



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

JUL 18 2003

Information Systems Laboratories, Inc.
ATTN: James Meyer
11140 Rockville Pike, Suite 500
Rockville, MD 20852

SUBJECT: TASK ORDER NO. 10 ENTITLED, "ACR-700 INPUT MODEL DEVELOPMENT"
UNDER CONTRACT NO. NRC-04-02-054

Dear Mr. Meyer:

This letter definitizes Task Order No. 10 in accordance with the enclosed statement of work. The period of performance for Task Order No. 10 is July 17, 2003 through September 30, 2005. The task order estimated cost and fixed fee is set forth as follows: Estimated Costs:\$690,458 Fixed Fee:\$53,055 CPFF Total:\$743,513. \$320,000 in funds is hereby allotted to this task order of which \$297,165 is for the estimated cost and \$22,835 is for fixed fee. The accounting data for this task order is set forth as follows: RES ID: RES-C03-059 APPN: 31X0200 B&R:36015115107 JCN:Y6812 BOC: 252A Amount Obligated This Action:\$320,000.

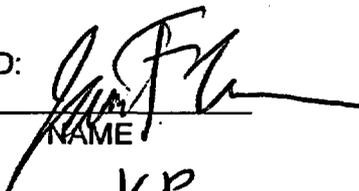
Please indicate your acceptance of Task Order No.10 by having an official authorized to bind your organization execute three copies of this document, by signing in the space provided, and return two copies to me. You should retain the third copy for your records. All other terms and conditions of this task order remain unchanged.

Should you have any questions, regarding this task order, please contact me on (301) 415-8168.

Sincerely,


Stephen M. Pool, Contracting Officer
Division of Contracts
Office of Administration

ACCEPTED:



NAME
VP

TITLE
7/21/03

DATE

see SOW, page 2



STATEMENT OF WORK

NRC-04-02-054 TASK ORDER 10

TITLE: ACR-700 INPUT MODEL DEVELOPMENT

I. BACKGROUND

As part of the review for ACR-700, the NRC staff is evaluating the applicability of the computer codes that will be used to perform transient and accident evaluation for the plant. These codes have been developed in Canada and have been used to evaluate CANDU type reactors for many years. The ACR-700 is a new design and will require new safety analyses as part of the design certification process. The NRC staff will need independent audit capability to evaluate the results predicted by AECL Technologies Inc. which is the applicant for ACR-700. Special component models developed in South Korea have been added to the RELAP5 computer code for analysis of CANDU type reactors which should enable the code to model the ACR-700 design.

The transient and accident analysis of older CANDU designs has involved simultaneous evaluation of the thermal/hydraulic condition within the reactor system with a three dimensional analysis of the reactor power. This is required because of the positive reactivity feedback from the heavy water coolant. ACR-700 is expected to have negative reactivity feedback from the coolant which will be ordinary water. Because of the negative reactivity coefficient, three dimensional analyses of reactor power may not be as important for ACR-700 as for older CANDU designs. The staff needs to maintain three dimensional capability however, for audit purposes. For this reason the RELAP5 model for ACR-700 should have capability to interface with PARCS which is the NRC's three dimensional reactor power computer code. Development of the PARCS model and verification of the RELAP5 models developed by South Korea will be part of a Users Need request to the NRC Office of Research.

II. OBJECTIVES OF PROPOSED WORK

A primary objective is to develop RELAP5 and TRAC-M input models for ACR-700. A secondary objective is to analyze thermal hydraulic transients and breaks in the ACR 700 to support the ACR 700 design certification process. A third objective is to develop input models for TRAC-M for two test facilities.

The TRAC-M input deck development will also support the TRAC-M development for applicability and assessment for ACR applications. The RELAP input model will be used by NRR in the evaluation of the applicant's computer codes used for Chapter 15 transient and accident analyses. The contractor will compare sample RELAP5 results to those of the applicant and provide the NRC staff with insights for judging the significance of code differences.

The input models will be compatible with a PARCS code model of the reactor core for ACR-700.

III. SCOPE OF WORK

Task 1. TRAC and RELAP5 Input Model Development

Develop TRAC-M and RELAP5 input describing ACR-700. Work on input models for TRAC and RELAP will occur in parallel in a way to minimize unnecessary inefficiencies. This input should be suitable for analysis of loss of coolant accidents and design basis transients including main steam line break and steam generator tube rupture. Interface to the PARCS three dimensional reactor power computer code will be included in addition to the point kinetics option. Acquire all information (drawings, design description, CATHENA input deck and notebook, etc) necessary and compile information necessary to model ACR-700. Include information necessary to model the reactor coolant system, steam generators, moderator system and engineered safety features. Information needed to model the reactor protection and engineered safety features actuation and control logic should also be included. Provide lists of information requirements to the Technical Monitor for transmittal to AECL Technologies Inc.

Estimated Completion Date: March 31, 2004
Estimated Level of Effort: 11 staff months

Task 2. Application of PARCS to ACR-700

Investigate the applicability of PARCS code to ACR-700, and implement any revision necessary to assure that PARCS can be used for ACR-700 applications.

Estimated Completion Date: March 31, 2004
Estimated Level of Effort: 1 staff month

Task 3. Nodalization Studies and Attainment of Steady State Condition

Perform nodalization studies to determine the model requirements necessary for the arrangement of the several hundred feeder pipes and fuel channels. Explore different grouping of channels in the horizontal and vertical planes. Explore the number of axial nodes per channel necessary to properly represent flow and heat transfer, particularly with respect to heat transfer in individual channels. Select the most appropriate nodalization and implement it into both input decks.

Steady state both plant input decks. The input will be demonstrated to hold steady state for the reactor at full power by running to 1000 seconds in the transient mode.

Estimated Completion Date: April 30, 2003 
Estimated Level of Effort: 2 staff months

Task 4. Experimental Facility Input Model Development

Prepare TRAC-M input models for the Cold Water Injection Facility and the RD-14M integral test facility. Acquire all information (drawings, design description, CATHENA input deck and notebook, etc) necessary and compile information necessary to model the two facilities. These facilities will be used to assess TRAC-M for LOCA, natural circulation, and loop flow stability. The assessments to be performed will be defined at a later date in a subsequent modification.

Estimated Completion Date: July 31, 2004
Estimated Level of Effort: 8 staff months

Task 5. Analysis and Evaluation

For each of both TRAC-M and RELAP5 codes, prepare an analysis of a header break loss of coolant accident, a feeder line break loss of coolant accident, and an anticipated transient. Compare these results to those of AECL Technology Inc. Evaluate differences and the causes of the differences. The exact analyses to be performed will be specified by the technical monitor later.

Estimated Completion Date: July 31, 2004
Estimated Level of Effort: 9 staff-months

Task 6. On-Call Assistance

On-Call assistance represents a continuing effort. Some example areas where technical assistance may be needed: (a) Assistance to NRC in formulating the development plan for future code versions, (b) Interactions with code users, (c) Participation in the annual Nuclear Safety Research Conference, and (d) Participation in ANS 5.4 meetings and activities.

Estimated Completion Date: September 30, 2005
Estimated Level of Effort: 3 staff-months

IV. REPORTING REQUIREMENTS

1. Notebooks used for developing TRAC-M and RELAP5 input decks for ACR-700 reactor calculations shall be submitted to the NRC.
2. A letter report shall be submitted to describe the work performed to assure that the PARCS code is applicable to the ACR-700 reactor.
3. A letter report shall be submitted to describe nodalization studies performed to arrive at the most optimum nodalization scheme for both TRAC-M and RELAP5 decks.
4. Notebooks used for developing TRAC-M input decks for two experimental facilities mentioned above shall be submitted to the NRC.
5. A letter report shall be submitted to describe the work performed to investigate selected accident scenarios in comparison with AECL results.

PUBLICATIONS NOTE

NRC encourages the publication of the scientific results from NRC-sponsored programs in refereed scientific and engineering journals as appropriate. If the contractor proposes to publish in the open literature or present the information at a meeting in addition to submitting the required technical reports, approval of the proposed paper or presentation should be obtained from the NRC Project Manager prior to expending effort on the writing of the paper or presentation. When the writing is completed, the NRC Project Manager shall either approve the material as submitted, approve it subject to NRC-suggested revisions, or disapprove it. In any event, the NRC Project Manager may disapprove or delay publication or presentation of papers on information that is subject to Commission approval that has not been ruled upon or which has been disapproved. Additional information regarding the publication of NRC

sponsored research is contained in NRC Management Directives 3.8, "Unclassified Contractor and Grantee Publications in the NUREG Series," and 3.9, "NRC Staff and Contractor Speeches, Papers, and Journal Articles on Regulatory and Technical Subjects."

If the paper or presentation is in addition to the required technical reports and the NRC Project Manager determines that it will benefit the NRC project, the Project Manager may authorize payment of publishing and/or travel costs, if any, from the project funds. If the Project Manager determines that the paper or presentation would not benefit the NRC project, the costs associated with the publication or presentation will be borne by the contractor. For any publications or presentations falling into this category, the NRC reserves the right to require that such publication or presentation will not identify the NRC's sponsorship of the work.

V. Deliverables and Delivery Schedule

1. A forecast milestone chart is required within 3 months after contract award.
2. Input decks and accompanying notebooks for the input models under task 1 should be submitted by May 31, 2004.
3. Letter reports describing the work performed under tasks 2 and 3 should be submitted by May 31, 2004.
4. Input decks and accompanying notebooks for the input models under task 4 should be submitted by August 31, 2004.
5. Letter reports describing the work performed under task 5 should be submitted by August 31, 2004.
6. A Monthly Letter Status Report is to be submitted to the NRC Project Manager by the 20th of the month with copies provided to the following:

Office of Nuclear Regulatory Research Project Manager and Technical Monitor

Office of Nuclear Reactor Regulation staff (Walton Jensen)

Division of Contracts and Property Management, Office of Administration (Mail Stop T-712)

The Monthly Letter Status Report will identify the title of the project, the job code, the Principal Investigator, the period of performance, the reporting period, summarize each month's technical progress, list monthly spending, total spending to date, and the remaining funds. Any administrative or technical difficulties which may affect the schedule or costs of the project shall be immediately brought to the attention of the NRC project manager.

Note: (1) NRC has implemented a new document management system, Agencywide Documents Access and Management System (ADAMS). For the present, contractors' mail will not be placed in ADAMS. All documents mailed to NRC (e.g., letters, technical reports, monthly letter reports, and other mail) should have "Addressee Only" on the envelope to keep it from being entered into ADAMS. Send mail for the addressee and cc's as separate mailings.

(2) NEW STANDARDS FOR CONTRACTORS WHO PREPARE NUREG-SERIES MANUSCRIPTS

The U.S. Nuclear Regulatory Commission (NRC) is capturing its official records electronically. These records will be saved electronically in the Agency-wide Documents Access and Management System, known as ADAMS. The NRC is currently scanning each final NUREG-series publication from the printed copy. Therefore, submit your final manuscript that has been approved by your NRC Project Manager in both electronic and camera-ready copy.

All format guidance, as specified in NUREG-0650, Revision 2, will remain the same with one exception. You will no longer be required to include the NUREG-series report number (designator) on the bottom of each page of the manuscript. The NRC will assign this designator when we send the camera-ready copy to the printer and will place the designator on the cover, title page, and spine. The NRC project manager will forward a copy of the cover and title page so the contractor can prepare an image file to include in the electronic manuscript. For the electronic manuscript, convert the file to Portable Document Format (pdf).

VI. MEETINGS AND TRAVEL REQUIREMENTS

Two two-day trips to Canada by ISL staff to gather information. Other travels may be considered if needed, but must be approved by the NRC Project Manager. Foreign travel must be approved by processing NRC Form 445, in addition to being provided as part of the approved proposal.

X. QUALITY ASSURANCE

Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554) directs the Office of Management and Budget (OMB) to issue government-wide guidelines (FR Vol. 67, No. 36, pp. 8452-8460) that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies." NRC Information Quality Guidelines are provided in FR Vol. 67, No. 190, pp. 61695-61699.

The Contractor shall cite contractor quality assurance procedures used in the conduct of this work that provide for compliance with OMB and NRC guidelines.

XI. NRC-FURNISHED MATERIAL

Proprietary CATHENA input deck(s), if and when available, and reports, some of which may be proprietary, will be provided to the ISL, Inc by the NRC. At this time, the dates on which this material will be provided are not known.