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

January 18, 2002

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

SUBJECT: MODIFICATION NO. 12 TO TASK ORDER NO. 2
UNDER CONTRACT NO. NRC-04-97-046

Dear Mr. Wright:

This letter confirms verbal authorization provided via e-mail on January 17, 2002, to commence work under the subject modification on January 16, 2002, with a temporary ceiling of $10,000.

This letter definitizes Modification No. 12 to Task Order No. 2. Accordingly, this task order modification shall be performed in accordance with the attached Statement of Work and in accordance with the contractor's technical proposal dated January 8, 2002. This modification increases the ceiling amount by $260,938 from $2,095,489 to $2,356,427 and the obligated amount by $180,000 from $1,804,216.60 to $1,984,216.60. The effective date of this modification is January 16, 2002. Accordingly, the task order is hereby modified as follows:

The total estimated cost for full performance of Task Order #2 is $2,356,427 with a period of performance of September 30, 1997 through November 30, 2002. Funds in the amount of $180,000 are being obligated for performance of this modification which hereby increases the obligated amount. The Contractor shall not incur costs for this task order which exceed the cumulative obligated amount of $1,984,216.60.

Accounting Data for Task Order No. 2, Modification No. 12, are as follows:

B&R No.:	26015110205
APPN No.:	31X0200.260
Job Code:	W6749
BOC:	252A
RES ID:	RES-C02-343
Obligated Amount of this Action:	$180,000

A summary of obligations under this task order, from the date of award through this modification are provided below:

Total FY 97 NRC Obligations:	$162,000
Total FY 98 NRC Obligations:	$300,012
Total FY 99 NRC Obligations:	$478,549.60
Total FY 00 NRC Obligations:	$457,382
Total FY 01 NRC Obligations:	$406,273
Total FY 02 NRC Obligations:	$180,000
Cumulative Obligations:	$1,984,216.60

JAN 22 2002

TEMPLATE-ADM001

ADM02

NRC-04-97-046
Task Order No. 2
Modification No. 12

This modification obligates FY 02 funds in the amount of $180,000

All other terms and conditions remain unchanged.

Please indicate your acceptance of this task order modification by having an official, authorized to bind your organization, execute three(3) copies of this document in the space provided and return two(2) copies to Deborah Neff, Contract Specialist, at the address listed below. You should retain the third copy for your records.

U.S. Nuclear Regulatory Commission
Division of Contracts & Property Management
Mail Stop T-7-I-2
Washington, DC 20555

If you have any questions concerning this action, please contact Ms. Neff at 301-415-8160.

Sincerely,

for Mary H. Mace, Contracting Officer
Contract Management Branch No. 1
Division of Contracts & Property Management
Office of Administration

Enclosure:
As stated

ACCEPTANCE:

Name

Eric E. Fulkerson
Sr. Contract Manager
Title

JAN 24 2002
Date

Modification (No.12) to the Statement of Work of Task Order #2, "Modularization of TRAC-P," under Contract # NRC-04-97-046 and Job Code W6749, "Thermal-Hydraulic Research"

Additional Work Requirements (1/16/02 - 11/30/02)

Revise Tasks 5, 12, 16, and 24.

Task 5. Provide Technical Assistance

This task provides technical assistance to NRC. Examples include technical presentations and tutorial session on the TRAC-M code, conference calls, meetings, and written correspondence to help the NRC staff gain adequate expertise to perform code development and maintenance functions.

Estimated Level of Effort: 2 staff-months (funded by carryover)
Estimated Completion Date: November 30, 2002 (new date)

Task 12. Development Error Resolution

Under Task 2, the solution procedure as well as the component communication has been revamped in a more modularized and parallelized manner. During these drastic modifications, a number of long standing code bugs were located and corrected. It is highly probable that some others were introduced in these tasks and a number of other long standing bugs exist in areas not touched by this effort. Given the high level of testing thus far, these two classes of bugs can be expected to be relatively subtle, and careful interpretation of final test results will be necessary to locate and correct such bugs. In addition, the final round of testing can be expected to reveal various modeling deficiencies and coding inefficiencies that should be corrected before final release. Task 12 is dedicated to the detection and resolution of these problems. Submit resolution reports and code modifications to the NRC configuration control as per the currently invoked procedures.

Deliverables: patch files for code modifications, resolution reports, and test plan and results.

Estimated Level of Effort: 2 staff-months (funded by carryover)
Estimated Completion Date: November 30, 2002 (new date)

Task 16. Higher Order Numerical Methods

Incorporation of the External Component has facilitated coupling the consolidated code to other tools, such as CFD codes. CFD codes utilize higher-order differencing schemes, whereas the consolidated code is limited to a first-order technique. Unfortunately, when coupling two different order numerical schemes, numerically-induced bifurcations may be generated at the location of the coupling if strong gradients are present. Therefore, it may be necessary to incorporate higher-order numerics into the consolidated code.

First-order differencing limits the ability of the code to preserve gradients in physical properties, such as boron concentration and thermal and density fronts. A second-order method would

ameliorate this limitation and improve the code's prediction of boron concentration and physical properties (such as density and temperature) that influence the core power predicted by a coupled kinetics code. These gradients also influence instability predictions, and a less numerically diffusive scheme would improve the code's ability to model these transients. Instability calculations are now performed only with the semi-implicit method, due to the high diffusion of the SETS scheme. However, SETS allows the code to run at larger time steps. It may be possible to run stability cases with SETS if a higher order scheme were used. This would result in a faster running code and would allow the semi-implicit option to be removed from the code, which would reduce the maintenance effort. (Note that RELAP5 currently has a method to sharpen the thermal gradient. This would not be needed if a higher order differencing scheme were implemented, thereby facilitating the RELAP5 consolidation.)

In order to efficiently couple the TRAC code to a CFD code and to minimize numerical diffusion to better represent gradients in physical properties, higher-order numerics should be incorporated into TRAC. This work has been facilitated by the modularization of the hydraulic component to hydraulic component communication in the code as well as the modularization of the solution procedure. Before the optimal means of providing this capability is determined, a pilot study of various approaches should be done so that final incorporation into TRAC is done efficiently and the run-time is not dramatically hindered.

TRAC code will be stripped down to minimize its complexity, leaving just the minimal coding required to run SETS and SEMI-IMPLICIT schemes for a network consisting of both one-dimensional and three-dimensional components. The numerical scheme will be modified to provide a second-order differencing technique, while leaving the first order technique in place. This approach will provide the ability to judge the benefit and detriment of the higher-order technique. Factors should include numerical diffusion, run-time, and numerical stability. Test cases should be devised to test these factors and should be run with both schemes to determine the most advantageous differencing method. Implementation is also a concern and the code architecture should also be studied and discussed to ensure that when incorporated into TRAC, the coding is readable and extendable. Provide a letter report to NRC to summarize the results of this study. All coding must be done in F90 and should be portable across all NRC platforms (SUN, SGI, HP, DEC Alpha, Windows NT, IBM AIX).

Deliverables: a letter report in both text and electronic format, and the pilot code developed during this study in electronic format.

Estimated Level of Effort: 8 staff-months (for this performance period)
Estimated Completion Date: November 30, 2002 (new date)

Task 24. Robustness

The root cause of cases where decks fail to converge shall be determined and the code shall be modified to enhance robustness.

Deliverables: coding and documentation as per the NRC SQA plan

Estimated Level of Effort: 4 staff-months
Estimated completion date: November 30, 2002 (new date)

Meetings and Travel:

The contractor will attend four meetings at the NRC office in Rockville, Maryland. For planning purpose, each meeting will involve one person and last for two days. Also for planning purpose, the contractor will attend an international meeting involving one person, and present a paper at one technical society meeting. However, any travel must be approved in advance by the NRC Technical Monitor.