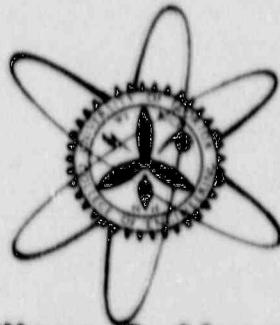


UNIVERSITY OF FLORIDA TRAINING REACTOR

LICENSE NUMBER: R-56

**UPDATED PROPOSAL SUBMITTED TO
THE NUCLEAR REGULATORY COMMISSION
TO MEET 10 CFR 50.64 REQUIREMENTS
FOR UPDATING SCHEDULING OF UFTR CONVERSION
FROM HEU TO LEU FUEL**



**Dr. William G. Vernetson
Director of Nuclear Facilities**

March 27, 1990

DEPARTMENT OF NUCLEAR ENGINEERING SCIENCES

College of Engineering

University of Florida

Gainesville

9004100402 900327
PDR ADOCK 05000083
P FDC

UNIVERSITY OF FLORIDA TRAINING REACTOR

LICENSE NUMBER: R-56

UPDATED PROPOSAL SUBMITTED TO
THE NUCLEAR REGULATORY COMMISSION
TO MEET 10 CFR 50.64 REQUIREMENTS
FOR UPDATING SCHEDULING OF UFTR CONVERSION
FROM HEU TO LEU FUEL

Dr. William G. Vernetson
Director of Nuclear Facilities

March 27, 1990

UNIVERSITY OF FLORIDA TRAINING REACTOR FUEL CONVERSION FROM HIGH ENRICHED TO LOW ENRICHED URANIUM FUEL

INTRODUCTION

This proposal is submitted to the Nuclear Regulatory Commission to meet the requirement that the licensee for the University of Florida Training Reactor (UFTR), as a licensee of a non-power reactor authorized to possess and use high enriched uranium (HEU) fuel shall develop and submit a proposal to replace all HEU fuel possessed under the R-56 license with available low enriched uranium (LEU) fuel acceptable to the Nuclear Regulatory Commission on a schedule determined pursuant to 10 CFR 50.64 Paragraph (c) (2). This proposal addresses the overall process of conversion from initial preparations following receipt of funding to support conversion to final verification, testing, and summary reporting on the converted UFTR. Three primary phases have been identified for control and administration of the overall process of conversion as follows:

- I. Preparation for Conversion.
- II. Conversion (assuming NRC order to convert).
- III. Review and Verification of Conversion.

Table I contains a listing of key activities involved in each phase of the conversion from receipt of funding for conversion from the Department of Energy (DOE) to final submittal of summary reports to DOE and NRC on the conversion.

PHASE I: PREPARATION FOR CONVERSION

Phase I commenced with receipt of funding for conversion from DOE to cover Phase I only. This funding was considered to be certified per the letter contained in Appendix I of the 1987 proposal; this proposal was submitted to the Department of

Energy and official notice of receipt of funding was received with a letter dated November 12, 1987. Because of errors in the contract description provided by DOE, the full approval for receipt of funding was delayed until receipt of the confirming letter dated December 21, 1987. Copies of both letters as well as the 1987 certification letter are enclosed in Appendix I along with documentation showing the extension of the current DOE grant to support Phase I work which has been delayed beyond the original two-year grant period.

Initial efforts in the process to convert the UFTR from use of high enriched to low enriched fuel (HEU-LEU) consisted of preliminary tests and an evaluation to determine whether the SPERT-type fuel available to the R-56 licensee but currently under license SNM-1050 could be qualified for use in the UFTR. Visual and radiographic test results to date were positive in this regard. Unfortunately, equipment failures and the need to move the SPERT (SNM-1050) fuel storage facility impacted the schedule during the 1988 year so the radiographic tests were not completed until April, 1989 along with relicensing the SPERT fuel storage facility. Overall, the results of the radiographic tests of the SPERT fuel were positive showing that the condition of the fuel was such that its integrity was assured. Phase I then continued with activities to justify a fuel selection, either SPERT or silicide, based upon results of prequalification testing of existing SPERT fuel) and identifying any modifications in existing reactor systems necessitated by use of the new fuel.

Several previously unconsidered potential complications noted during the previous year have been investigated during the past year. This effort was directed to maintaining and/or improving the UFTR neutronics characteristics while minimizing the overall cost of UFTR conversion. The only two fuels that have been considered are the existing SPERT UO_2 , stainless steel clad fuel presently under the SNM-1050 license and the newly

developed silicide fuel to be available through the RERTR program at Argonne National Laboratory.

The first choice had been to use the already existing SPERT fuel for which a number of neutronics and thermal-hydraulics analyses are in existence. This is the cheaper fuel if acceptable since it is already manufactured. However, even after completion of the prequalification program for the qualification tests used to assure the SPERT fuel can meet UFTR requirements without compromising safety, it was necessary to assure this use could be made without requiring costly modifications which could outweigh the low initial cost of SPERT fuel (no manufacturing costs) and have impact on core neutronics per earlier analyses. The Department of Energy has been receptive to this evaluation of the two fuels and work in this area has progressed well during this year. Unfortunately, the complexity and cost of potential structural (the SPERT fuel loading would weigh about 2000 pounds versus the present 50 pound core loading) and shielding changes necessitated by use of the SPERT fuel resulted in a milestone decision in mid-year 1989 not to utilize the SPERT fuel for conversion but rather to utilize the standard plate-type silicide fuel. The anticipated shielding changes potentially necessitated by use of the SPERT fuel were especially strong factors in the decision since space in the UFTR facility is already limited and the facility was cited for two violations in this area in 1989.

In parallel with selection of the plate type silicide LEU fuel and identification of necessary reactor systems changes, a safety analysis is being performed for the selected LEU fuel conversion and associated system changes. Implementation of the neutronics codes to be used has been underway during the past year and is now nearly complete. UFTR conversion calculations were progressing well until the loss in August, 1989 of the graduate student performing the neutronics calculations as he decided to pursue the

doctoral degree at another university. The unavailability of another qualified student committed to assume this responsibility has resulted in further delays. Nevertheless, a student project in Fall, 1989 continuing to the present has resulted in some progress in assuring neutronics methodology is adequate though many calculations are being updated and repeated. It is hoped that this individual will remain on the project for his thesis work; if this retention effort is successful, the analyses will be able to move forward as projected in this proposal. Delays here have necessitated an extension in the initial DOE grant which has been received as documented in Appendix I. In addition to neutronic and thermal-hydraulic analysis, shielding and effluent analyses will be documented to identify any changes in procedures, security plan, technical specifications or other license documents that must be considered as part of conversion. This submittal will also contain documents detailing the various tests and surveillances planned as part of the conversion. At this point a complete set of licensing documents for the conversion will be submitted along with a conversion application for review and approval. Assuming resolution of all questions, this submittal will conclude the Phase I licensee efforts. Phase I will then conclude with the issuance by the NRC of the specific Order to Convert.

PHASE II. CONVERSION (Assuming NRC Order to Convert)

Phase II (Conversion) will begin with receipt of the NRC Order directing the conversion and any necessary changes to the license, facility and/or procedures per 10 CFR 50.64(c)(3). This second phase is not yet funded by the existing DOE grant for which an extension will be requested and will include all final tests conducted with the HEU fuel to serve primarily as the basis for later comparison with similar tests with LEU fuel. Phase II will then involve a number of key activities aimed ultimately at having LEU

fuel replace HEU fuel at the UFTR facility to include:

1. Shutdown core decay for several weeks followed by shipment of irradiated HEU fuel.
2. Qualification of the selected LEU fuel (as applicable).
3. Implementation of required facility changes necessitated for use of LEU fuel.
4. Receipt of unirradiated LEU fuel.
5. Documentation of all changes.
6. Completion of all requirements for core loading with LEU fuel followed by loading of the LEU fuel and startup testing to low power.
7. Documentation and record organization for the LEU fuel implementation.

PHASE III: REVIEW AND VERIFICATION OF CONVERSION

Phase III (Review and Verification of Conversion) will consist of a series of activities designed to verify the quality of the conversion process to include both the physical implementation of the LEU fuel and the documentation of the implementation. Activities in Phase III will include:

1. Completion of startup as well as power testing and related surveillances.
2. Verification and evaluation of UFTR operational characteristics.
3. Review of conversion plan and data for consistency.
4. Approval for return of UFTR to normal operations.
5. Return to normal operations.
6. Submission of Final Report to NRC/DOE summarizing HEU operational conditions and comparing these results with the predictions contained in the Safety Analysis submitted to NRC at the end of Phase I and approved as part of the Order to Convert.

SUMMARY CONCLUSIONS

As noted earlier, a relatively detailed list of the various elements that must be obtained, produced or otherwise generated as required throughout the three phases of the UFTR conversion from HEU to LEU fuel is presented in Table I. The current plan continues to be to generate as much of the required safety analysis and design work in-house as possible. Only items such as silicide fuel, (now the selected fuel) would be designed and manufactured outside the administrative control of the UFTR licensee. At this point, without having identified all required changes, it is not possible to delineate exactly what other external support may be needed. The neutronics and thermal-hydraulics analyses are all planned to be conducted in-house which has necessitated some external support from the RERTR program at Argonne National Laboratory to assure proper code implementation at the University of Florida to carry out the required safety analysis. Code implementation is now progressing though with delays due to graduate student changes and inability to identify qualified graduate students to work on the project for their thesis work.

The overall flow diagram for HEU to LEU conversion of the UFTR is presented in Figure 1. Key stages in the three phases, as well as key input items at the various stages, are indicated at each stage.

Finally, Table II contains an updated tentative schedule (Revision 4) for the major milestone events in the UFTR conversion process commencing with the notification of receipt of funding effective in December, 1987 and concluding with submittal of a final report to NRC and DOE summarizing the results of the conversion by August, 1993. It should be noted that this schedule is tentative and, as required by 10 CFR 50.64, will be

updated yearly. There has been considerable schedule slippage during the past two years. The schedule is also subject to variations caused by availability of replacement fuel (plate type or silicide) or other items involved in required facility changes as well as variations in the level of DOE funding after the first two year period (now extended) for which funding has been received. Other areas which may impact the schedule are the availability of a shipping cask especially for irradiated HEU fuel (we are currently using our HEU fuel at a rate of about 1.5 MW-Days per year so it will probably require a cask versus a 6M container) and final usage of the UFTR with HEU fuel to provide a basis for comparison of changes in operating characteristics or to meet education, research and service commitments. Within these constraints and conditions, the schedule in Table II is one which the licensee is committed to meeting and which the licensee considers relatively realistic based upon expected resources.

Although much of the detail of the conversion process has depended upon the final selection of fuel types, this selection is now finalized; therefore, the information, especially the tentative schedule in Table II provided in this updated proposal, shows that the LEU conversion at the UFTR has progressed during this year although significant delays occurred during the year due to requirements to complete testing of the SPERT fuel and to maintain graduate student support for the safety analyses. The key decisions remaining will involve identification and evaluation of system changes required by the conversion and assurance of the neutronics methodology. The schedule will be most impacted, however, by the times required for performing and documenting the safety analysis and perhaps for manufacture of the LEU fuel. The schedule presented in Table II is considered to be realistic and should be attainable now that considerable preliminary work has been completed provided qualified graduate student support remains available.

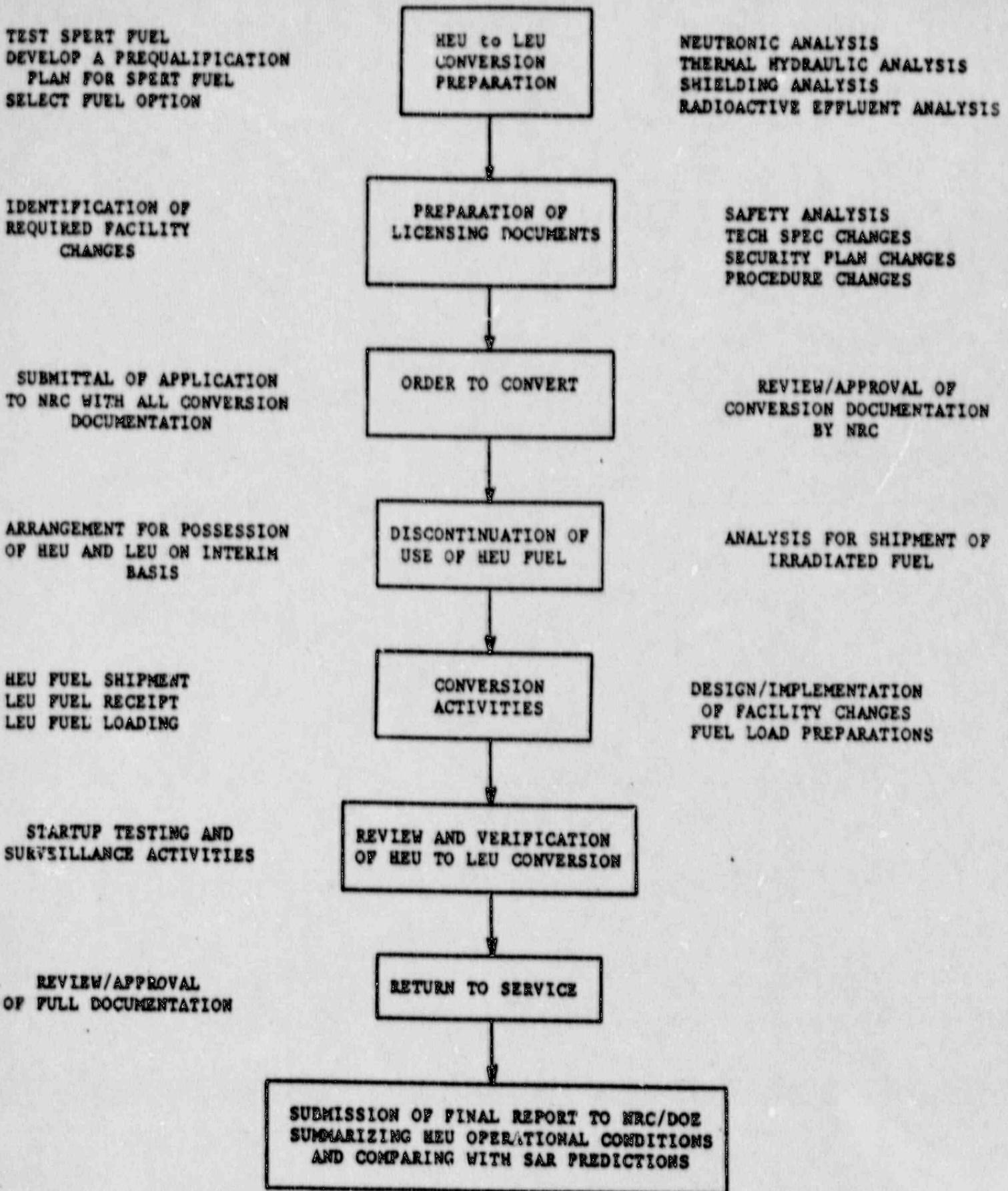


Figure 1. University of Florida Training Reactor HEU to LEU Conversion Flow Diagram

TABLE I

University of Florida Training Reactor
Key Activities for HEU to LEU Fuel Conversion

I. PHASE I - PREPARATION FOR CONVERSION

- A. Receipt of Funding from Department of Energy
- B. Analysis of UFTR-Specific LEU Conversion Options
 - 1. Pretesting of Selected SPERT Fuel Pins
 - 2. Development of a Qualification Program for SPERT Fuel Pins
 - 3. Completion of Pre-Qualification Testing of SPERT Fuel
 - 4. Evaluation of Comparative Conversion Options (SPERT VS. SILICIDE)
 - 5. Selection of LEU Fuel Option for UFTR Conversion
- C. Safety Analysis/Licensing Studies
 - 1. Neutronic Analysis for LEU-Fueled UFTR
 - 2. Thermal-Hydraulic Analysis for LEU-Fueled UFTR
 - 3. Shielding Analysis for LEU-Fueled UFTR
 - 4. Radioactive Effluent Analysis as Required
- D. Identification of Changes in the R-56 License, Technical Specifications, Facility, Security Documents and Procedures Under the Scope of 10 CFR 60.64(c)(3) as Necessitated by Fuel Conversion
- E. Preparation of Full Submittal to NRC to Support Conversion Including All Supporting Documents

II. PHASE II - CONVERSION

- A. NRC Order to Convert
- B. Fuel-Related Activities
 - 1. Qualification of Selected LEU Fuel
 - 2. Final UFTR Operations with HEU Fuel
 - 3. Shipment of Irradiated Fuel
 - 4. Receipt of LEU Fuel
- C. Implementation of Required Changes in R-56 License per Item ID.
- D. LEU Fuel Loading Activities
 - 1. Completion of Preparations for Core Load
 - 2. Loading of LEU Fuel
 - 3. Startup Testing and Surveillance
- E. Completion of Startup Documentation

III. PHASE III - REVIEW AND VERIFICATION OF CONVERSION

- A. Completion of Startup Testing and Related Surveillances
- B. Completion of Power Testing and Surveillances
- C. Determination of UFTR Operational Characteristics
- D. Return to Normal Operations
- E. Submission of Final Conversion Report to NRC/DOE

TABLE II

(Revision 4)

University of Florida Training Reactor
Tentative Milestone Schedule
for HEU to LEU Fuel Conversion

I.	Effective Date of Receipt of Funding	November, 1987
II.	Date of Full Submittal to NRC of Application to Convert (including all necessary documents)	April, 1991
III.	Date of NRC Order to Convert	August, 1991
A.	Date of Completion of All Plans to Convert	March, 1992
B.	Date of Receipt of LEU Fuel	May, 1992
C.	Date of Completion of Any Final Tests With HEU Fuel	July, 1992
D.	Date of Removal of HEU Fuel	September, 1992
E.	Date of Shipment of HEU Fuel	December, 1992
F.	Date of Loading of LEU Fuel	February , 1993
G.	Date of Completion of Determination of Initial Operational Parameters With LEU (Startup and Power Operations Testing)	April, 1993
H.	Date of Submittal of Report to NRC/DOE Summarizing New Operational Characteristics and Comparing With Predictions of Safety Analysis	August, 1993

APPENDIX I

LETTERS OF NOTIFICATION THAT
FEDERAL GOVERNMENT FUNDING FOR
UFTR CONVERSION IS AVAILABLE AND
HAS BEEN RECEIVED FROM THE
DEPARTMENT OF ENERGY



Department of Energy
Washington, D.C. 20545

NOV 21 1986

Dr. William G. Vernetson
Nuclear Facilities Division
University of Florida
Gainesville, FL 32611

Dear Dr. Vernetson:

This letter is to inform you that funding is available during FY-87 through the U.S. Department of Energy to initiate the conversion of your reactor from HEU to LEU fuel. It is requested, therefore, that you submit a proposal, including a detailed cost estimate, to accomplish the safety analysis phase of the conversion. The proposal should not include costs for the new fuel, spent fuel cask rental, or fuel shipping since these tasks are being handled by others.

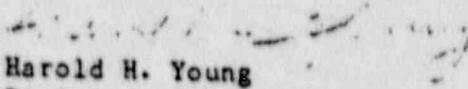
You are also reminded that technical assistance for safety documentation review and analysis is available through the RERTR program at the Argonne National Laboratory. Your proposal should be coordinated with and reflect the degree of support to be provided by RERTR/ANL.

We would like to receive your proposal by January 15, 1987. Please direct it to:

Mr. Richard E. Stephens, Director
Division of University and Industry Programs
Office of Field Operations Management
Office of Energy Research
U.S. Department of Energy
Washington, D.C. 20585

If you have any questions, please call me or Keith Brown on 301-353-3995.

Sincerely yours,


Harold H. Young
Division of University & Industry Programs
Office of Field Operations Management
Office of Energy Research

cc: R. Stephens, ER-44
A. Travelli, RERTR/ANL



Department of Energy
Oak Ridge Operations
Post Office Box E
Oak Ridge, Tennessee 37831

205 NOV 17 1987

MR

November 12, 1987

Mr. Dillard C. Marshall
Assistant Director
Office of Research Administration
University of Florida
Gainesville, FL 32611

Dear Mr. Marshall:

GRANT NO. DE-FG05-88ER75387 - AMENDMENT NO. A000

Enclosed are two copies of the subject grant document which have been signed on behalf of the Department of Energy.

If this document is satisfactory, please have the two enclosed copies signed by the proper official on behalf of your organization and return one fully executed copy to this office. The remaining fully executed copy is for your retention.

In addition, please have executed the enclosed Assurance of Compliance - Nondiscrimination in Federally Assisted Programs, and return the signed original to this office together with the executed copy of the grant and a completed Form DOE-538, Notice of Energy RD&D Project. Please return two copies of the DOE-538.

Sincerely,

Charles D. Crowe
Contracting Officer
Contract Management Branch
Procurement & Contracts Division

AD-423:Lyle

Enclosures:

1. Grant (2 cys.)
2. Assurance of Compliance
3. DOE 538 (3 cys)





Department of Energy

Oak Ridge Operations
Post Office Box E
Oak Ridge, Tennessee 37831

December 21, 1987

RECEIVED DEC 29 1987

Dr. William G. Vernetson
Director of Nuclear Facilities
College of Engineering
University of Florida
Gainesville, FL 32611

Dear Dr. Vernetson:

GRANT NO. DE-FG05-88ER75387 (REVISED PROJECT DESCRIPTION)

In response to telephone conversations with you and with Keith Brown at Argonne, enclosed is a revised project description for your grant from the Department of Energy to cover cost of the conversion from HEU to LEU fuel in University of Florida's training reactor. I apologize for the confusion and delay in this revision reaching you.

Please substitute the attached Part II, Project Description and Reporting Requirements, for the one transmitted to Dillard Marshall on November 12, 1987, and have Mr. Marshall sign the award and return an original to us as soon as possible. You will not be able to draw down any money from Letter of Credit on this award until the original copy is returned to us.

Thank you for calling our attention to the fact that your award is different from the other reactor fuel conversion awards the Department of Energy has.

Sincerely,

Martha A. Lyle

Martha A. Lyle
Contract Specialist
Contract Management Branch
Procurement and Contracts Division

AD-423:Lyle

Enclosure:
Part II of Grant DE-FG05-88ER75387

cc: Dillard C. Marshall, Asst. Dir.
Research Administration
University of Florida
223 Grinter Hall
Gainesville, FL 32611





Department of Energy

Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

December 19, 1989

205 DEC 20 '89

MR

Mr. Dillard C. Marshall
University of Florida
223 Grinter Hall
Gainesville, Florida 36211

SUBJECT: Grant No. DE-FG07-88ER75387

Dear Mr. Marshall:

We are enclosing three copies of the subject grant which have been signed on behalf of DOE. Please have all three copies signed by an authorized official and return two fully executed copies to this office within two weeks from the date of this letter. The third fully executed copy is for your retention.

Should you have any questions, please contact Ann Rydalch on (208) 526-9617.

Sincerely,

A handwritten signature in cursive script that reads "Trudy A. Thorne".

Trudy A. Thorne
Contract Specialist
Financial Assistance Branch

Enclosure

UNIVERSITY OF FLORIDA

GAINESVILLE, 32611



THE DIVISION OF SPONSORED RESEARCH
Office of the Vice President for Research

223 Grinter Hall
804/382-4808
804/382-1882

December 21, 1989

Ms. Trudy A. Thorne
Contract Specialist
Financial Assistance Branch
Department of Energy
Idaho Operations Office
785 DOE Place
Idaho Falls, Idaho 83402

RE: Grant No.: DE-FG07-88ER75387, Amendment #M002
Principal Investigator: Dr. William G. Vernetson

Dear Ms. Thorne:

Enclosed are two copies of the above referenced amendment which I have officially signed for the University of Florida.

If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

A handwritten signature in cursive script, reading "Dillard C. Marshall", followed by a horizontal line.

Dillard C. Marshall
Assistant Director of Research

DCM/mr

Enclosure

EFO

UNIVERSITY OF FLORIDA
OFFICIAL AWARD ACCEPTANCE

DATE PRINTED: 12/21/89

CERTIFICATION OF ACCEPTANCE (NOA) FOR THE PRESIDENT
OF THE UNIVERSITY OF FLORIDA, ACTING ON BEHALF OF
THE BOARD OF REGENTS

QUESTIONS - PLEASE CONTACT THE UF DIVISION
SPONSORED RESEARCH, AWARD ADMINISTRATION
205 GRINTER HALL, 392-1582

TITLE: PROPOSAL FOR GOV'T SUPPORT TO COVER COST OF UFTR CONVERSION
FROM HEN TO LEU FUEL

ADMINISTRATIVE DATA

UPN #: 87081002 RELATED UPN#: _____ AWARD DATE: 01/05/88
 AGENCY: U S DEPT OF ENERGY (F048) P.I.: VERNETSON W G
 VISION: _____ SSN: 216-44-9124
 AGENCY NO: DE-FG05-88ER75387 COLL: EIES - ENGINEERING
 TYPE: NEW (N) CONTINUATION (C) DEPT: NUCLEAR ENGINEERING SCIENCES
 RENEWAL (R) SUPPLEMENTAL (S) CO-PI: _____
 EXTENSION REVISED SSN: - -
 CATEGORY: RESEARCH (R) TRAINING (T) COLL: _____
 OTHER (O) DEPT: _____
 PROGRAM: CONTRACT (C) PUR. ORDER (P) HEGIS #: 210920
 COOP. AGREE (A) SPA (S) HUMAN SUBJECTS APPROVAL #: _____
 MEMO OF UND (M) GRANT (G) HS APPROVAL EXPIRES: _____
 IMP: GUARANTEED BY: _____ LAB ANIMAL APPROVAL #: _____
 RM: SUPERSEDES: _____ RECOMBINANT DNA/RNA: _____ BIOHAZARDS: _____
 BUDG BEG: 11/15/87 BUDG END: 04/30/91 PROPRIETARY/CONFIDENTIAL: _____
 PROJ BEG: 11/15/87 PROJ END: 04/30/91 SUBCONTRACTOR: UF: _____
 PROJECT PERIOD #: 87081002 PRIME NAME: _____
 FUNDS RESTRICTED YES NO NO: _____
 HISTORY UPN #: 87081002 FLA DEMO PROJ: N OTHER: _____

COST DATA

APPLICABLE INDIRECT COST WILL ACCRUE TO THE UNIT(S) AS SPECIFIED ON PROPOSAL

DUAL INVOLVEMENT: _____ IDC RETURN CODE: Y
 ON-CAMPUS OFF-CAMPUS
 ACCOUNT NO: 450812612 ACCOUNT NO: _____
 DIRECT AMOUNT: \$ NO COST EXT DIRECT AMOUNT: \$ _____
 INDIRECT AMOUNT: \$ -0- INDIRECT AMOUNT: \$ _____
 RATE 45.0% BASE MTD RATE _____ BASE _____
 TOTAL AMOUNT: \$ NO COST EXT TOTAL AMOUNT: \$ _____
 COST SHARING REQUIRED: \$ _____ COST SHARING REQUIRED: \$ _____
 TOTAL FUNDING OF THIS AWARD: \$ NO COST EXT
 TOTAL COST SHARING OF THIS AWARD: \$ _____
 UNRECOVERED INDIRECT COST: \$ _____
 CUMULATIVE PROJECT FUNDING: \$ 169,431.00
 CFDA #: _____

REMARKS

DEPT CONTACT: EIES
ADDRESS: _____

Dillard C. Marshall
 AUTHORIZED UNIVERSITY ACCEPTANCE SIGNATURE
 DIVISION OF SPONSORED RESEARCH
 NAME: DILLARD C. MARSHALL
 TITLE: ASSISTANT DIRECTOR OF RESEARCH