UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

JAN 30 2002

Purdue Research Foundation
ATTN: Thomas Wright
1063 Hovde Hall, Purdue University
West Lafayette, IN 47907-1063

Dear Mr. Wright:

SUBJECT: TASK ORDER NO. 16 ENTITLED "MOX NEUTRONICS" UNDER CONTRACT NO. NRC-04-97-046

In accordance with Section G.4, Task Order Procedures, of the subject contract, this letter definitizes Task Order No. 16. This effort shall be performed in accordance with the enclosed Statement of Work. The period of performance for Task Order No. 16 is February 1, 2002 through December 31, 2002. The total estimated cost for full performance of the basic task order is $173,000. Funds in the amount of $173,000 are hereby obligated for performance of this task order.

Accounting data for Task Order No. 16 is as follows:

B&R No.: 260-15-11-022-0
Job Code: Y-6336
BOC Code: 252A
RES ID: RES-C02-359
Appropriation No.: 31X0200
Obligated Amount This Action: $173,000

The following individuals are considered by the Government to be essential to the successful performance of the work hereunder:

[redacted]

The contractor agrees that such personnel shall not be removed from the effort under this task order without compliance with Contract Clause H.2-Key Personnel

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TEMPLATE-ADM 001

ADM 07

The issuance of this task order does not amend any terms or conditions of the subject contract.

Your contacts during the course of this task order are:

Technical Matters: James Han, Project Officer
(301) 415-6773

Contractual Matters: Stephen Pool, Contract Specialist
(301) 415-8168

Please indicate your acceptance of this task order by having an official, authorized to bind your organization, execute three copies of this document in the space provided and return two copies to the Contract Specialist. You should retain the third copy for your records.

Sincerely,

Stephen M. Pool, Contracting Officer
Division of Contracts and Property Management

Enclosure:
As stated

ACCEPTED: TASK ORDER NO. 16

NAME

FEB 6 2002
DATE

Eric E. Fulkerson
Sr. Contract Manager
TITLE

Statement of Work for Task Order #16, "MOX Neutronics," under Contract # NRC-04-97-046, "Thermal-Hydraulic Research"

I. Background

The NRC needs to modify and improve the computer codes for licensing analysis of light water reactor cores using mixed oxide (MOX) fuel. The PARCS code has been chosen as the agency's reactor kinetics code and is currently being maintained and updated at Purdue. However, the code was originally developed for uranium oxide fuel and needs to be modified in order to model MOX fuel. This task order will extend the PARCS capability to model the MOX reactor cores.

II. Objective

The objective of this task order is to develop modeling capability for PARCS to accurately predict the steady-state and transient behavior of the light water reactor core using MOX fuel.

III. Work Requirements (2/1/02 – ~~1/15/03~~ 12/31/02)

Six tasks will be performed.

Task 1. Multigroup/SP3 Code Verification

This task has two subtasks.

Subtask 1.1 Steady-State

The coding for the multigroup, SP3, pin by pin capability has been completed in PARCS. This task is to verify the coding for the steady-state by comparing code performance to analytic solutions for the steady-state.

Subtask 1.2 Transient

This task is to verify the coding for the transient by comparing code performance to analytic solutions for the transient without feedback.

Estimated Level of Effort: 2 staff-months
Estimated Completion Date: May 15, 2002

Task 2. MOX Benchmark Problem I: VENUS-II Critical Experiments

This task has two subtasks.

Subtask 2.1 HELIOS Solution

VENUS-II, which is a small experimental core, includes MOX fuel at the core periphery. As part of the code validation process, the VENUS-II experiment will be calculated with the PARCS code. First, a full core calculation will be performed with the HELIOS collision probability code to provide a reference solution. It is necessary to have a HELIOS solution in order to separate the error in the subsequent PARCS calculation that is attributable to basic cross section data.

Subtask 2.2 PARCS Solution

The VENUS-II critical experiment will then be calculated with the multigroup, pin by pin, SP3 capability in PARCS. Multigroup pin-by-pin cross sections will be generated from HELIOS, and the solution will be compared with both HELIOS and with the actual experimental data.

Estimated Level of Effort: 5 staff-months
Estimated Completion Date: June 15, 2002

Task 3. MOX Benchmark Problem II: OECD MOX REA TRANSIENT

This tasks has three subtasks.

Subtask 3.1 Specification Preparation

The OECD has given preliminary approval to a numerical benchmark to simulate the ejection of a control rod from a UO_2 and a MOX core. The proposed benchmark core is a 2D model of a reduced size LWR (5x5 fuel assemblies). The problem is reduced in size so that it is possible to perform an integral transport reference solution to attract maximum participation of OECD benchmark members. This task will be to prepare the specifications of the benchmark in accordance with OECD standards. This will include generation of all the cross sections with the HELIOS code.

Subtask 3.2 Transient Solutions with PARCS

This task performs the benchmark calculations with the PARCS code. This includes solutions using the standard 2-group homogenized diffusion methods, as well as the multigroup, SP3, pin by pin methods to be able to isolate accuracy effects for both the UO2 and the MOX cores.

Subtask 3.3 Analysis of Results

This task analyzes the results from participants and prepares reports on the benchmark.

Estimated Level of Effort: 6 staff-months
Estimated Completion Date: ~~January 15, 2003~~ 12/31/02

Task 4. MOX Benchmark Problem III: Full-Core, 3D LWR Analysis

The OECD Benchmark problem is a reduced size core and will provide important insight regarding neutronics methods of MOX fuel analysis. However, it is important to perform full-core, 3D analysis on a practical LWR problem similar to the proposed core for MOX fuel irradiation. This task initiates a full-core, 3D model for performing REA transient analysis.

Estimated Level of Effort: 1 staff-month
Estimated Completion Date: ~~January 15, 2003~~ 12/31/02

Task 5. Code Documentation and Staff Training

This task has four subtasks.

Subtask 5.1 Code Input Manual

The PARCS code input manual will be updated with detailed sample problems.

Subtask 5.2 Code Programmer's Manual

The modules and subroutines added to PARCS will be explained in detail in the programmer's manual.

Subtask 5.3 Code Theory Manual

The PARCS code theory manual will be updated with the methods developed for MOX core analysis.

Subtask 5.4 Staff Training

This task will cover the training required to support the NRC staff with the new PARCS functionality for MOX fuel analysis.

Estimated Level of Effort: 4.5 staff-months
Estimated Completion Date: ~~January 15, 2003~~ 12/31/02

Task 6. Provide Technical Support

This task provides technical support in terms of answering questions, attending meetings, making presentations, reviewing technical reports, and performing additional analysis and calculations as requested by the NRC Technical Monitor.

Estimated Level of Effort: 0.5 staff-month
Estimated Completion Date: ~~January 15, 2003~~ 12/31/02

IV. Monthly Progress Report

In addition to the deliverables listed above for each task, the contractor shall provide a monthly technical progress report by the 20th of the following month. The report summarizes activities of the month under this Task Order, which include the work performed during the period, milestone status, and anticipated and encountered problem areas.

V. Meetings and Travel

A one-day meetings is expected to take place at the NRC headquarters in Rockville, Maryland. The meeting will be attended by one or two persons from this Task Order. Additionally, the PI will attend the OECD WPPR Meeting in Paris, France from June 25-27 in order to present the OECD MOX Transient Benchmark. However, all travel will be approved in advance by the NRC Technical Monitor.