

AWARD/CONTRACT		1. THIS CONTRACT IS RATED ORDER UNDER DPAS (15 CFR 350)	RATING N/A	PAGE OF PAGES 1 43
2. CONTRACT NO. (Proc. Inst. Ident.) NRC-04-06-067		3. EFFECTIVE DATE See Block 19c.	4. REQUISITION/PURCHASE REQUEST/PROJECT NO. RS-NRC-04-05-056	
5. ISSUED BY U.S. Nuclear Regulatory Commission Div. of Contracts Attn: Jeffrey R. Mitchell, 301-415-6465 Mail Stop T-7-I-2 Washington, DC 20555		CODE 3100	6. ADMINISTERED BY (If other than Item 5) U.S. Nuclear Regulatory Commission Div. of Contracts Mail Stop T-7-I-2 Washington, DC 20555	

7. NAME AND ADDRESS OF CONTRACTOR (No., street, city, county, State and ZIP Code) THE RECTOR AND VISITORS OF THE UNIVERSITY OF VIRGINIA ATTN: GERALD J. KANE P.O. BOX 400195 CHARLOTTESVILLE VA 229044195		8. DELIVERY <input type="checkbox"/> FOB ORIGIN <input checked="" type="checkbox"/> OTHER (See below)		
		9. DISCOUNT FOR PROMPT PAYMENT		
		10. SUBMIT INVOICES (4 copies unless otherwise specified) TO THE ADDRESS SHOWN IN: ITEM		

CODE Contractors DUNS: 065391526	FACILITY CODE	12. PAYMENT WILL BE MADE BY U.S. Nuclear Regulatory Commission Payment Team, Mail Stop T-7-I-4 T-7-I-2 DMC Attn: (NRC-04-06-067) Washington DC 20555	
11. SHIP TO/MARK FOR U.S. Nuclear Regulatory Commission Washington DC 20555		CODE	3100

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION: <input type="checkbox"/> 10 U.S.C. 2304(c) () <input type="checkbox"/> 41 U.S.C. 253(c) ()	14. ACCOUNTING AND APPROPRIATION DATA RES-C05-369 66015111195 N6124 252A 31x0200.660 Obligate \$440,000.00
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15A. ITEM NO	15B. SUPPLIES/SERVICES	15C. QUANTITY	15D. UNIT	15E. UNIT PRICE	15F. AMOUNT
	The Contractor shall provide the U.S. Nuclear Regulatory Commission (NRC) with the services as described in Section C "Statement of Work" and in accordance with the terms and conditions of this contract. ORCA.GOV incorporated by reference				

15G. TOTAL AMOUNT OF CONTRACT

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	B	SUPPLIES OR SERVICES AND PRICES/COSTS		PART III - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACH.			
	C	DESCRIPTION/SPECS./WORK STATEMENT			J	LIST OF ATTACHMENTS	
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CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE

17. <input checked="" type="checkbox"/> CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return 2 copies to issuing office.) Contractor agrees to furnish and deliver all items or perform all the services set forth or otherwise identified above and on any continuation sheets for the consideration stated herein. The rights and obligations of the parties to this contract shall be subject to and governed by the following documents: (a) this award/contract, (b) the solicitation, if any, and (c) such provisions, representations, certifications, and specifications as are attached or incorporated by reference herein. (Attachments are listed herein.) Stewart P. Craig	18. <input type="checkbox"/> AWARD (Contractor is not required to sign this document.) Your offer on Solicitation Number _____, including the additions or changes made by you which additions or changes are set forth in full above, is hereby accepted as to the items listed above and on any continuation sheets. This award consummates the contract which consists of the following documents: (a) the Government's solicitation and your offer, and (b) this award/contract. No further contractual document is necessary.
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19A. NAME AND TITLE OF SIGNER Assistant Director for Grants Office of Sponsored Programs University of Virginia	20A. NAME OF CONTRACTING OFFICER Donald A. King Contracting Officer
19B. NAME OF CONTRACTOR BY _____ (Signature of person authorized to sign)	20B. UNITED STATES OF AMERICA BY Donald A. King (Signature of Contracting Officer)
19C. DATE SIGNED 08-29-2006	20C. DATE SIGNED 8/5/2006

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PART I - THE SCHEDULE**SECTION B - SUPPLIES OR SERVICES AND PRICE/COSTS****B.1 PROJECT TITLE**

The title of this project is as follows:

"Digital System Dependability Performance"

B.2 BRIEF DESCRIPTION OF WORK (MAR 1987)

The contractor will be responsible for performing the experiments, subsequent technical analysis, and reporting in accordance with NRC requirements. Task 1: Safety Assessment of a Safety-Critical Commercial Computer System, Optional Task 2: Refinement of Safety Assessment Methodology for Safety-Critical Commercial Computer Systems, and Optional Task 3: Validation of Safety Assessment Methodology for Safety-Critical Commercial Computer Systems.

B.3 CONSIDERATION AND OBLIGATION--COST REIMBURSEMENT (JUN 1988) ALTERNATE I (JUN 1988)

- (a) The total estimated cost to the Government for full performance under this contract is \$619,940.00.
- (b) The amount presently obligated by the Government with respect to this contract is \$440,000.00.
- (c) **OPTIONAL TASK 1:**
The total estimated cost to the Government for full performance under optional task 1 is \$464,710.00.
- (d) **OPTIONAL TASK 2:**
The total estimated cost to the Government for full performance under optional task 2 is \$305,699.00.

SUMMARY

Base Task	\$619,940.00
Option Task 1	\$464,710.00
Option Task 2	\$305,699.00
Total	\$1,390,349.00

SECTION C - DESCRIPTION/SPECIFICATIONS/STATEMENT OF WORK**I. BACKGROUND**

NUREG/CR-0020, "Embedded Digital System Reliability and Safety Analyses," [Ref. 1] provided the technical basis for selecting a method to analyze the behavior of digital systems under the influence of internal/external and normal/faulted conditions of the inputs, outputs, hardware, and software. The uniqueness of the analysis method is that it can simulate software design faults and diagnostic faults while most other methods are hardware oriented and only account for random hardware faults. The method has been used for safety-critical digital system safety evaluation in Europe and has been reviewed by safety assessors at TÜV Germany. The research was performed under a Cooperative Agreement between the Nuclear Regulatory Commission (NRC) and the University of Virginia (UVA) Center for Safety-Critical Systems (CSCS), and it involved developing assessment methods for evaluating digital system reliability, safety, and, most recently, security, including the interrelated dependencies of hardware and software. Also investigated was the efficacy of software-hardware diagnostics and other fault management mechanisms at both the channel and system levels.

The UVA research effort has yielded a methodology [Refs. 2, 3, 4, and 5] for quantifying digital system reliability and safety for advanced complex processor-based safety-critical systems. The methodology is suitable for modeling and analyzing failures of hardware or software, and finding resultant system-wide effects. The methodology generates probabilistic analytical solutions of computer-based system failures, with the critical system parameter being *fault coverage* (or simply *coverage*). The modeling and influence of fault coverage on reliability and safety has been known for thirty years, but until recently has been very difficult to estimate for digital systems to a very high certainty. The coverage estimate can be made from experimentally testing a system under various fault conditions, e.g., using fault injection techniques, to determine if the system recognizes the fault and transitions to either a "failed-safe" or "failed-unsafe" state. The data thus collected experimentally can be used in the coverage parameter estimation within known confidence limits. The resulting values are used to solve equations representing an analytical safety model of the system under study [3].

Fault injection [Refs. 6, 8] involves inserting faults into a system and monitoring the system to determine its behavior in response to the fault for the purpose of providing parameter estimations for reliability and safety assessments. Computer simulation can be used to perform the fault injection on a model of the design, as opposed to performing the fault injection on the actual system. With today's computing power the fault injection and recording of the results can be very efficient for complex digital systems. This makes reliability and safety assessment more obtainable than ever before and can include the combined effect of hardware, software, and humans (e.g., system operators and maintenance staff). These developments, when implemented according to a valid technical basis and coupled with modeling/simulation methods (such as those available over the world-wide web), can result in more realistic and accurate digital system reliability and safety assessments compared to present methods.

Some general conclusions that can be drawn from this research at this time are:

- 1) the same digital system architecture can result in different safety properties depending on the value of *fault coverage*;

2) the methodology is not dependent on any knowledge of the hardware or software *development methods* or attributes, but will assess the results of the development methods in an objective manner;

3) the methodology can accommodate proprietary special purpose systems or COTS component systems;

4) the methodology tests the ability, accuracy, and efficiency of internal software and hardware diagnostics to perform their error detection and management capabilities.

The above conclusions indicate the methodology is well suited for application to a regulatory process for assessing the safety of digital systems. Therefore, research continues on development of detailed methods and tools to properly characterize and analyze digital systems for performance, reliability, failure modes, and subsystem and system safety. The detailed methods and tools will be applied to several case studies of digital nuclear safety systems currently in use or anticipated for use at nuclear facilities in the United States. The goal of the research is to promote more efficient staff review of digital systems by providing a sharp focus on risk-significant areas.

II. OBJECTIVES

A safety assessment methodology, e.g., the one described in Refs. 1 - 6 and 8, will be applied to the case study of a commercial-off-the-shelf (COTS) nuclear digital safety system. The results of this effort are expected to advance the state-of-the-art of reliability and safety assessment of nuclear digital safety systems. The results obtained may directly impact future licensing applications in terms of safety of nuclear facilities proposing to install the particular equipment. The knowledge and understanding gained will be used in developing the technical bases for regulatory requirements regarding safety-related digital systems, including acceptance criteria (e.g., in revisions to the standard review plan, chapter 7) and regulatory guidance documents. Additional discussion on the objectives is given below. The tasks to be performed in order to meet the objectives are described in Section III, SCOPE OF WORK. Reporting requirements regarding periodic updates and financial expenditures are given in Section IV, REPORTING REQUIREMENTS. A final report will be delivered by the contractor to the NRC Project Manager at the end of this project. Requirements regarding the final report are described in Section V, DELIVERABLES AND DELIVERY SCHEDULE. Additional guidance on the final report is given in Section III.

Task 1 - Safety Assessment of a Safety-Critical Commercial Computer System

One major objective of this task is to quantify the safety of a digital nuclear safety system using a process similar to the one developed through funding from the NRC. A safety assessment methodology that calculates *fault coverage*, steady-state safety, probability of failure upon demand, mean time to hazardous event (or similar metric), and that uses fault injection techniques combined with dynamic simulation will be applied to assessing the safety of a commercial computer system used in a safety-critical nuclear application. The system will be supplied as Government Furnished Equipment (GFE) for this task. The system anticipated is a general-purpose distributed control system (DCS) with the ability to support various types of

control applications. Lessons learned from previous fault simulation/injection experiments will be leveraged during the period of performance of this task. The description of this task is given in Section III under TASK 1.

Another major objective of this task is to develop the process for incorporating the safety assessment results into nuclear plant probabilistic risk assessments (e.g., see Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions On Plant-Specific Changes to the Licensing Basis," Rev 1, ADAMS accession number ML003740133). Therefore, interaction with experts from multiple domains will be required, including the fault tolerance community, risk engineers (i.e., probabilistic risk assessment experts), and potentially process control security practitioners. Modeling and simulation tools used during this task will be adequately explained and safety assessment results will be made available to experts for peer review.

Optional Task 2 - Refinement of Safety Assessment Methodology for Safety-Critical Commercial Computer Systems

Optional Task 3 - Validation of Safety Assessment Methodology for Safety-Critical Commercial Computer Systems

These two optional tasks, if exercised, will apply the selected safety assessment method to two other NRC-approved general-purpose distributed control systems (DCS). Lessons learned from previous fault simulation/injection experiments during TASK 1 will be leveraged during the period of performance of these optional tasks. The description of these optional tasks are given in Section III.

III. SCOPE OF WORK

This project will assess digital system dependability (e.g., Laprie et al. [Ref. 7]) using government furnished equipment (GFE) as a test case. In TASK 1, techniques developed during previous NRC-funded research will be applied to the GFE. Included in the first task is site acceptance testing, system testbed configuration planning and set up, and testbed network configuration planning, set up, and access validation. OPTIONAL TASKs 2 and 3, if funded, will apply the assessment methodology to two other NRC-approved digital safety platforms. A NUREG-series report will document the technical basis for incorporating the chosen safety system assessment methodology into the NRC regulatory process. Additionally, topics for future research by NRC are to be identified in the contractor's final report to NRC. Other required deliverables include periodic status reports, interim technical reports, and a draft NUREG-series report. The final report shall incorporate the NRC Project Manager's comments following review of the draft report. See Section V, DELIVERABLES AND DELIVERY SCHEDULE, for further information.

TASK 1, Safety Assessment of a Safety-Critical Commercial Computer System

Contractor shall apply a safety assessment technique¹ the same as or similar to the one documented in [Refs. 1 to 6, and 8] to a digital system supplied by the NRC as Government Furnished Equipment (GFE). The GFE for the case study is a general-purpose distributed control system (DCS) with the ability to support various types of control and/or safety applications. Contractor shall not modify any part of the GFE(s) to improve the assessment results. Because the duration and resource requirements of this task, it has been separated into several sub-tasks.

SUBTASK 1.1, Preparations for GFE Acceptance and Testing

Prior to delivery of the GFE, Contractor shall prepare its facilities for storage and testing of the system. Contractor shall store and test the GFE at a location on the Contractor's site that is secure (i.e., controlled access, no or minimal number of windows facing either outdoors or hallways), environmentally compatible (i.e., cooling and humidity controls), and of sufficient space to allow expansion of the base system. The NRC PM will approve the location on Contractor's site, as well as the adequacy of access controls.

In preparation of delivery of the GFE, Contractor shall prepare a plan and propose a basic network diagram for configuring the GFE on the Contractor's LAN/WAN. Included in the plan and network design shall be provisions for controlled network access, network traffic monitoring, and secure remote (Internet) access to the GFE by third parties who will be approved only by the NRC Project Manager (PM). Contractor shall propose in the plan which of its staff will be the network/system administrator of the GFE and test network. Contractor shall propose staff who have the technical background to administer, maintain, protect, reconfigure, and repair the GFE and test network as needed. Test network access, passwords, and test network administrator rights shall be strictly controlled by Contractor, with Contractor staff having administrator rights to be approved by the NRC PM. Knowledge management will be a consideration in making the final decision. Contractor changes to the test configuration network shall be approved by the NRC PM prior to making the changes.

Contractor shall establish a web site which will serve to test the configuration of the test network, provide remote viewing of test and system status, support demonstrations of system and test capabilities to audiences at remote locations, and provide on-line access to NRC-funded research. Initially, access to the web site shall be controlled in conformance with the above requirements. When the test network and web site are demonstrated to be operational and adequately secure, at the discretion of the NRC PM, the web site shall be partitioned into public and private domains. At no time shall the public domain contain sensitive unclassified information. The public domain shall not provide any electronic means for accessing the test system. The web site shall be

¹ Depending on Contractor's level of familiarity with previous NRC work, it may be prudent to review applicable NRC-furnished materials (Section XI, NRC FURNISHED MATERIALS) either prior to or in parallel with this task.

maintained by Contractor during the period of performance of this statement of work. The private domain shall be maintained in conformance with the above access and configuration control requirements during the period of performance of this statement of work. Contractor shall not make changes to the web site, either public or private domains, without first obtaining approval from the NRC PM. During closeout of this project, the private domain shall be purged of all information at the direction of the NRC PM. Costs incurred as a result of maintaining the public web site active after the period of performance ends are borne solely by Contractor.

In preparation of delivery of the GFE, Contractor staff selected as the GFE test network administrator will attend a hands-on GFE training course at the GFE vendor's site at the discretion of the NRC PM. Detailed information will be provided by the NRC PM after contract award. However, the training course is not required to successfully meet the objectives of this statement of work.

In preparation of delivery of the GFE, Contractor shall prepare a project plan. The project plan shall include all activities, technical and non-technical, that are necessary to prepare, coordinate, configure, test, document, and present on the safety assessment of the GFE. Furthermore, Contractor shall address the specific safety assessment test activities in the project plan. Contractor shall use GFE technical documentation provided by the NRC PM to prepare the safety assessment test plan. Contractor shall provide a separate document only for the safety assessment activities for easy reference. Contractor shall identify this separate document as a subdocument to the project plan using a document numbering scheme consistent with NUREG-series format requirements. See Section V, DELIVERABLES AND DELIVERY SCHEDULE for additional information on the test plan reporting requirements.

SUBTASK 1.2, GFE Acceptance, Test Configuration Setup, and GFE Testing

Upon delivery of the GFE to Contractor's site, Contractor shall perform tests (i.e., site acceptance testing) to ensure the system is configured with the hardware and software as specified, and that the system is operational. The extent of testing and specific acceptance criteria will be determined in cooperation with the NRC Project Manager (PM). See SUBTASK 1.1 for additional details.

The intention is for the NRC to provide as GFE actual reactor plant safety-related application software as a component of the test system. However, if the actual reactor plant application software becomes unavailable the alternative approach will be to implement a relatively simple control software program on the GFE platform to demonstrate the safety assessment process. In this case, Contractor shall propose to the NRC PM various control software applications that will best illustrate the capabilities of the assessment process. NRC PM will give final approval to the control software application executed on the platform for purposes of performing the safety assessment.

The purpose of SUBTASK 1.1 was to develop the test plan. In SUBTASK 1.2, Contractor shall implement the test plan with focus on total system assessment by investigating assessment approaches that combine simulation (e.g., internal microprocessor failure simulation) with experimental fault injection (e.g., hardware fault injection). Contractor shall develop system models for both simulation and analytical

analysis. Contractor's assessment activities shall involve interfacing the GFE running the mutually agreed upon software application with a simulation model of the power plant process and then performing fault injection experiments on the integrated test system. If "unsafe" failures are found, they shall be documented in order to identify the important safety issues that need to be addressed by NRC staff. Also, Contractor shall provide a list or table of potential mitigation measures (e.g., redesign, extra hardware, software patches) for each identified unsafe failure. Contractor shall not modify any part of the GFE to improve the assessment results. See Section V, DELIVERABLES AND DELIVERY SCHEDULE, for additional information on reporting requirements. The power plant process model is included in the GFE list in Section XI, NRC FURNISHED MATERIALS.

The approach documented in Refs. 1 to 6 and 8 is resource-intensive, because of the extensive knowledge required to adequately and properly apply fault injection techniques to system safety evaluations. Therefore, Contractor shall look for ways to improve the efficiency of the selected approach. The focus should be on potential "process improvements" that make it practical to a performance-based regulatory environment. In such an environment, any proposed design is acceptable as long as it is shown to satisfy the Commission's requirements for reliability (i.e., the regulations). Thus the most efficient process is one which can be applied to any system, configuration, and architecture without regard for intellectual property concerns. Contractor shall document these efficiencies. See Section V, DELIVERABLES AND DELIVERY SCHEDULE, for additional information on reporting requirements.

Note that Contractor may have to sign a non-disclosure agreement with the GFE vendor in order to obtain access to resources necessary to successfully complete this subtask. Early termination of the project could result if failure to sign a non-disclosure agreement prevents obtaining technical information on the GFE necessary to perform the safety analysis and an alternative method for obtaining the data is not found.

Results of the activities specified above in SUBTASKS 1.1 and 1.2 shall be documented in interim progress reports as well as in the draft report deliverable. See Section V, DELIVERABLES AND DELIVERY SCHEDULE, for further information.

OPTIONAL TASK 2, Refinement of Safety Assessment Methodology for Safety-Critical Commercial Computer Systems

Contractor shall perform activities described in TASK 1 above to a second digital system supplied by the NRC as Government Furnished Equipment (GFE). The GFE for this second case study is a general-purpose distributed control system (DCS) with the ability to support various types of control and/or safety applications. Contractor shall leverage the results and knowledge gained during TASK 1 to the evaluation of the second GFE. The intention of this task is to refine the methodology described in Refs. 1 to 6 while evaluating the second GFE. The level of effort is expected to be lower relative to TASK 1 due to familiarity with the methodology. Contractor shall work with the NRC PM to identify which activities under TASK 1 will be performed during this optional task.

Results of the activities specified above in OPTIONAL TASK 2 shall be documented in interim progress reports as well as in the draft report deliverable. See Section V, DELIVERABLES AND DELIVERY SCHEDULE, for further information.

OPTIONAL TASK 3, Validation of Safety Assessment Methodology for Safety-Critical Commercial Computer Systems

Contractor shall perform activities described in TASK 1 above on a third digital system supplied by the NRC as Government Furnished Equipment (GFE). The GFE for this third case study is a general-purpose distributed control system (DCS) with the ability to support various types of control and/or safety applications. Contractor shall leverage the results and knowledge gained during TASK 1 and OPTIONAL TASK 2 to the evaluation of the third GFE. The intention of this task is to validate the methodology on a third GFE. The level of effort is expected to be lower relative to OPTIONAL TASK 2 due to familiarity with the methodology and the assumption that major revisions to the methodology will not be required to successfully complete this third case study. Contractor shall work with the NRC PM to identify which activities under TASK 1 will be performed during this optional task.

Results of the activities specified above in OPTIONAL TASK 3 shall be documented in interim progress reports as well as in the draft report deliverable. See Section V, DELIVERABLES AND DELIVERY SCHEDULE, for further information.

IV. KEY PERSONNEL QUALIFICATIONS

Contractor shall provide personnel with the following qualifications to support TASK 1 and OPTIONAL TASKS 2 and 3:

- (a) Familiarity with the process described in references 1 through 6 in Section XII, REFERENCES, to the extent sufficient that the process can be applied to the digital safety systems under study;
- (b) Demonstrated experience in applying fault-tolerant design and analysis to high-integrity, real-time safety systems (e.g., medical systems, transportation systems, oil and gas process control, manufacturing systems);
- (c) Demonstrated experience in performing fault-injection experiments on high-integrity, real-time safety systems (e.g., medical systems, transportation systems, oil and gas process control, manufacturing systems);
- (d) Familiarity with RTL and VHDL and modeling tools, including experience with using such tools in the design and analysis of integrated circuits. Knowledge and experience shall include modify existing VHDL models to support fault-injection experiments;
- (e) Knowledge of computer system architectures found in the real-time control industry. This knowledge includes system architecture (e.g., TMR, Duplicate with Comparison, and so on) as well as microprocessor architectures (i.e., knowledge of instruction set architectures and instruction sets. Demonstrated experience in analyzing these architectures in terms of fault-tolerance;
- (f) Experience in the programming of computers using the following languages: C/C++, assembly, machine code. Knowledge of internal processor architectures of various processors is implied.
- (g) Knowledge of and experience in programming/analyzing real-time operating systems, such as QNX, VRTX, applied in a real-time, safety-critical operational environment.

- (h) Knowledge and experience in using full system simulation tools, specifically Virtutech SIMICS, and The Mathworks MATLAB. Experience in interfacing these tools to other testing tools in a laboratory setting during analysis of safety system quality/reliability/safety.

V. DELIVERABLES AND DELIVERY SCHEDULE

All deliverables, with some exceptions noted below, shall meet the requirements of Attachment 1, *New Standards for Contractors Who Prepare NUREG-series Manuscripts*.

The contractor shall provide the NRC Project Manager the following^{2,3} :

1) TASK 1, Safety Assessment of a Safety-Critical Commercial Computer System

a) SUBTASK 1.1, Preparations for GFE Acceptance and Testing

(i) INTERIM REPORT 1.1-A, GFE Configuration and Test Plan

Contractor shall provide a project plan for the safety and security assessment of the government furnished equipment (GFE). The project plan shall include all activities, technical and non-technical, that are necessary to prepare, coordinate, configure, test, document, and present on the safety assessment of the GFE. Furthermore, Contractor shall address the specific safety assessment test activities in the project plan. Contractor shall use GFE technical documentation provided by the NRC PM to prepare the safety assessment test plan. Contractor shall provide a separate document only for the safety assessment activities for easy reference. Contractor shall identify this separate document as a subdocument to the project plan using a document numbering scheme consistent with NUREG-series format requirements.

The project plan shall also address the following elements:

(a) Storage location of the GFE on Contractor's site, including physical access and environmental controls.

(b) Test network configuration, including a block diagram of the proposed architecture, and how access to the network and GFE will be controlled. The proposed configuration shall include discussion of Contractor personnel who will administer, maintain, and repair the test network. Provisions for configuration management for controlling test network modifications to support testing and or test facility upgrades shall be identified.

(c) Web site design, including security provisions and access control of the web site. The public portion of the web site can be hosted by Contractor (e.g., university LAN/WAN) with full access and state-of-the-practice in web site security. The private portion must have appropriate and adequate access control such that unauthorized persons cannot obtain access. Contractor shall identify Contractor personnel having access to the private domain of the web site. NRC PM will approve all changes to access control list. Contractor shall be capable of providing

² The Contractor shall utilize a technical writer for this effort to ensure high quality of all submissions to the NRC. To ensure the highest quality standards are maintained throughout the project, Contractor management shall review each draft letter report prior to its submission. The content of technical reports should follow generally accepted writing practices, see NUREG-650, Revision 1, "Publishing Documents in the NUREG Series.

³ The NRC Project Manager will provide comments to the contractor within 60 days of receipt of the specified draft NUREG/CRs.

remote (e.g., VPN) access to third parties designated and approved only by the NRC PM. Such configurations shall be captured by the configuration management system described for part b), above.

Examples of items that could be addressed in the project plan include, but are not limited to: preparation activities, such as identifying and rearranging and/or cleaning the storage location for the GFE at Contractor's site, obtaining technical documentation, etc.; signing of non-disclosure agreements with the GFE vendor; preparing monthly letter status reports to the NRC PM; preparing presentation material for conference proceedings, technical journal articles, etc. Other activities that should be addressed in the test plan, listed in no particular order:

- Develop a confidentiality agreement with GFE vendor
- Selection of an application
- Review the system design documentation
- Obtain the process model from NRC PM and/or GFE vendor
- Acquire all components for the physical prototype
- Construct the physical prototype
- Identification and selection of appropriate standards
- Identification and selection of design automation tools to use
- Development of a plan for experimental testing of the final prototype
- Development of a safety assurance approach
- Develop an architectural model of the system
- Development of initial system models for both analytical and simulation analysis
- Analysis and generation of results for the system
- Perform a detailed sensitivity analysis
- Develop a statistical model
- Evaluate fault injection options

Special note is made of coordination effort, which includes presentations on Contractor's progress and/or results. The NRC expects to collaborate with several organizations on digital safety system assessment research, both domestic and foreign. Contractor shall support the NRC PM on such collaborative activities, including traveling to and/or hosting research partners. Specific activities are to be decided, but recommendations from Contractor will be sought by the NRC PM.

This Interim Report is due 60 days after contract award.

b) SUBTASK 1.2, GFE Acceptance, Test Configuration Setup, and GFE Testing

(i) INTERIM REPORT 1.2-A, GFE Test Results

Contractor shall perform site acceptance testing to the criteria established in cooperation with the NRC PM. Any modifications to the system required as a result of the site acceptance testing shall be documented along with the final system configuration (i.e., deficiency item close out).

Contractor shall document the safety assessment process followed, the results of the fault injection testing (i.e., "hybrid assessments"), and any recommended/completed system design changes performed to satisfy safety criteria, if applicable. Discussion of the process shall include identifying software and/or hardware utilized for the experiments, experimental system setup (including the test network configuration), simulation software and process models, and raw test data output.

Contractor shall discuss identified efficiencies and how they were/could be realized. One aspect of this discussion shall be how the test process can be utilized in a regulatory framework, where the focus is on safety assessment as opposed to safety design.

This Interim Report is due 15 months after delivery of GFE to Contractor's site. This Interim Report does not have to conform to NUREG-series format requirements. However, the contents of this report shall be included in the final report, which shall meet the requirements for NUREG-series documents. See item 4, below, for additional information on draft and final report requirements.

2) OPTIONAL TASK 2, Refinement of Safety Assessment Methodology for Safety-Critical Commercial Computer Systems

This optional task will evaluate a second digital system that will be provided to Contractor as government furnished equipment (GFE). The safety-security assessment activities applied to this second GFE will be the same as those applied to the first GFE in TASKs 1 and 2. Therefore, Contractor shall document the OPTIONAL TASK 2 effort the same way as outlined above for TASKs 1 and 2, with the following exceptions.

(i) INTERIM REPORT 1.1-A, GFE Configuration and Test Plan

Contractor shall submit a separate Interim Report for the second GFE at the end of SUBTASK 1.1. Draft versions shall be discussed with the NRC Project Manager to ensure reporting expectations are met. Note the project plan may have to be revised significantly to adequately plan the hybrid assessment activities required for the second GFE.

This Interim Report is due 60 days after OPTIONAL TASK 2 is initiated.

(ii) INTERIM REPORT 1.2-A, GFE Test Results

Contractor shall submit a separate Interim Report for SUBTASK 1.2. The potential efficiencies identified in SUBTASK 1.2 shall be applied to OPTIONAL TASK 3 and reported in this Interim Report. Any refinements of the methodology shall be documented in Volume 1 of the final NUREG-series report. See item 4, below, for additional information.

This Interim Report is due 12 months after delivery of the second GFE to Contractor's site.

3) OPTIONAL TASK 3, Validation of Safety Assessment Methodology for Safety-Critical Commercial Computer Systems

This optional task will evaluate a third digital system that will be provided to Contractor as government furnished equipment (GFE). The safety assessment activities applied to this third GFE will be the same as those applied to the first and second GFEs in TASK 1 and OPTIONAL TASK 2. Therefore, Contractor shall document the OPTIONAL TASK 3 effort the same way as outlined above for TASK 1 and OPTIONAL TASK 2, with the following exceptions.

(i) INTERIM REPORT 1.1-A, GFE Configuration and Test Plan

Contractor shall submit a separate Interim Report for the third GFE at the end of SUBTASK 1.1. Draft versions shall be discussed with the NRC Project Manager to ensure reporting expectations are met. Note the project plan may have to be revised significantly to adequately plan the hybrid assessment activities required for the third GFE.

This Interim Report is due 60 days after OPTIONAL TASK 3 is initiated.

(ii) INTERIM REPORT 1.2-A, GFE Test Results

Contractor shall submit a separate Interim Report for SUBTASK 1.2. The potential efficiencies identified in SUBTASK 1.2 and OPTIONAL TASK 2 shall be applied to OPTIONAL TASK 3 and reported in this Interim Report. Any refinements of the methodology shall be documented in Volume 1 of the final NUREG-series report. See item 4, below, for additional information.

This Interim Report is due 10 months after delivery of the third GFE to Contractor's site.

4) Report Structure

Contractor shall submit a multi-volume report satisfying format requirements for NUREG-series documents. Volume 1 of the report shall provide an overview of the project's activities, a description of the technical basis for the safety assessment methodology, a description of "efficiencies" identified and applied during the assessment process, and challenges and solutions for successful completion. Volume 1 shall also provide a summary of results of the safety assessments of each funded GFE. If "unsafe" failures are found, the report shall also provide a list or table of potential mitigation measures (e.g., redesign, extra hardware, software patches). However, Contractor shall not modify any part of the GFE(s) to improve the assessment results. Finally, Contractor shall propose recommendations on future research. This volume shall have "Volume 1" in the title. Interim Reports 1.1-A and 1.2-A shall form system-specific volumes of the NUREG-series report. For example, for the first GFE analyzed, Volume 2 shall contain Interim Reports 1.1-A, 1.2-A specific to that GFE. For the second GFE, Interim Reports 1.1-A, 1.2-A specific to that GFE shall compose Volume 3, and so on for the third GFE. However, if OPTIONAL TASKS 2 and 3 are not initiated, a multi-volume report will not be necessary, and therefore "Volume" will not be required in the title of the NUREG-series report on the methodology and its application to the first (and only) GFE analyzed. If time and resources allow, Contractor shall include system-specific volume descriptions/explanations of potential mitigation measures for each identified "unsafe" failure in the associated GFE, whether design change, hardware modification, software modification, operational procedure, etc. Contractor shall not modify the GFE(s) to improve the assessment results.

Contractor shall provide to the NRC PM a draft report satisfying requirements for NUREG-series documents. This draft NUREG-series report is due thirty days after delivery of the final Interim Report 1.2-A. After a sixty-day comment period, Contractor shall incorporate comments from the NRC PM and submit the revised NUREG-series report as the final version. See Attachment 1 for additional requirements.

VI. MEETINGS AND TRAVEL

1 trip, 2 persons within 14 days of contract award for project kick-off meeting at NRC Headquarters, Washington, DC.

1 trip, 1 person, 180 days after award of contract for a Project Review Meeting to NRC staff at NRC Headquarters, Washington DC.

1 trip, 1 person, at completion of SUBTASK 1.2 to present results to NRC staff at NRC Headquarters, Washington DC. If OPTIONAL TASKS 2 and 3 are funded, three of these trips will be made to NRC Headquarters.

2 trips, 2 persons each trip, after the completion of SUBTASK 1.2 to conferences to present the developed assessment methodology. One conference on security and one conference on dependable computing or fault tolerance. If OPTIONAL SUBTASKS 2 and 3 are funded, six trips will be made. See Section X,

PUBLICATIONS, regarding NRC approval of publications and presentations over and above required project deliverables.

NRC Project Manager will conduct biweekly telephone conference calls for project reviews. These may be substituted, at the Project Manager's discretion, with project review meetings at Contractor's facility. Adequate notice prior to such visits will be given to Contractor for planning purposes.

Contractor shall host one workshop or seminar on the developed methodology after completion of SUBTASK 1.2. If OPTIONAL TASKs 2 and 3 are exercised, at least three workshops/seminars shall be hosted by Contractor. Location of the workshops/seminars shall be at Contractor's facility, but specific times and dates shall be set in cooperation with the NRC Project Manager. The workshop/seminar shall be a minimum of one day and maximum of three days in duration.

VII. EQUIPMENT REQUIRED

The following is a list of equipment required by Contractor to perform the work described in the above tasks. The list identifies both hardware and software test tools required to perform the fault-injection experiments. The list is not meant to be all-inclusive, as one of the tasks described above requires identifying "efficiencies" in the selected assessment method, which may lead to identifying other tools listed below.

- (a) Logic analyzer
- (b) In-circuit emulator(s)
- (c) Virtutech SIMICS
- (d) C/C++ compiler(s)
- (e) Debugger (e.g., Softlce)
- (f) Assembler
- (g) Disassembler
- (h) Hex editor
- (i) Development kits (as necessary)
- (j) Nuclear power plant simulation system, which includes the simulation software and PC
- (k) Network equipment necessary to establish a test network with public and private domains
- (l) PC network (fault-injection unit, reactor simulation unit, data logger, etc.)

VIII. REFERENCES

1. U.S. Nuclear Regulatory Commission, "Embedded Digital System Reliability and Safety Analyses," NUREG/GR-0020, February 2001. (*FURNISH UPON REQUEST)
2. University of Virginia, Center for Safety-Critical Systems, Department of Electrical and Computer Engineering, "A Numerical Safety Evaluation Process for Safety-Critical Systems," UVA-CSCS-NSE-001, Revision 02, Charlottesville, Virginia, August 2003. (*FURNISH UPON REQUEST)
3. University of Virginia, Center for Safety-Critical Systems, Department of Electrical and Computer Engineering, "Analytical Safety Model," UVA-CSCS-NSE-002, Revision 01, Charlottesville, Virginia, August 2003. (*FURNISH UPON REQUEST)
4. University of Virginia, Center for Safety-Critical Systems, Department of Electrical and Computer Engineering, "Statistical Model," UVA-CSCS-NSE-003, Revision 00, Charlottesville, Virginia, August 2003. (*FURNISH UPON REQUEST)
5. University of Virginia, Center for Safety-Critical Systems, Department of Electrical and Computer Engineering, "Generic Processor Fault Model," UVA-CSCS-NSE-004, Revision 00, Charlottesville, Virginia, August 2003. (*FURNISH UPON REQUEST)

6. University of Virginia, Center for Safety-Critical Systems, Department of Electrical and Computer Engineering, "A Perspective on the State of Research on Fault Injection Techniques," UVA-CSCS-FIT-001, Charlottesville, Virginia, August 2003. (*FURNISH UPON REQUEST)
7. J.-C. Laprie, A. Avizienis, and B. Randell. 2000. Fundamental concepts of dependability. A summary of Technical report, "Dependability of computer systems: Fundamental concepts, terminology, and examples," LAAS-CNRS, October 2000. (CAN BE FOUND ON ELECTRONIC JOURNAL DATABASES)
8. University of Virginia, Center for Safety-Critical Systems, Department of Electrical and Computer Engineering, "A Technique for Performing Fault Injection Using SIMICS," UVA-CSCS-SFI-001, Charlottesville, Virginia, December 2004. (*FURNISH UPON REQUEST)

Note: (*FURNISH UPON REQUEST)

Email JRM6@NRC.GOV or Call 301-415-6465 for a CD electronic copy of the above references.

SECTION D - PACKAGING AND MARKING**D.1 PACKAGING AND MARKING (MAR 1987)**

The Contractor shall package material for shipment to the NRC in such a manner that will ensure acceptance by common carrier and safe delivery at destination. Containers and closures shall comply with the Interstate Commerce Commission Regulations, Uniform Freight Classification Rules, or regulations of other carriers as applicable to the mode of transportation. On the front of the package, the Contractor shall clearly identify the contract number under which the product is being provided.

SECTION E - INSPECTION AND ACCEPTANCE**E.1 NOTICE LISTING CONTRACT CLAUSES INCORPORATED BY REFERENCE**

The following contract clauses pertinent to this section are hereby incorporated by reference (by Citation Number, Title, and Date) in accordance with the clause at FAR "52.252-2 CLAUSES INCORPORATED BY REFERENCE" in Section I of this contract. See FAR 52.252-2 for an internet address (if specified) for electronic access to the full text of a clause.

NUMBER	TITLE	DATE
52.246-9	FEDERAL ACQUISITION REGULATION (48 CFR Chapter 1) INSPECTION OF RESEARCH AND DEVELOPMENT (SHORT FORM)	APR 1984

E.2 PLACE OF INSPECTION AND ACCEPTANCE (MAR 1987)

Inspection and acceptance of the deliverable items to be furnished hereunder shall be made by the Project Officer at the destination.

SECTION F - DELIVERIES OR PERFORMANCE**F.1 NOTICE LISTING CONTRACT CLAUSES INCORPORATED BY REFERENCE**

The following contract clauses pertinent to this section are hereby incorporated by reference (by Citation Number, Title, and Date) in accordance with the clause at FAR "52.252-2 CLAUSES INCORPORATED BY REFERENCE" in Section I of this contract. See FAR 52.252-2 for an internet address (if specified) for electronic access to the full text of a clause.

NUMBER	TITLE	DATE
52.242-15	FEDERAL ACQUISITION REGULATION (48 CFR Chapter 1) STOP-WORK ORDER ALTERNATE I (APR 1984)	AUG 1989
52.247-34	F.O.B. DESTINATION	NOV 1991
52.247-48	F.O.B. DESTINATION--EVIDENCE OF SHIPMENT	FEB 1999

F.2 2052.211-70 PREPARATION OF TECHNICAL REPORTS (JAN 1993)

All technical reports required by Section C and all Technical Progress Reports required by Section F are to be prepared in accordance with the attached Management Directive 3.8, "Unclassified Contractor and Grantee Publications in the NUREG Series." Management Directive 3.8 is not applicable to any Contractor Spending Plan (CSP) and any Financial Status Report that may be included in this contract. (See List of Attachments).

F.3 2052.211-71 TECHNICAL PROGRESS REPORT (JAN 1993)

The contractor shall provide a monthly Technical Progress Report to the project officer and the contracting officer. The report is due within 15 calendar days after the end of the report period and must identify the title of the project, the contract number, appropriate financial tracking code specified by the NRC Project Officer, project manager and/or principal investigator, the contract period of performance, and the period covered by the report. Each report must include the following for each discrete task/task order:

- (a) A listing of the efforts completed during the period, and milestones reached or, if missed, an explanation provided;
- (b) Any problems or delays encountered or anticipated and recommendations for resolution. If the recommended resolution involves a contract modification, e.g., change in work requirements, level of effort (cost) or schedule delay, the contractor shall submit a separate letter to the contracting officer identifying the required change and estimated cost impact.
- (c) A summary of progress to date; and
- (d) Plans for the next reporting period.

F.4 2052.211-72 FINANCIAL STATUS REPORT (OCT 1999)

The contractor shall provide a monthly Financial Status Report (FSR) to the project officer and the contracting officer. The FSR shall include the acquisition of, or changes in the status of, contractor-held property acquired with government funds valued at the time of purchase at \$50,000 or more. Whenever these types of property changes occur, the contractor shall send a copy of the report to the Chief, Property and Acquisition Oversight Branch, Office of Administration. The report is due within 15 calendar days after the end of the report period and must identify the title of the project, the contract number, the appropriate financial tracking code (e.g., Job Code Number or JCN) specified by the NRC Project Officer, project manager and/or principal investigator, the contract period of performance, and the period covered by the report. Each report must include the following for each discrete task:

- (a) Total estimated contract amount.
- (b) Total funds obligated to date.
- (c) Total costs incurred this reporting period.
- (d) Total costs incurred to date.
- (e) Detail of all direct and indirect costs incurred during the reporting period for the entire contract or each task, if it is a task ordering contract.
- (f) Balance of obligations remaining.
- (g) Balance of funds required to complete contract/task order.
- (h) Contractor Spending Plan (CSP) status: A revised CSP is required with the Financial Status Report whenever the contractor or the contracting officer has reason to believe that the total cost for performance of this contract will be either greater or substantially less than what had been previously estimated.
 - (1) Projected percentage of completion cumulative through the report period for the project/task order as reflected in the current CSP.
 - (2) Indicate significant changes in the original CSP projection in either dollars or percentage of completion. Identify the change, the reasons for the change, whether there is any projected overrun, and when additional funds would be required. If there have been no changes to the original NRC-approved CSP projections, a written statement to that effect is sufficient in lieu of submitting a detailed response to item "h".
- (i) Property status:
 - (1) List property acquired for the project during the month with an acquisition cost between \$500 and \$49,999. Give the item number for the specific piece of equipment.
 - (2) Provide a separate list of property acquired for the project during the month with an acquisition cost of \$50,000 or more. Provide the following information for each item of property: item description or nomenclature, manufacturer, model number, serial number, acquisition cost, and receipt date. If no property was acquired during the month, include a statement to that effect. The same information must be provided for any component or peripheral equipment which is part of a "system or system unit."

(3) For multi-year projects, in the September monthly financial status report provide a cumulative listing of property with an acquisition cost of \$50,000 or more showing the information specified in paragraph (i)(2) of this clause.

(4) In the final financial status report provide a closeout property report containing the same elements as described above for the monthly financial status reports, for all property purchased with NRC funds regardless of value unless title has been vested in the contractor. If no property was acquired under the contract, provide a statement to that effect. The report should note any property requiring special handling for security, health, safety, or other reasons as part of the report.

(j) Travel status: List the starting and ending dates for each trip, the starting point and destination, and the traveler(s) for each trip.

(k) If the data in this report indicates a need for additional funding beyond that already obligated, this information may only be used as support to the official request for funding required in accordance with the Limitation of Cost (LOC) Clause (FAR 52.232-20) or the Limitation of Funds (LOF) Clause FAR 52.232-22.

F.5 PLACE OF DELIVERY--REPORTS (JUN 1988)

The items to be furnished hereunder shall be delivered, with all charges paid by the Contractor, to:

(a) Project Officer (1 copies)

Attn: Roman Shaffer
11555 Rockville Pike, Rockville MD 20852

(b) Contracting Officer (1 copy)

Attn: Donald A. King
11555 Rockville Pike, Rockville MD 20852

F.6 DURATION OF CONTRACT PERIOD (MAR 1987)

This contract shall commence on Day of Award (See Block 19c) and will expire September 30, 2009.

For Task 1, the period of performance is from Day of Award (See Block 19c), through March 31, 2008. In months, the period of performance is 19 months from the date of contract award.

If OPTIONAL TASK 2 is exercised, the period of performance is estimated to be 19 months from the exercised date.

If OPTIONAL TASK 3 is exercised, the period of performance is from exercised date through September 30, 2009.

NOTE: NRC is still working with GSA to procure equipment required to perform the work described in Section C, Statement of Work. Delivery of the system to NRC is anticipated to be as early as October 2005, but could be as late as December 2005. Because this contract may be in idle for several months after contract award, the contractor shall plan accordingly.

SECTION G - CONTRACT ADMINISTRATION DATA**G.1 PROJECT OFFICER AUTHORITY (FEB 2004)**

(a) The contracting officer's authorized representative hereinafter referred to as the project officer for this contract is:

Name: Roman Shaffer
Address: U.S. Nuclear Regulatory Commission
Mail Stop: T10-D20
11555 Rockville Pike
Rockville, MD 20852
Telephone Number: 301-415-7606

(b) Performance of the work under this contract is subject to the technical direction of the NRC project officer. The term technical direction is defined to include the following:

(1) Technical direction to the contractor which shifts work emphasis between areas of work or tasks, authorizes travel which was unanticipated in the Schedule (i.e., travel not contemplated in the Statement of Work (SOW) or changes to specific travel identified in the SOW), fills in details, or otherwise serves to accomplish the contractual SOW.

(2) Provide advice and guidance to the contractor in the preparation of drawings, specifications, or technical portions of the work description.

(3) Review and, where required by the contract, approval of technical reports, drawings, specifications, and technical information to be delivered by the contractor to the Government under the contract.

(c) Technical direction must be within the general statement of work stated in the contract. The project officer does not have the authority to and may not issue any technical direction which:

(1) Constitutes an assignment of work outside the general scope of the contract.

(2) Constitutes a change as defined in the "Changes" clause of this contract.

(3) In any way causes an increase or decrease in the total estimated contract cost, the fixed fee, if any, or the time required for contract performance.

(4) Changes any of the expressed terms, conditions, or specifications of the contract.

(5) Terminates the contract, settles any claim or dispute arising under the contract, or issues any unilateral directive whatever.

(d) All technical directions must be issued in writing by the project officer or must be confirmed by the project officer in writing within ten (10) working days after verbal issuance. A copy of the written direction must be furnished to the contracting officer. A copy of NRC Form 445, Request for Approval of Official Foreign Travel, which has received final approval from the NRC must be furnished to the contracting officer.

(e) The contractor shall proceed promptly with the performance of technical directions duly issued by the project officer in the manner prescribed by this clause and within the project officer's authority under the provisions of this clause.

(f) If, in the opinion of the contractor, any instruction or direction issued by the project officer is within one of the categories as defined in paragraph (c) of this section, the contractor may not proceed but shall notify the contracting officer in writing within five (5) working days after the receipt of any instruction or direction and shall request the contracting officer to modify the contract accordingly. Upon receiving the notification from the contractor, the contracting officer shall issue an appropriate contract modification or advise the contractor in writing that, in the contracting officer's opinion, the technical direction is within the scope of this article and does not constitute a change under the "Changes" clause.

(g) Any unauthorized commitment or direction issued by the project officer may result in an unnecessary delay in the contractor's performance and may even result in the contractor expending funds for unallowable costs under the contract.

(h) A failure of the parties to agree upon the nature of the instruction or direction or upon the contract action to be taken with respect thereto is subject to 52.233.1 . Disputes.

(i) In addition to providing technical direction as defined in paragraph (b) of the section, the project officer shall:

(1) Monitor the contractor's technical progress, including surveillance and assessment of performance, and recommend to the contracting officer changes in requirements.

(2) Assist the contractor in the resolution of technical problems encountered during performance.

(3) Review all costs requested for reimbursement by the contractor and submit to the contracting officer recommendations for approval, disapproval, or suspension of payment for supplies and services required under this contract.

(4) Assist the contractor in obtaining the badges for the contractor personnel.

(5) Immediately notify the Security Branch, Division of Facilities and Security (SB/DFS) (via e-mail) when a contractor employee no longer requires access authorization and return of any NRC issued badge to SB/DFS within three days after their termination.

(6) Ensure that all contractor employees that require access to classified Restricted Data or National Security Information or matter, access to sensitive unclassified information (Safeguards, Official Use Only, and Proprietary information) access to sensitive IT systems or data, unescorted access to NRC controlled buildings/space, or unescorted access to protected and vital areas of nuclear power plants receive approval of SB/DFS prior to access in accordance with Management Directive and Handbook 12.3.

G.2 2052.215-77 TRAVEL APPROVALS AND REIMBURSEMENT (OCT 1999)

(a) All foreign travel must be approved in advance by the NRC on NRC Form 445, Request for Approval of Official Foreign Travel, and must be in compliance with FAR 52.247-63 Preference for U.S. Flag Air Carriers. The contractor shall submit NRC Form 445 to the NRC no later than 30 days before beginning travel.

SECTION H - SPECIAL CONTRACT REQUIREMENTS**H.1 2052.209-72 CONTRACTOR ORGANIZATIONAL CONFLICTS OF INTEREST (JAN 1993)**

(a) Purpose. The primary purpose of this clause is to aid in ensuring that the contractor:

(1) Is not placed in a conflicting role because of current or planned interests (financial, contractual, organizational, or otherwise) which relate to the work under this contract; and

(2) Does not obtain an unfair competitive advantage over other parties by virtue of its performance of this contract.

(b) Scope. The restrictions described apply to performance or participation by the contractor, as defined in 48 CFR 2009.570-2 in the activities covered by this clause.

(c) Work for others.

(1) Notwithstanding any other provision of this contract, during the term of this contract, the contractor agrees to forego entering into consulting or other contractual arrangements with any firm or organization the result of which may give rise to a conflict of interest with respect to the work being performed under this contract. The contractor shall ensure that all employees under this contract abide by the provision of this clause. If the contractor has reason to believe, with respect to itself or any employee, that any proposed consultant or other contractual arrangement with any firm or organization may involve a potential conflict of interest, the contractor shall obtain the written approval of the contracting officer before the execution of such contractual arrangement.

(2) The contractor may not represent, assist, or otherwise support an NRC licensee or applicant undergoing an NRC audit, inspection, or review where the activities that are the subject of the audit, inspection, or review are the same as or substantially similar to the services within the scope of this contract (or task order as appropriate) except where the NRC licensee or applicant requires the contractor's support to explain or defend the contractor's prior work for the utility or other entity which NRC questions.

(3) When the contractor performs work for the NRC under this contract at any NRC licensee or applicant site, the contractor shall neither solicit nor perform work in the same or similar technical area for that licensee or applicant organization for a period commencing with the award of the task order or beginning of work on the site (if not a task order contract) and ending one year after completion of all work under the associated task order, or last time at the site (if not a task order contract).

(4) When the contractor performs work for the NRC under this contract at any NRC licensee or applicant site,

(i) The contractor may not solicit work at that site for that licensee or applicant during the period of performance of the task order or the contract, as appropriate.

(ii) The contractor may not perform work at that site for that licensee or applicant during the period of performance of the task order or the contract, as appropriate, and for one year thereafter.

(iii) Notwithstanding the foregoing, the contracting officer may authorize the contractor to solicit or perform this type of work (except work in the same or similar technical area) if the contracting officer determines that the situation will not pose a potential for technical bias or unfair competitive advantage.

(d) Disclosure after award.

(1) The contractor warrants that to the best of its knowledge and belief, and except as otherwise set forth in this contract, that it does not have any organizational conflicts of interest as defined in 48 CFR 2009.570-2.

(2) The contractor agrees that if, after award, it discovers organizational conflicts of interest with respect to this contract, it shall make an immediate and full disclosure in writing to the contracting officer. This statement must include a description of the action which the contractor has taken or proposes to take to avoid or mitigate such conflicts. The NRC may, however, terminate the contract if termination is in the best interest of the Government.

(3) It is recognized that the scope of work of a task-order-type contract necessarily encompasses a broad spectrum of activities. Consequently, if this is a task-order-type contract, the contractor agrees that it will disclose all proposed new work involving NRC licensees or applicants which comes within the scope of work of the underlying contract. Further, if this contract involves work at a licensee or applicant site, the contractor agrees to exercise diligence to discover and disclose any new work at that licensee or applicant site. This disclosure must be made before the submission of a bid or proposal to the utility or other regulated entity and must be received by the NRC at least 15 days before the proposed award date in any event, unless a written justification demonstrating urgency and due diligence to discover and disclose is provided by the contractor and approved by the contracting officer. The disclosure must include the statement of work, the dollar value of the proposed contract, and any other documents that are needed to fully describe the proposed work for the regulated utility or other regulated entity. NRC may deny approval of the disclosed work only when the NRC has issued a task order which includes the technical area and, if site-specific, the site, or has plans to issue a task order which includes the technical area and, if site-specific, the site, or when the work violates paragraphs (c)(2), (c)(3) or (c)(4) of this section.

(e) Access to and use of information.

(1) If in the performance of this contract, the contractor obtains access to information, such as NRC plans, policies, reports, studies, financial plans, internal data protected by the Privacy Act of 1974 (5 U.S.C. Section 552a (1988)), or the Freedom of Information Act (5 U.S.C. Section 552 (1986)), the contractor agrees not to:

(i) Use this information for any private purpose until the information has been released to the public;

(ii) Compete for work for the Commission based on the information for a period of six months after either the completion of this contract or the release of the information to the public, whichever is first;

(iii) Submit an unsolicited proposal to the Government based on the information until one year after the release of the information to the public; or

(iv) Release the information without prior written approval by the contracting officer unless the information has previously been released to the public by the NRC.

(2) In addition, the contractor agrees that, to the extent it receives or is given access to proprietary data, data protected by the Privacy Act of 1974 (5 U.S.C. Section 552a (1988)), or the Freedom of Information Act (5 U.S.C. Section 552 (1986)), or other confidential or privileged technical, business, or financial information under this contract, the contractor shall treat the information in accordance with restrictions placed on use of the information.

(b) The contractor must receive written approval from the NRC Project Officer before taking travel that was unanticipated in the Schedule (i.e., travel not contemplated in the Statement of Work, or changes to specific travel identified in the Statement of Work).

(c) The contractor will be reimbursed only for those travel costs incurred that are directly related to this contract and are allowable subject to the limitations prescribed in FAR 31.205-46.

(d) It is the responsibility of the contractor to notify the contracting officer in accordance with the Limitations of Cost clause of this contract when, at any time, the contractor learns that travel expenses will cause the contractor to exceed the estimated costs specified in the Schedule.

(e) Reasonable travel costs for research and related activities performed at State and nonprofit institutions, in accordance with Section 12 of Pub. L. 100-679, shall be charged in accordance with the contractor's institutional policy to the degree that the limitations of Office of Management and Budget (OMB) guidance are not exceeded. Applicable guidance documents include OMB Circular A-87, Cost Principles for State and Local Governments; OMB Circular A-122, Cost Principles for Nonprofit Organizations; and OMB Circular A-21, Cost Principles for Educational Institutions.

G.3 2052.216-71 INDIRECT COST RATES-ALTERNATE 1 (JAN 1993)

The contractor is reimbursed for allowable indirect costs in accordance with the following predetermined rates:

INDIRECT COST POOL	RATE	BASE	PERIOD
Fringe Benefit (Faculty)	[REDACTED]	Day of Award	Contract Expiration
Fringe Benefit (Wage)	[REDACTED]	Day of Award	Contract Expiration
Facilities and Administrative (Indirect/Overhead)	[REDACTED]	Day of Award	Contract Expiration

(3) Subject to patent and security provisions of this contract, the contractor shall have the right to use technical data it produces under this contract for private purposes provided that all requirements of this contract have been met.

(f) Subcontracts. Except as provided in 48 CFR 2009.570-2, the contractor shall include this clause, including this paragraph, in subcontracts of any tier. The terms contract, contractor, and contracting officer, must be appropriately modified to preserve the Government's rights.

(g) Remedies. For breach of any of the above restrictions, or for intentional nondisclosure or misrepresentation of any relevant interest required to be disclosed concerning this contract or for such erroneous representations that necessarily imply bad faith, the Government may terminate the contract for default, disqualify the contractor from subsequent contractual efforts, and pursue other remedies permitted by law or this contract.

(h) Waiver. A request for waiver under this clause must be directed in writing to the contracting officer in accordance with the procedures outlined in 48 CFR 2009.570-9.

(i) Follow-on effort. The contractor shall be ineligible to participate in NRC contracts, subcontracts, or proposals therefor (solicited or unsolicited), which stem directly from the contractor's performance of work under this contract. Furthermore, unless so directed in writing by the contracting officer, the contractor may not perform any technical consulting or management support services work or evaluation activities under this contract on any of its products or services or the products or services of another firm if the contractor has been substantially involved in the development or marketing of the products or services.

(1) If the contractor, under this contract, prepares a complete or essentially complete statement of work or specifications, the contractor is not eligible to perform or participate in the initial contractual effort which is based on the statement of work or specifications. The contractor may not incorporate its products or services in the statement of work or specifications unless so directed in writing by the contracting officer, in which case the restrictions in this paragraph do not apply.

(2) Nothing in this paragraph precludes the contractor from offering or selling its standard commercial items to the Government.

H.2 2052.215-70 KEY PERSONNEL (JAN 1993)

(a) The following individuals are considered to be essential to the successful performance of the work hereunder:



The contractor agrees that personnel may not be removed from the contract work or replaced without compliance with paragraphs (b) and (c) of this section.

(b) If one or more of the key personnel, for whatever reason, becomes, or is expected to become, unavailable for work under this contract for a continuous period exceeding 30 work days, or is expected to devote substantially less effort to the work than indicated in the proposal or initially anticipated, the contractor shall immediately notify the contracting officer and shall, subject to the concurrence of the contracting officer, promptly replace the personnel with personnel of at least substantially equal ability and qualifications.

(c) Each request for approval of substitutions must be in writing and contain a detailed explanation of the circumstances necessitating the proposed substitutions. The request must also contain a complete resume for the proposed substitute and other information requested or needed by the contracting officer to evaluate the proposed substitution. The contracting officer and the project officer shall evaluate the contractor's request and the contracting officer shall promptly notify the contractor of his or her decision in writing.

(d) If the contracting officer determines that suitable and timely replacement of key personnel who have been reassigned, terminated, or have otherwise become unavailable for the contract work is not reasonably forthcoming, or that the resultant reduction of productive effort would be so substantial as to impair the successful completion of the contract or the service order, the contract may be terminated by the contracting officer for default or for the convenience of the Government, as appropriate. If the contracting officer finds the contractor at fault for the condition, the contract price or fixed fee may be equitably adjusted downward to compensate the Government for any resultant delay, loss, or damage.

H.3 2052.235-71 SAFETY, HEALTH, AND FIRE PROTECTION (JAN 1993)

The contractor shall take all reasonable precautions in the performance of the work under this contract to protect the health and safety of its employees and of members of the public, including NRC employees and contractor personnel, and to minimize danger from all hazards to life and property. The contractor shall comply with all applicable health, safety, and fire protection regulations and requirements (including reporting requirements) of the Commission and the Department of Labor. If the contractor fails to comply with these regulations or requirements, the contracting office may, without prejudice to any other legal or contractual rights of the Commission, issue an order stopping all or any part of the work. Thereafter, a start work order for resumption of work may be issued at the discretion of the contracting officer. The contractor may not make a claim for an extension of time or for compensation or damages by reason of, or in connection with, this type of work stoppage.

H.4 GOVERNMENT FURNISHED EQUIPMENT/PROPERTY (JANUARY 2001)

(a) The NRC will provide the contractor with the following items for use under this contract:

For TASK 1 of this statement of work, the following materials will be furnished to Contractor. Identifying information will be provided to Contractor after contract award to protect proprietary information.

1. PDF versions of Refs. 1 through 6 and 8, listed in Section XII, REFERENCES
2. Commercial test software (e.g., simulation software, development kits)
3. Commercial test hardware (e.g., emulator, logic analyzer)
4. Government Furnished Equipment #1 (GFE #1)

5. Vendor documentation for GFE #1
6. Vendor portable/mobile test equipment for GFE #1
7. Dynamic simulation model of plant process, e.g., RELAP, TRACE, Simulink model(s)
8. Nuclear Regulatory documents germane to the assessment of GFE #1, as required, e.g., Safety Evaluation Report(s), Regulatory Guides, NUREGs, Management Directives.

If OPTIONAL TASKS 2 and/or 3 are/is funded, the following items will be provided to Contractor, as applicable.

9. Government Furnished Equipment #2 (GFE #2)
10. Vendor documentation for GFE #2
11. Vendor portable/mobile test equipment for GFE #2
12. Dynamic simulation model of plant process, e.g., RELAP, TRACE, Simulink model(s)
13. Nuclear Regulatory documents germane to the assessment of GFE #2, as required, e.g., Safety Evaluation Report(s), Regulatory Guides, NUREGs, Management Directives.
14. Government Furnished Equipment #3 (GFE #3)
15. Vendor documentation for GFE #3.
16. Vendor portable/mobile test equipment for GFE #3
17. Dynamic simulation model of plant process, e.g., RELAP, TRACE, Simulink model(s)
18. Nuclear Regulatory documents germane to the assessment of GFE #3, as required, e.g., Safety Evaluation Report(s), Regulatory Guides, NUREGs, Management Directives.

(b) The above listed equipment/property is hereby transferred from contract/agreement .

(c) Only the equipment/property listed above in the quantities shown will be provided by the Government. The contractor shall be responsible and accountable for all Government property provided under this contract and shall comply with the provisions of the FAR Government Property Clause under this contract and FAR Subpart 45.5, as in effect on the date of this contract. The contractor shall investigate and provide written notification to the NRC Contracting Officer (CO) and the NRC Division of Facilities and Security, Physical Security Branch of all cases of loss, damage, or destruction of Government property in its possession or control not later than 24 hours after discovery. The contractor must report stolen Government property to the local police and a copy of the police report must be provided to the CO and to the Division of Facilities and Security, Physical Security Branch.

(d) All other equipment/property required in performance of the contract shall be furnished by the Contractor.

H.5 SEAT BELTS

Contractors, subcontractors, and grantees, are encouraged to adopt and enforce on-the-job seat belt policies and programs for their employees when operating company-owned, rented, or personally owned vehicles.

H.6 Annual and Final Contractor Performance Evaluations

Annual and final evaluations of contractor performance under this contract will be prepared in accordance with FAR 42.15, "Contractor Performance Information," normally at the time the contractor is notified of the NRC's intent to exercise the contract option. If the multi-year contract does not have option years, then an annual evaluation will be prepared (state time for annual evaluation). Final evaluations of contractor performance will be prepared at the expiration of the contract during the contract closeout process.

The Contracting Officer will transmit the NRC Project Officer's annual and final contractor performance evaluations to the contractor's Project Manager, unless otherwise instructed by the contractor. The contractor will be permitted thirty days to review the document. The contractor may concur without comment, submit additional information, or request a meeting to discuss the performance evaluation. The Contracting Officer may request the contractor's Project Manager to attend a meeting to discuss the performance evaluation.

Where a contractor concurs with, or takes no exception to an annual performance evaluation, the Contracting Officer will consider such evaluation final and releasable for source selection purposes. Disagreements between the parties regarding a performance evaluation will be referred to an individual one level above the Contracting Officer, whose decision will be final.

The Contracting Officer will send a copy of the completed evaluation report, marked "For Official Use Only," to the contractor's Project Manager for their records as soon as practicable after it has been finalized. The completed evaluation report also will be used as a tool to improve communications between the NRC and the contractor and to improve contract performance.

The completed annual performance evaluation will be used to support future award decisions in accordance with FAR 42.1502(a) and 42.1503(c). During the period the information is being used to provide source selection information, the completed annual performance evaluation will be released to only two parties - the Federal government personnel performing the source selection evaluation and the contractor under evaluation if the contractor does not have a copy of the report already.

H.7 Compliance with U.S. Immigration Laws and Regulations

NRC contractors are responsible to ensure that their alien personnel are not in violation of United States Immigration and Naturalization (INS) laws and regulations, including employment authorization documents and visa requirements. Each alien employee of the Contractor must be lawfully admitted for permanent residence as evidenced by Alien Registration Receipt Card Form 1-151 or must present other evidence from the Immigration and Naturalization Services that employment will not affect his/her immigration status. The INS Office of Business Liaison (OBL) provides information to contractors to help them understand the employment eligibility verification process for non-US citizens. This information can be found on the INS website, <http://www.ins.usdoj.gov/graphics/services/employerinfo/index.htm#obl>.

The NRC reserves the right to deny or withdraw Contractor use or access to NRC facilities or its equipment/services, and/or take any number of contract administrative actions (e.g., disallow costs, terminate for cause) should the Contractor violate the Contractor's responsibility under this clause.

(End of Clause)

H.8 NRC INFORMATION TECHNOLOGY SECURITY TRAINING (AUG 2003)

NRC contractors shall ensure that their employees, consultants, and subcontractors with access to the agency's information technology (IT) equipment and/or IT services complete NRC's online initial and refresher IT security training requirements to ensure that their knowledge of IT threats, vulnerabilities, and associated countermeasures remains current. Both the initial and refresher IT security training courses generally last an hour or less and can be taken during the employee's regularly scheduled work day.

Contractor employees, consultants, and subcontractors shall complete the NRC's online, "Computer Security Awareness" course on the same day that they receive access to the agency's IT equipment and/or services, as their first action using the equipment/service. For those contractor employees, consultants, and subcontractors who are already working under this contract, the on-line training must be completed in accordance with agency Network Announcements issued throughout the year 2003 within three weeks of issuance of this modification.

Contractor employees, consultants, and subcontractors who have been granted access to NRC information technology equipment and/or IT services must continue to take IT security refresher training offered online by the NRC throughout the term of the contract. Contractor employees will receive notice of NRC's online IT security refresher training requirements through agency-wide notices.

The NRC reserves the right to deny or withdraw Contractor use or access to NRC IT equipment and/or services, and/or take other appropriate contract administrative actions (e.g., disallow costs, terminate for cause) should the Contractor violate the Contractor's responsibility under this clause.

H.9 PROPRIETARY DATA AND SENSITIVE UNCLASSIFIED INFORMATION

In connection with performance of the work under this contract, the Contractor may be furnished, or may develop or acquire, proprietary data (trade secrets) or confidential or privileged technical, business, or financial information, including Commission plans, policies, reports, financial plans, internal data protected by the Privacy Act of 1974 (P.L. 93.579), or other information which has not been released to the public or has been determined by the Commission to be otherwise exempt from disclosure to the public.

The Contractor agrees to hold such information in confidence and not to directly or indirectly duplicate, disseminate, or disclose such information in whole or in part to any other person or organization except as may be necessary to perform the work under this contract. The Contractor agrees to return such information to the Commission or otherwise dispose of it, either as the Contracting Officer may from time to time direct during the progress of the work, or in any event, as the Contracting Officer shall direct upon completion or termination of this contract. Failure to comply with this clause shall be grounds for termination of this contract."

Prior to the provision of any proprietary information, the contractor's employees and employees of any subcontractor who will have access to such information shall execute and be bound by a formal, written non-disclosure agreement.

(End of Clause)

H.10 2052.235-70 PUBLICATION OF RESEARCH RESULTS (OCT 1999)

(a) The principal investigator(s)/contractor shall comply with the provisions of NRC Management Directive 3.8 (Vol. 3, Part 1) and NRC Handbook 3.8 (Parts I-IV) regarding publication in refereed scientific and engineering journals or dissemination to the public of any information, oral or written, concerning the work performed under this contract. Failure to comply with this clause shall be grounds for termination of this contract.

(b) The principal investigator(s)/contractor may publish the results of this work in refereed scientific and engineering journals or in open literature and present papers at public or association meetings at interim stages of work, in addition to submitting to NRC the final reports and other deliverables required under this contract. However, such publication and papers shall focus on advances in science and technology and minimize conclusions and/or recommendations which may have regulatory implications.

(c) The principal investigator(s) shall coordinate all such publications with, and transmit a copy of the proposed article or paper to, the NRC Contracting Officer or Project Officer, prior to publication. The NRC agrees to review and provide comments within thirty (30) days after receipt of a proposed publication. However, in those cases where the information to be published is (1) subject to Commission approval, (2) has not been ruled upon, or (3) disapproved by the Commission, the NRC reserves the right to disapprove or delay the publication. Further, if the NRC disagrees with the proposed publication for any reason, it reserves the right to require that any publication not identify the NRC's sponsorship of the work and that any associated publication costs shall be borne by the contractor.

H.11 REVIEW AND APPROVAL OF REPORTS

(a) Reporting Requirements. The contractor/grantee shall comply with the terms and conditions of the contract/grant regarding the contents of the draft and final report, summaries, data, and related documents, to include correcting, deleting, editing, revising, modifying, formatting, and supplementing any of the information contained therein, at no additional cost to the NRC. Performance under the contract/grant will not be deemed accepted or completed until it complies with the NRC's directions. The reports, summaries, data, and related documents will be considered draft until approved by the NRC. The contractor/grantee agrees that the direction, determinations, and decisions on approval or disapproval of reports, summaries, data, and related documents created under this contract/grant remain solely within the discretion of the NRC.

(b) Publication of Results. Prior to any dissemination, display, publication, or release of articles, reports, summaries, data, or related documents developed under the contract/grant, the contractor/grantee shall submit them to the NRC for review and approval. The contractor/grantee shall not release, disseminate, display or publish articles, reports, summaries, data, and related documents, or the contents therein, that have not been reviewed and approved by the NRC for release, display, dissemination or publication. The contractor/grantee agrees to conspicuously place any disclaimers, markings or notices, directed by the NRC, on any articles, reports, summaries, data, and related documents that the contractor/grantee intends to release, display, disseminate or publish to other persons, the public, or any other entities. The contractor/grantee agrees, and grants, a royalty-free, nonexclusive, irrevocable worldwide license to the government, to use, reproduce, modify, distribute, prepare derivative works, release, display or disclose the articles, reports, summaries, data, and related documents developed under the contract/grant, for any governmental purpose and to have or authorize others to do so.

(c) Identification/Marking of Sensitive Unclassified and Safeguards Information. The decision, determination, or direction by the NRC that information possessed, formulated or produced by the contractor/grantee constitutes sensitive unclassified or safeguards information is solely within the authority and discretion of the NRC. In performing the contract/grant, the contractor/grantee shall clearly mark sensitive unclassified and safeguards information, to include for example, "OUO-Allegation Information" or "OUO-Security Related Information" on any reports, documents, designs, data, materials, and written information, as directed by the NRC. In addition to marking the information as directed by the NRC, the contractor shall use the applicable NRC cover sheet (e.g., NRC Form 461 "Safeguards Information") in maintaining these records and documents. The contractor/grantee shall ensure that sensitive unclassified and safeguards information is handled, maintained and protected from unauthorized disclosure, consistent with NRC policies and directions. The contractor/grantee shall comply with the requirements to mark, maintain, and protect all information, including documents, summaries, reports, data, designs, and materials in accordance with the provisions of Section 147

of the Atomic Energy Act of 1954 as amended, its implementing regulations (10 CFR 73.21), Sensitive Unclassified and Non-Safeguards Information policies, and NRC Management Directive and Handbook 12.6.

(d) Remedies. In addition to any civil, criminal, and contractual remedies available under the applicable laws and regulations, failure to comply with the above provisions, and/or NRC directions, may result in suspension, withholding, or offsetting of any payments invoiced or claimed by the contractor/grantee. If the contractor/grantee intends to enter into any subcontracts or other agreements to perform this contract/grant, the contractor/grantee shall include all of the above provisions in any subcontracts or agreements.

(c) Identification/Marking of Sensitive Unclassified and Safeguards Information. The decision, determination, or direction by the NRC that information possessed, formulated or produced by the contractor/grantee constitutes sensitive unclassified or safeguards information is solely within the authority and discretion of the NRC. In performing the contract/grant, the contractor/grantee shall clearly mark sensitive unclassified and safeguards information, to include for example, "OUO-Allegation Information" or "OUO-Security Related Information" on any reports, documents, designs, data, materials, and written information, as directed by the NRC. In addition to marking the information as directed by the NRC, the contractor shall use the applicable NRC cover sheet (e.g., NRC Form 461 "Safeguards Information") in maintaining these records and documents. The contractor/grantee shall ensure that sensitive unclassified and safeguards information is handled, maintained and protected from unauthorized disclosure, consistent with NRC policies and directions. The contractor/grantee shall comply with the requirements to mark, maintain, and protect all information, including documents, summaries, reports, data, designs, and materials in accordance with the provisions of Section 147 of the Atomic Energy Act of 1954 as amended, its implementing regulations (10 CFR 73.21), Sensitive Unclassified and Non-Safeguards Information policies, and NRC Management Directive and Handbook 12.6.

(d) Remedies. In addition to any civil, criminal, and contractual remedies available under the applicable laws and regulations, failure to comply with the above provisions, and/or NRC directions, may result in suspension, withholding, or offsetting of any payments invoiced or claimed by the contractor/grantee. If the contractor/grantee intends to enter into any subcontracts or other agreements to perform this contract/grant, the contractor/grantee shall include all of the above provisions in any subcontracts or agreements.

H.12 WHISTLEBLOWER PROTECTION FOR NRC CONTRACTOR AND SUBCONTRACTOR EMPLOYEES.

a) The U.S. Nuclear Regulatory Commission (NRC) contractor and its subcontractor are subject to the Whistleblower Employee Protection public law provisions as codified at 42 U.S.C. 5851. NRC contractor(s) and subcontractor(s) shall comply with the requirements of this Whistleblower Employee Protection law, and the implementing regulations of the NRC and the Department of Labor (DOL). See, for example, DOL Procedures on Handling Complaints at 29 C.F.R. Part 24 concerning the employer obligations, prohibited acts, DOL procedures and the requirement for prominent posting of notice of Employee Rights at Appendix A to Part 24.

b) Under this Whistleblower Employee Protection law, as implemented by regulations, NRC contractor and subcontractor employees are protected from discharge, reprisal, threats, intimidation, coercion, blacklisting or other employment discrimination practices with respect to compensation, terms, conditions or privileges of their employment because the contractor or subcontractor employee(s) has provided notice to the employer, refused to engage in unlawful practices, assisted in proceedings or testified on activities concerning alleged violations of the Atomic Energy Act of 1954 (as amended) and the Energy Reorganization Act of 1974 (as amended).

c) The contractor shall insert this or the substance of this clause in any subcontracts involving work performed under this contract.

PART II - CONTRACT CLAUSES**SECTION I - CONTRACT CLAUSES****I.1 NOTICE LISTING CONTRACT CLAUSES INCORPORATED BY REFERENCE**

The following contract clauses pertinent to this section are hereby incorporated by reference (by Citation Number, Title, and Date) in accordance with the clause at FAR "52.252-2 CLAUSES INCORPORATED BY REFERENCE" in Section I of this contract. See FAR 52.252-2 for an internet address (if specified) for electronic access to the full text of a clause.

NUMBER	TITLE	DATE
	FEDERAL ACQUISITION REGULATION (48 CFR Chapter 1)	
52.202-1	DEFINITIONS	JUL 2004
52.203-3	GRATUITIES	APR 1984
52.203-5	COVENANT AGAINST CONTINGENT FEES	APR 1984
52.203-6	RESTRICTIONS ON SUBCONTRACTOR SALES TO THE GOVERNMENT	JUL 1995
52.203-7	ANTI-KICKBACK PROCEDURES	JUL 1995
52.203-8	CANCELLATION, RESCISSION, AND RECOVERY OF FUNDS FOR ILLEGAL OR IMPROPER ACTIVITY	JAN 1997
52.203-10	PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY	JAN 1997
52.203-12	LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS	SEP 2005
52.204-4	PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER	AUG 2000
52.204-7	CENTRAL CONTRACTOR REGISTRATION (OCT 2003)	OCT 2003
52.209-6	PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT	JAN 2005
52.215-2	AUDIT AND RECORDS--NEGOTIATION ALTERNATE II (APR 1998)	JUN 1999
52.215-8	ORDER OF PRECEDENCE--UNIFORM CONTRACT FORMAT	OCT 1997
52.215-10	PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA	OCT 1997
52.215-12	SUBCONTRACTOR COST OR PRICING DATA	OCT 1997
52.215-15	PENSION ADJUSTMENTS AND ASSET REVERSIONS (JAN 2004)	OCT 2004
52.215-18	REVERSION OR ADJUSTMENT OF PLANS FOR POSTRETIREMENT BENEFITS OTHER THAN PENSIONS (PRB)	JUL 2005
52.215-19	NOTIFICATION OF OWNERSHIP CHANGES	OCT 1997

52.216-7	ALLOWABLE COST AND PAYMENT *	DEC 2002
	<i>*Refer to (a)(1) and replace reference to Subpart 31.2 with Subpart 31.3</i>	
52.216-11	COST CONTRACT--NO FEE ALTERNATE 1 (APR 1984)	APR 1984
52.219-4	NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS	JUL 2005
52.219-8	UTILIZATION OF SMALL BUSINESS CONCERNS	MAY 2004
52.219-9	SMALL BUSINESS SUBCONTRACTING PLAN ALTERNATE II (OCT 2001)	JUL 2005
52.219-16	LIQUIDATED DAMAGES--SMALL BUSINESS SUBCONTRACTING PLAN	JAN 1999
52.222-3	CONVICT LABOR	JUN 2003
52.222-21	PROHIBITION OF SEGREGATED FACILITIES	FEB 1999
52.222-26	EQUAL OPPORTUNITY	APR 2002
52.222-35	EQUAL OPPORTUNITY FOR SPECIAL DISABLED VETERANS, OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS	DEC 2001
52.222-36	AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES	JUN 1998
52.222-37	EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS	DEC 2001
52.223-6	DRUG-FREE WORKPLACE	MAY 2001
52.225-1	BUY AMERICAN ACT--SUPPLIES	JUN 2003
52.225-13	RESTRICTIONS ON CERTAIN FOREIGN PURCHASES	FEB 2006
52.227-1	AUTHORIZATION AND CONSENT ALTERNATE I (APR 1984)	JUL 1995
52.227-2	NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT	AUG 1996
52.227-11	PATENT RIGHTS -- RETENTION BY THE CONTRACTOR (SHORT FORM)	JUN 1997
52.228-7	INSURANCE--LIABILITY TO THIRD PERSONS	MAR 1996
52.232-17	INTEREST	JUN 1996
52.232-18	AVAILABILITY OF FUNDS	APR 1984
52.232-22	LIMITATION OF FUNDS	APR 1984
52.232-23	ASSIGNMENT OF CLAIMS	JAN 1986
52.232-33	PAYMENT BY ELECTRONIC FUNDS--CENTRAL CONTRACTOR REGISTRATION	OCT 2003
52.233-3	PROTEST AFTER AWARD ALTERNATE I (JUN 1985)	AUG 1996
52.233-4	APPLICABLE LAW FOR BREACH OF CONTRACT CLAIM	OCT 2004
52.242-1	NOTICE OF INTENT TO DISALLOW COSTS	APR 1984
52.242-3	PENALTIES FOR UNALLOWABLE COSTS	MAY 2001
52.242-13	BANKRUPTCY	JUL 1995
52.243-2	CHANGES--COST REIMBURSEMENT ALTERNATE V (APR 1984)	AUG 1987
52.244-2A	SUBCONTRACTS ALTERNATE I (JAN 2006)	JAN 2006
52.244-5	COMPETITION IN SUBCONTRACTING	DEC 1996
52.244-6	SUBCONTRACTS FOR COMMERCIAL ITEMS AND COMMERCIAL COMPONENTS	FEB 2006
52.245-5	GOVERNMENT PROPERTY (COST-REIMBURSEMENT,	JUL 1985

	TIME-AND-MATERIAL OR LABOR-HOUR CONTRACTS)	
	ALTERNATE I (JUL 1985)	
52.245-9	USE AND CHARGES	AUG 2005
52.246-23	LIMITATION OF LIABILITY	FEB 1997
52.246-25	LIMITATION OF LIABILITY--SERVICES	FEB 1997
52.249-5	TERMINATION FOR CONVENIENCE OF THE GOVERNMENT (EDUCATIONAL AND OTHER NONPROFIT INSTITUTIONS)	SEP 1996
52.253-1	COMPUTER GENERATED FORMS	JAN 1991

I.2 52.232-25 PROMPT PAYMENT (OCT 2003)

Notwithstanding any other payment clause in this contract, the Government will make invoice payments under the terms and conditions specified in this clause. The Government considers payment as being made on the day a check is dated or the date of an electronic funds transfer (EFT). Definitions of pertinent terms are set forth in sections 2.101, 32.001, and 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see paragraph (a)(4) of this clause concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments--

(1) Due date.

(i) Except as indicated in paragraphs (a)(2) and (c) of this clause, the due date for making invoice payments by the designated payment office is the later of the following two events:

(A) The 30th day after the designated billing office receives a proper invoice from the Contractor (except as provided in paragraph (a)(1)(ii) of this clause).

(B) The 30th day after Government acceptance of supplies delivered or services performed. For a final invoice, when the payment amount is subject to contract settlement actions, acceptance is deemed to occur on the effective date of the contract settlement.

(ii) If the designated billing office fails to annotate the invoice with the actual date of receipt at the time of receipt, the invoice payment due date is the 30th day after the date of the Contractor's invoice, provided the designated billing office receives a proper invoice and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(2) Certain food products and other payments.

(i) Due dates on Contractor invoices for meat, meat food products, or fish; perishable agricultural commodities; and dairy products, edible fats or oils, and food products prepared from edible fats or oils are--

(A) For meat or meat food products, as defined in section 2(a)(3) of the Packers and Stockyard Act of 1921 (7 U.S.C. 182(3)), and as further defined in Pub. L. 98-181, including any edible fresh or frozen poultry meat, any perishable poultry meat food product, fresh eggs, and any perishable egg product, as close as possible to, but not later than, the 7th day after product delivery.

(B) For fresh or frozen fish, as defined in section 204(3) of the Fish and Seafood Promotion Act of 1986 (16 U.S.C. 4003(3)), as close as possible to, but not later than, the 7th day after product delivery.

(C) For perishable agricultural commodities, as defined in section 1(4) of the Perishable Agricultural Commodities Act of 1930 (7 U.S.C. 499a(4)), as close as possible to, but not later than, the 10th day after product delivery, unless another date is specified in the contract.

(D) For dairy products, as defined in section 111(e) of the Dairy Production Stabilization Act of 1983 (7 U.S.C. 4502(e)), edible fats or oils, and food products prepared from edible fats or oils, as close as possible to, but not later than, the 10th day after the date on which a proper invoice has been received. Liquid milk, cheese, certain processed cheese products, butter, yogurt, ice cream, mayonnaise, salad dressings, and other similar products, fall within this classification. Nothing in the Act limits this classification to refrigerated products. When questions arise regarding the proper classification of a specific product, prevailing industry practices will be followed in specifying a contract payment due date. The burden of proof that a classification of a specific product is, in fact, prevailing industry practice is upon the Contractor making the representation.

(ii) If the contract does not require submission of an invoice for payment (e.g., periodic lease payments), the due date will be as specified in the contract.

(3) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in paragraphs (a)(3)(i) through (a)(3)(x) of this clause. If the invoice does not comply with these requirements, the designated billing office will return it within 7 days after receipt (3 days for meat, meat food products, or fish; 5 days for perishable agricultural commodities, dairy products; edible fats or oils, and food products prepared from edible fats or oils), with the reasons why it is not a proper invoice. The Government will take into account untimely notification when computing any interest penalty owed the Contractor.

(i) Name and address of the Contractor.

(ii) Invoice date and invoice number. (The Contractor should date invoices as close as possible to the date of the mailing or transmission.)

(iii) Contract number or other authorization for supplies delivered or services performed (including order number and contract line item number).

(iv) Description, quantity, unit of measure, unit price, and extended price of supplies delivered or services performed.

(v) Shipping and payment terms (e.g., shipment number and date of shipment, discount for prompt payment terms). Bill of lading number and weight of shipment will be shown for shipments on Government bills of lading.

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to notify in the event of a defective invoice.

(viii) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.

(ix) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision (e.g., 52.232- 38, Submission of Electronic Funds Transfer Information with Offer), contract clause (e.g., 52.232-33, Payment by Electronic Funds Transfer--Central Contractor Registration, or 52.232-34, Payment by Electronic Funds Transfer--Other Than Central Contractor Registration), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(x) Any other information or documentation required by the contract (e.g., evidence of shipment).

(4) Interest penalty. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if payment is not made by the due date and the conditions listed in paragraphs (a)(4)(i) through (a)(4)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday, the designated payment office may make payment on the following working day without incurring a late payment interest penalty.

(i) The designated billing office received a proper invoice.

(ii) The Government processed a receiving report or other Government documentation authorizing payment, and there was no disagreement over quantity, quality, or Contractor compliance with any contract term or condition.

(iii) In the case of a final invoice for any balance of funds due the Contractor for supplies delivered or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(5) Computing penalty amount. The Government will compute the interest penalty in accordance with the Office of Management and Budget prompt payment regulations at 5 CFR part 1315.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor, Government acceptance is deemed to occur constructively on the 7th day (unless otherwise specified in this contract) after the Contractor delivers the supplies or performs the services in accordance with the terms and conditions of the contract, unless there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. If actual acceptance occurs within the constructive acceptance period, the Government will base the determination of an interest penalty on the actual date of acceptance. The constructive acceptance requirement does not, however, compel Government officials to accept supplies or services, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The prompt payment regulations at 5 CFR 1315.10(c) do not require the Government to pay interest penalties if payment delays are due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. The Government and the Contractor shall resolve claims involving disputes and any interest that may be payable in accordance with the clause at FAR 52.233-1, Disputes.

(6) Discounts for prompt payment. The designated payment office will pay an interest penalty automatically, without request from the Contractor, if the Government takes a discount for prompt payment improperly. The Government will calculate the interest penalty in accordance with the prompt payment regulations at 5 CFR part 1315.

(7) Additional interest penalty.

(i) The designated payment office will pay a penalty amount, calculated in accordance with the prompt payment regulations at 5 CFR part 1315 in addition to the interest penalty amount only if--

(A) The Government owes an interest penalty of \$1 or more;

(B) The designated payment office does not pay the interest penalty within 10 days after the date the invoice amount is paid; and

(C) The Contractor makes a written demand to the designated payment office for additional penalty payment, in accordance with paragraph (a)(7)(ii) of this clause, postmarked not later than 40 days after the invoice amount is paid.

(ii)(A) The Contractor shall support written demands for additional penalty payments with the following data. The Government will not request any additional data. The Contractor shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest is due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) If there is no postmark or the postmark is illegible--

(1) The designated payment office that receives the demand will annotate it with the date of receipt, provided the demand is received on or before the 40th day after payment was made; or

(2) If the designated payment office fails to make the required annotation, the Government will determine the demand's validity based on the date the Contractor has placed on the demand, provided such date is no later than the 40th day after payment was made.

(iii) The additional penalty does not apply to payments regulated by other Government regulations (e.g., payments under utility contracts subject to tariffs and regulation).

(b) Contract financing payment. If this contract provides for contract financing, the Government will make contract financing payments in accordance with the applicable contract financing clause.

(c) Fast payment procedure due dates. If this contract contains the clause at 52.213-1, Fast Payment Procedure, payments will be made within 15 days after the date of receipt of the invoice.

(d) Overpayments. If the Contractor becomes aware of a duplicate contract financing or invoice payment or that the Government has otherwise overpaid on a contract financing or invoice payment, the Contractor shall immediately notify the Contracting Officer and request instructions for disposition of the overpayment.

I.3 52.217-7 OPTION FOR INCREASED QUANTITY—SEPARATELY PRICED LINE ITEM (MAR 1989)

The Government may require the delivery of the numbered line item, identified in the Schedule as an option item, in the quantity and at the price stated in the Schedule. The Contracting Officer may exercise the option by written notice to the Contractor within the period of performance under this contract. Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

I.4 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

<http://www.arnet.gov/far>

PART III - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACHMENTS**SECTION J - LIST OF ATTACHMENTS**

ATTACHMENT NUMBER	TITLE	DATE	NO. PAGES
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ATTACHMENT # 1**NEW STANDARDS FOR CONTRACTORS WHO PREPARE NUREG-SERIES MANUSCRIPTS**

The U.S. Nuclear Regulatory Commission (NRC) will begin to capture its official records electronically on January 1, 2000. All records will be saved electronically in the Agency wide Documents Access and Management System, known as ADAMS.

The NRC will capture each final NUREG-series publication in its native application. Therefore, commencing January 1, 2000, please submit your final manuscript that has been approved by your NRC Project Officer 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 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 designator for each report will no longer be assigned when the decision to prepare a publication is made. The NRC's Publishing Services Branch will inform the NRC Project Officer for the publication of the assigned designator when the final manuscript is sent to the printer.

For the electronic manuscript, prepare the text in WordPerfect 8/9/10, and use any of the following file types for charts, spreadsheets, and the like.

File Types to be Used for NUREG-Series Publications	
File Type	File Extension
WordPerfect®	.wpd
Microsoft® PowerPoint®	.ppt
Corel® QuattroPro®	wb3
Corel® Presentations	.shw
Microsoft Excel	.xls
Portable Document Format	.pdf

This list is subject to change if new software packages come into common use at NRC or by our licensees or other stakeholders that participate in the electronic submission process. If a portion of your manuscript is from another source and you cannot obtain an acceptable electronic file type for this portion (e.g., an appendix from an old publication), the NRC can, if necessary, create a tagged image file format (file extension.tif) for that portion of your report. Note that you should continue to submit original photographs, which will be scanned, since digitized photographs do not print well.

If you chose to publish a compact disk (CD) of your publication, place on the CD copies of the manuscript in both (1) a portable document format (PDF); (2) a WordPerfect 8/9/10 file format, and (3) an Adobe Acrobat Reader, or, alternatively, print instructions for obtaining a free copy of Adobe Acrobat Reader on the back cover insert of the jewel box.

Attachment No. 2

BILLING INSTRUCTIONS FOR COST REIMBURSEMENT TYPE
CONTRACTS

Attachment No. 3

CONTRACTOR SPENDING PLAN