 1999 and received on April 12, 1999 indicated no conversion funding is available during fiscal year 1999 so there was no need for submission of the HEU-to-LEU conversion document to NRC. The letter is available at the UFTR facility for anyone desiring to examine it.

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 not 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.

During the 1998-99 reporting year, there was no activity in this area as efforts to get the Department of Energy to take this fuel back have been unsuccessful to date. It is hoped that renewed efforts spearheaded by the Radiation Control Office will be able to get this fuel removed to allow cancellation of the SNM-1050 license and decommissioning of the facility during the next reporting year (1999-00). There is some expectation for success as the DOE now has a program for accepting back such material.

In a related area there was administrative activity. The largest external project accomplished during the 1998-99 reporting year was to oversee and assist with delivery of two 600 Ci Cobalt-60 sources which were accepted into the reactor cell making use of the overhead crane. In addition to receiving the two fresh Co-60 sources, two depleted sources (<150 Ci each) were processed, repackaged and shipped back to the vendor. This required an amendment to the UFTR Quality Assurance Program No. 0578 to make it very general. Proposed Revision 4 to the QA Program was sent to NRC with a letter dated March 29, 1999. Subsequently, Quality Assurance Program Approval for Radioactive Material Packages No. 0578, Revision No. 4 was approved by NRC letter dated May 19, 1999. It is hoped this renewed QA Program Revision 4 will also be useable for shipping the SNM-1050 licensed fuel when the time comes. The spent Co-60 sources were then shipped out in May 1999 with no problems encountered.

TABLE VI-1

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-1 (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)
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 1, 12/97)

TABLE VI-2

LISTING OF APPROVED UFTR STANDARD OPERATING PROCEDURES
(as of August 31, 1999)

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, 1999)

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 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 1998	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
October 1998	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
November 1998	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
December 1998	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
January 1999	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
February 1999	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
March 1999	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
April 1999	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
May 1999	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
June 1999	0.0000×10^{6} μCi/Month	0.0000×10^{-10} μCi/ml
July 1999	5.6179×10^{6} μCi/Month	2.1909×10^{-9} μCi/ml
August 1999	8.0503×10^{6} μCi/Month	3.1394×10^{-9} μCi/ml

TOTAL ARGON-41 Releases for the Reporting Year: 13.6682 Ci
YEARLY AVERAGE ARGON-41 Release Concentration: 4.4419×10^{-10} 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 4.4419×10^{-10} μCi/ml. Even with the newest 10 CFR Part 20 values reducing the Argon-41 release

concentration limit to 1.0 x 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 32% of the allowable limit and the second highest is less than 22% 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 1998 – Dec 1998	3072.49 μCi/kW-hr [2]	6.773 x 10^{-8} μCi/ml [2]
Jan 1999 – Jun 1999	3072.49 μCi/kW-hr [2]	6.773 x 10^{-8} μCi/ml [2]
Jul 1999 – Aug 1999	3986.62 μCi/kW-hr	11.194 x 10^{-8} μCi/ml

[1]Values used to assure average release concentration meets 10 CFR 20 limits.
[2]These values were determined from measurements made in Jan 1998 and are the same as the previous periods because the experimental measurements were not conducted during this time period due to the shutdown and subsequent disassembly of the core (MLP #98-15) which was extended for most of the reporting year.

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 4.24 x 10^{-8} μCi/ml (β-γ) and 1.36 x 10^{-8} μCi/ml (α) for this 1998-99 reporting period. There was one discharge from the holding tanks this reporting period. On May 21, 1999 a total of 85,700 liters were discharged. The tank contained 0.04 μCi of total activity, 0.10 μCi of dissolved activity, and less than 0.01 μCi activity of suspended solids. This was the last discharge from the underground holding tanks. Under 10 CFR 50.59 Evaluation and Determination Number 99-04 (Modification/Upgrade of Effluent Discharge System for Reactor Building), the underground holdup tanks were taken off line on May 19, 1999. Subsequently, the wastewater was collected in several polyethylene tanks and stored there until the outside aboveground permanent 1,000-gallon holdup tank and the inside permanent 150-gallon holdup tank were implemented. All discharges from the inside tank are to the outside aboveground tank. There were no discharges from the outside aboveground tank during this reporting period.

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 1985-86, 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 1986-87 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 and other documents 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 1998 to August 1999 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 except for TLD No. 2. 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 within the accuracy of the monitoring instruments for all except TLD No. 2.

During January 1999 radiation dosimetry monitoring was switched from film and TLD badges to Luxel badges per 10 CFR 50.59 Evaluation and Determination Number 98-10 (Personnel Monitoring Device Change from Film/TLD Badges to Luxel Dosimeters). Film and TLD badges had a minimum reported radiation dose of 10 millirems. Luxel badges have a minimum reported radiation dose of 1 millirem. After December 1998 a reported dose of M signifies a radiation dose of less than 1 millirem.

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 No. 2 received higher than average exposure (9/98, 10/98, 11/98, 12/98, 1/99, 2/99, 3/99, 4/99, 5/99, 6/99) 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, 1998 TO AUGUST 31, 1999

TLD Designation	Total Exposure (mrem) [1]	Month(s) of Exposure
1	10	12/98
2	676	9/98, 10/98, 11/98, 12/98, 1/99, 2/99, 3/99, 4/99, 5/99, 6/99
3	M	--
4	M	--
5	M	--
6	M	--
7	70	11/98
8	12	2/99
9	M	--
10	M	--
11	M	--
12	M	--

[1]M denotes minimal (<10 mrem) exposure prior to Jan 1999. After Dec 1998 M denotes < 1 mrem.

TABLE VII-3B

THERMOLUMINESCENT DOSIMETER EXPOSURE RECORD BY MONTH OF EXPOSURE [1]

TLD Number	Sep 98 (mrem)	Oct 98 (mrem)	Nov 98 (mrem)	Dec 98 (mrem)	Jan 99 (mrem)	Feb 99 (mrem)	Mar 99 (mrem)	Apr 99 (mrem)	May 99 (mrem)	Jun 99 (mrem)	Jul 99 (mrem)	Aug 99 (mrem)
1	M	M	M	10	M	M	M	M	M	M	M	M
2	110	80	80	110	40	73	45	94	27	17	M	M
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	M	M	M	M	M	M
6	M	M	M	M	M	M	M	M	M	M	M	M
7	M	M	70	M	M	M	M	M	M	M	M	M
8	M	M	M	M	M	12	M	M	M	M	M	M
9	M	M	M	M	M	M	M	M	M	M	M	M
10	M	M	M	M	M	M	M	M	M	M	M	M
11	M	M	M	M	M	M	M	M	M	M	M	M
12	M	M	M	M	M	M	M	M	M	M	M	M

[1]M denotes minimal (<10 mrem) exposure prior to Jan 1999. After Dec 1998 M denotes < 1 mrem.

E. Personal Radiation Exposure

UFTR-associated personnel exposures greater than minimum detectable during the reporting period are summarized in this section. During the 1998-99 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 subject to ALARA considerations.

During January 1999 radiation dosimetry monitoring was switched from film and TLD badges to Luxel badges. Film and TLD badges had a minimum reported radiation dose of 10 millirems. Luxel badges have a minimum reported radiation dose of 1 millirem. After December 1998 a reported dose of M signifies a radiation dose of less than 1 millirem.

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 as well as doses listed for other UFTR personnel were a result of the extensive work in the reactor core area and are considered to meet ALARA considerations.

TABLE VII-4

ANNUAL UFTR PERSONNEL EXPOSURE

Personnel	Position	Permanent Film Badge Exposure (mrem) [1]
J. Powers	Senior Reactor Operator	140
J. Wolf	Senior Reactor Operator	253
W. Vernetson	Senior Reactor Operator	30
R. Salazar	Reactor Operator Trainee	1473
G. Macdonald	Reactor Operator Trainee	1782
T. Colbert	Reactor Operator Trainee	15

[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

Personnel	Position	Permanent Film Badge Exposure (mrem) [1]
B. Uhlmer	NAA Lab/Radiation Control Technician	10
S. Iverstine	NAA Lab/Reactor Facility Technician	20
A. Knight	NAA Lab/Reactor Facility Technician	10
J. Gilliam	NAA Lab/Reactor Facility Technician	17
J. Hamilton	NAA Lab/Radiation Control Technician	M

[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. These exposures are on an annual basis with no further breakdown because all exposures are well below 100 mrem for the year.

TABLE VII-6

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

Personnel [1]	Date	Exposure (mrem) [1]	Comments
J. Parker	02/03/99	10	Radiation Control Tech
B. Harraha	03/22/99	3	Tour
J. Smith	07/29/99	4	Tour

[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.