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UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

SEP 12 1994

Concord Associates, Inc.
ATTN: Paul M. Haas, President
725 Pellissippi Parkway, Suite 101
Knoxville, TN 37932

Dear Mr. Haas:

Subject: Contract No. NRC-04-91-069, Task Order No. 39 Entitled,
"Individual Plant Examination (IPE) Reviews, Internal Events,
Human Factors Only" (River Bend)

In accordance with Section G.5, Task Order Procedures, of the subject contract, this letter definitizes Task Order No. 39. This effort shall be performed in accordance with the enclosed Statement of Work.

Task Order No. 39 shall be in effect from September 16, 1994 through September 15, 1995 with a total cost ceiling of \$17,056.00. The amount of \$15,940.00 represents the total estimated reimbursable costs and the amount of \$1,116.00 represents the fixed fee.

The obligated amount of this task order is \$17,056.00.

Accounting Data for Task Order No. 39 is as follows:

APPN No.: 31X0200.460
B&R No.: 46019202300
JOB CODE: L1934
BOC No.: 252A
Obligated Amount: \$17,056.00
RES Identifier: RES-C94-203

The following individuals are considered to be essential to the successful performance for work hereunder: Dr. Paul Haas, Philip J. Swanson, and Dr. Michele Teranova.

The Contractor agrees that such personnel shall not be removed from the effort under the task order without compliance with Contract Clause H.1, Key Personnel.

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: Erasmia Lois, Project Officer
(301) 415-6560

Contractual Matters: Paulette Smith, Contract Administrator
(301) 415-6594

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Please indicate your acceptance of this task Order No. 39 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 above Contract Administrator. You should retain the third copy for your records.

If you have any questions regarding this matter, please contact Paulette Smith, Contract Specialist, on (301) 415-6594.

Sincerely,

Mary Mace
Mary Mace, Contracting Officer
Technical Acquisition Branch No. 1
Division of Contracts and
Property Management
Office of Administration

Enclosure:
Statement of Work

ACCEPTED: *Paul M. Haas*

Paul M. Haas
NAME

President
TITLE

9/20/94
DATE

Contract NRC-04-91-069
Concord Associates, Inc.

STATEMENT OF WORK
Task Order - 39

TITLE: Individual Plant Examination (IPE) Reviews,
Internal Events Human Reliability Analysis Only
(River Bend)

DOCKET NUMBER: 50-458

NRC PROJECT MANAGER: Erasmia Lois, RES (301-415-6560)

NRC TEAM LEADER FOR RIVER BEND: Erasmia Lois, RES
(301-415-6560)

TECHNICAL MONITOR: Erasmia Lois, RES (301-415-6560)

PERIOD OF PERFORMANCE: one year

BACKGROUND:

On November 23, 1988, the NRC issued Generic Letter 88-20, "Individual Plant Examination," which stated that licensees of existing plants should perform a systematic examination (IPE) to identify any plant-specific vulnerabilities to severe accidents, and to report the results to the Commission. The purpose of the IPE is to have each utility (1) develop an overall appreciation of severe accident behavior; (2) understand the most likely severe accident sequences at its plant; (3) gain a quantitative understanding of the overall probability of core damage and radioactive material releases; and (4) reduce the overall probability of core damage and radioactive releases by modifying procedures and hardware to prevent or mitigate severe accidents. All IPE submittals will be reviewed by the NRC staff to determine if licensees met the intent of Generic Letter 88-20.

OBJECTIVE:

The purpose of this contract is to solicit contractor support in order to enhance the NRC review of licensees' IPE submittals. This contract includes the examination and evaluation of the River Bend IPE submittal, specifically with regard to the human reliability analysis. The contractor review will be of limited scope and consist of a "submittal only" review and the licensee's response to questions raised by the staff. The "submittal only" review and gathering of associated insights will help the NRC staff determine whether the licensee's IPE process met the intent of Generic Letter 88-20, or whether a more detailed review is warranted.

By identifying the IPE's strengths and weaknesses, extracting important insights and findings, and providing a comparison to staff reviewed and accepted PSAs (e.g. NUREG-1150, PSAs identified in NUREG-1335 Appendix B), it is expected that the NRC will be in a better position to expeditiously evaluate the licensee's IPE process. To provide support under this contract, the contractor will search for obvious errors, omissions and inconsistencies in the IPE submittal and the licensee's response to a "Request for Additional Information," (RAI) as described in the work requirements listed below.

WORK REQUIREMENTS AND SCHEDULE:

The contractor will perform a "submittal only" review of the River Bend human reliability analysis. The contractor shall provide the qualified specialists and the necessary facilities, materials, and services to carry out such a review. The contractor will utilize NRC review guidance documents for detail and reference, as well as other interim guidance provided by the NRC Technical Monitor. The contractor is not expected to make a plant/site visit in order to perform this review.

Subtask 1. Review and Identification of IPE Insights

Perform a "submittal only" review of human reliability analysis and identify important IPE insights by completing the NRC IPE Data Summary Sheets. During the review, focus on the areas described below under "Work Requirement." The contractor will note any: (1) inconsistencies between methodology employed in the IPE submittals and other PSA studies, and (2) inconsistencies between the submittal's IPE findings and findings stemming from other PSAs (See NUREG-1335, Appendix B). Respond explicitly to each work requirement by appropriately characterizing any shortcomings with respect to the impact on IPE conclusions. Identify and provide a justification for a Request for Additional Information (RAI).

Work Requirement 1.1.

Perform a General Review of the Human Reliability Analysis

Check the following:

- 1.1.1 The contractor should determine that utility personnel were involved in the development and application of PRA techniques to their facility, and that the associated walkdowns and documentation reviews constituted a viable process for confirming that the IPE represents the as-built and as-operated plant.
- 1.1.2 The contractor should determine that the licensee performed an in-house peer review that provides some assurance that the IPE analytic techniques had been correctly applied and documentation is accurate.
- 1.1.3 The contractor should determine that the HRA allowed the licensee to develop a quantitative understanding of the contribution of

human errors to core damage frequency and containment failure probabilities.

Work Requirement 1.2.

Pre-Initiator Human Events

Check the following:

- 1.2.1 The contractor should determine that the licensee's process considered pre-initiator human events, i.e., human events associated with tasks performed during routine operations which can disable a system, and therefore, involve either miscalibration of system logic instrumentation or failure to restore a system or component after test or maintenance.
- 1.2.2 The contractor should confirm that the process utilized by the licensee to identify and select the pre-initiator human events included the following:
- Maintenance, test and calibration procedures for the systems and components modeled were reviewed by the systems analyst.
 - Discussions were held with appropriate plant personnel (e.g., maintenance, training, operations) on the interpretation and implementation of the plant's test, maintenance and calibration procedures to identify and understand the specific actions and the specific components manipulated when performing the maintenance, test or calibration task.
- 1.2.3 The contractor should determine that the licensee's screening process (if one was used) verified that the potential likelihood of pre-initiator human events is negligible relative to other human events (i.e., negligible probability to contribute to core damage). A generic screening basic human error probability (BHEP) value of $3E-2$ (based on THERP) for pre-initiator human events will generally assure that significant human events were not eliminated, or that significant accident sequences were not truncated.
- 1.2.4 The contractor should determine that the screening process included the following:
- Plant procedures were reviewed.
 - Discussions were held with plant personnel on interpretation and actual performance of required tasks.
 - The potential contribution (to the core damage frequency) of the human event eliminated was negligible.

1.2.5

The contractor should determine that the licensee's pre-initiator data considered plant-specific factors and dependencies. The contractor should determine that the plant-specific factors addressed (but not limited to) the following:

- A lower adjustment of a generic BHEP to represent the specific plant is appropriately justified by examination of procedures, interviews with training, operations and various crews, physical observations of components, walkthroughs of procedures, and evaluation of administrative controls such as tagging or independent written verification.
- Plant-specific recovery credit is identified; "recovery factors" can include post-maintenance or post-calibration tests or independent written checks, or periodic written checks performed per shift.
- Any applied recovery factors are appropriately justified; that is, the recovery action would indeed discover the error.

1.2.6

The contractor should determine that the licensee appropriately addressed the effects of dependencies on pre-initiator human events by considering the following:

- Plant conditions (e.g., poor lighting).
- Human engineering (e.g., labels, accessibility etc.).
- Performance by same crew, same time.
- Adequacy of training.
- Adequacy of procedures.
- Interviews with training, operations and various crews.

Work Requirement 1.3.

Post-Initiator Human Events

Check the following:

1.3.1

The contractor should determine that the licensee's process considered human events that are needed to prevent an accident as well as to mitigate the consequences of an accident. These events should, therefore, involve failure to properly respond to an event by either not performing the required activities as directed by the plant's procedures (e.g., EOPs), or not recognizing the critical faults and taking proper action. Two types of post-initiator human events that can be evaluated include the following:

- Response type actions include those human actions performed in response to the first level directive of the EOPs. For example, suppose the EOP directive instructs the operator to determine reactor water level status, and another directive instructs the operator to maintain reactor water level with system x. These actions - reading instrumentation to

determine level and actuating system x to maintain level - are response type actions.

- Recovery type actions include those performed to recover a specific failure or fault. For example, suppose system x failed to function and the operator attempts to recover it. This action- diagnosing the failure and then deciding on a course of action to "recover" the failed system-is a recovery type action.

1.3.2 The contractor should determine that the process used by the licensee to identify and select the post-initiator human events included (but not limited to) the following:

- Plant procedures (e.g., emergency operating procedures, system instructions, off-normal (or abnormal) event procedures) associated with the accident sequences delineated and the systems modeled were reviewed.
- Discussions were held with appropriate plant personnel (e.g., operators, shift supervisors, training, operations) on the interpretation and implementation of plant procedures to identify and understand the specific actions and the specific components manipulated when responding to the accident sequences modeled.

1.3.3 The contractor should determine that the licensee's screening process (if one was used) verified that the potential likelihood of post-initiator human events is negligible relative to other human events (i.e., negligible probability to contribute to core damage). A generic screening BHEP value of 0.5 for post-initiator human events will generally assure that significant human events were not eliminated, or that significant accident sequences were not truncated.

1.3.4 The contractor should determine that the screening process included the following:

- Plant procedures were reviewed.
- Discussions were held with plant personnel on interpretation and actual performance of required tasks.
- The potential contribution (to the core damage frequency) of the human event eliminated was negligible.

1.3.5 In reviewing the licensee's treatment of time during the quantification of post-initiator human events, the contractor

should determine that the licensee appropriately considered both the time available and the time required. The process used by the licensee to determine the time available to the operator should include one of the following:

- Plant-specific calculations of the specific or similar accident sequences.
- Reference calculations performed in other studies for similar plant and accident sequence.

1.3.6 The contractor should determine that the process used by the licensee to determine the time required by the operator to perform the needed action during a post-initiator human event (may include "diagnosis" time) is based on the following:

- Actual time measurements from operator "simulations" for each action. Time should not be based on operator interviews alone unless justification can be provided that all activities associated with the action have been properly considered (e.g., travel time, performance time). Simulations can include in-plant walkthroughs performed with the operator or, for the actions that take place in the control room, simulator observations. Time considerations should take into account time needed to perform preceding actions.

1.3.7 During the quantification of post-initiator human events, the contractor should determine that the plant-specific factors addressed (but not limited to) the following:

- Instrumentation (e.g., indications of parameter status such as reactor water level).
- Annunciators and alarms (e.g., cues)
- Procedures (e.g., type and location).
- Training (e.g., scenarios, frequency).
- Human Engineering (e.g., layout, accessibility of manipulated component).
- Staffing (e.g., minimum number in control room and responsibility).
- Communication between control room staff.
- Standards, policies and administrative controls.

1.3.8 The contractor should determine that the licensee appropriately accounted for dependencies in the quantification of the post-initiator human events by consideration of the following:

- Post-initiator human events can be modeled in the fault trees as basic events such as failure to manually actuate a system. The probability that the operator performs this function is dependent on the accident in progression (e.g., what symptoms are occurring, what other activities are being

successfully and unsuccessfully performed). When this basic event (i.e., failure to manually actuate the system) is modeled in the fault trees and the sequences are quantified, this basic event can appear, not only in different sequences, but in different combinations with different systems failures. In addition, the basic event can potentially be multiplied by other human events when the sequences are quantified, resulting in artificially low calculated human error contributions if dependencies are not taken into account.

- Post-initiator human events can also be modeled in the event trees as top events. The probability that the operator performs this function can still be dependent on the accident progression. The quantification of the human events needs to consider the performance shaping factors associated with each different sequence and the dependencies between human events.

Work Requirement 2.0.

Complete Data Sheets

- A. Summarize data on the Consolidated Data Summary Sheet as described below and note lack of information, as appropriate.

CONSOLIDATED DATA SUMMARY SHEET
(INTERNAL EVENTS)

- o Major operator action failures (contribution to CDF):
- o Significant PRA findings:
- o Enhanced procedures and operator actions (implemented after 1988 PRA):
- o Potential operational improvements (excludes hardware) under consideration and not modeled:

Subtask 2. Prepare Preliminary Technical Evaluation Report

Prepare a preliminary Technical Evaluation Report with the outline prescribed below.

I. Executive Summary

Provide a brief overview of the IPE review, the scope and depth as appropriate. Place emphasis on review areas identified as being important and rationale for importance, i.e., found to be important in other PSAs of similar design. Discuss any important or unique plant characteristics. Note plants with similar features and any important insights stemming from other relevant PSA studies.

II. Contractor Review Findings

Explicitly address each work requirement element listed above under Subtask 1, "Review and Identification of IPE Insights." Discuss any strength or weakness so identified and significance with respect to the overall IPE effort. Identify any additional information (in the form of questions back to the licensee) which would be important to the review effort. List these questions separately in an appendix. Indicate why the information is important for closure.

III. Overall Evaluation, Conclusion and Insights

Summarize the "submittal only" review conclusions based on the information submitted and significance of IPE strengths and weaknesses. Characterize important IPE findings and insights, including any significant plant operational characteristics (human actions) or analytic assumptions that impact insights. Describe and characterize any significant (human related) enhancements implemented by the licensee, specifically in response to important insights which stem from the IPE process. Identify any licensee commitments (e.g., training, procedural changes), and characterize the impact on IPE conclusions. Also identify and characterize any potential improvements not forthcoming but perceived to be significant.

IV. IPE Evaluation and Data Summary Sheets

Attach: (a) Consolidated Data Summary Sheets using the above outline, and (b) the NRC IPE data sheets.

Appendix: Questions and Comments

Provide all questions and comments which are to be discussed with the licensee. Provide rationale for comments, especially when seeking additional information.

Subtask 3. Prepare Final Technical Evaluation Report

Review the licensee's response to staff questions and comments. Update the preliminary TER developed under Subtask 2, as appropriate, based on the additional information received from the licensee. Emphasis should be placed on review areas identified under Subtask 2. Provide rationale as appropriate to support the need for any additional follow-on studies or recommendations.

Note: The contractor should be prepared to participate in telephone communications with the licensee and/or discussions with NRC review team members regarding the licensee's responses to questions and issues stemming from the preliminary TER.

REPORT REQUIREMENTS:

Technical Reports

The contractor will submit to the NRC Technical Monitor four copies of the Preliminary Technical Evaluation Report (TER) on January 30, 1995. Copies will include three hard copies and one 3.5" computer diskette version (Wordperfect 5.1 or other IBM PC compatible software acceptable to the NRC IPE Team Leader). The Preliminary TER shall summarize all findings, results, and conclusions in the areas examined in the format described under Subtask 2. If the contractor finds that the licensee's IPE is obviously deficient in any of the areas examined, the Technical Monitor should be notified in advance. Deficient or weak areas should be clearly documented in the Technical Evaluation Report. In addition, if the contractor finds that there are specific areas that need additional in-depth review, the Team Leader should be notified of the areas, and provided with the rationale for subsequent review.

The contractor will submit to the NRC Technical Monitor three copies of the Final Technical Evaluation Report (TER) two weeks after the receipt of the licensee's response to staff questions and comments. Copies will include two hard copies and one 3.5" computer diskette version (Wordperfect 5.1 or other IBM PC compatible software acceptable to the NRC IPE Team Leader). The Final TER shall update all findings, results, and conclusions in the areas examined in the format described under Subtask 2 as appropriate.

BUSINESS LETTER REPORT:

The contractor shall provide monthly progress reports in accordance with the requirements of the basic contract.

MEETINGS AND TRAVEL:

One, one person trip to NRC Headquarters to present and discuss review findings and conclusions.

ESTIMATED LEVEL OF EFFORT:

For each IPE reviewed:

Subtask 1	80 contractor hours
Subtask 2	80 contractor hours
Subtask 3	16 contractor hours

It shall be the responsibility of the contractor to assign technical staff, employees, and subcontractors who have the required educational background, experience, or combination thereof, to meet both the technical and regulatory objectives of the work specified in this SOW. The NRC will rely on representation made by the contractor concerning the qualifications of the personnel proposed for assignment to this task order including assurance that

all information contained in the technical and cost proposals, including resumes and conflict of interest disclosures, is accurate and truthful.

NRC FURNISHED MATERIAL:

1. Licensee's IPE submittal.
2. Licensee's response to staff generated questions and associated information.

TECHNICAL DIRECTION:

The NRC Project Manager is:

Erasmia Lois
Severe Accident Issues Branch
Division of Safety Issue Resolution
U.S. NRC, Mail Stop T-10F-13
Washington, D.C. 20555
Telephone No. (301) FTS-415-6560