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7. NAME AND ADDRESS OF CONTRACTOR (No., street, city, county, State and ZIP Code) MASSACHUSETTS INSTITUTE OF TECHNOLOGY 77 MASSACHUSETTS AVE CAMBRIDGE MA 021394301 8. DELIVERY  FOB ORIGIN  OTHER (See below) 9. DISCOUNT FOR PROMPT PAYMENT Net 30 10. SUBMIT INVOICES (4 copies unless otherwise specified) TO THE ADDRESS SHOWN IN

11. SHIP TO/MARK FOR CODE FACILITY CODE See SOW 12. PAYMENT WILL BE MADE BY CODE 3100 Department of Interior / NBC NRCPayments@nbc.gov Attn: Fiscal Services Branch - D2770 7301 W. Mansfield Avenue Denver CO 80235-2230

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:  10 U.S.C. 2304(c)( )  41 U.S.C. 253(c)(1) 14. ACCOUNTING AND APPROPRIATION DATA B&R: 960-15-171-172 JC: N6860 BOC: 252A AN: 31X0200.960 FFS: RES-C09-725 Amount Obligated: \$100,000

15A. ITEM NO.	15B. SUPPLIES/SERVICES	15C. QUANTITY	15D. UNIT	15E. UNIT PRICE	15F. AMOUNT
	The purpose of this contract is to provide support with the Automation and HSI Complexity in Advance Reactors Total Estimated Cost: \$741,090.22 Total Amount Obligated: \$100,000.00 Total Amount Available for Obligation: \$641,090.22 Period of Performance: September 30, 2009 - November 30, 2011				

15G. TOTAL AMOUNT OF CONTRACT \$741,090.22

16. TABLE OF CONTENTS See Attached Table of Contents

(X)	SEC.	DESCRIPTION	PAGE(S)	(X)	SEC.	DESCRIPTION	PAGE(S)
PART I - THE SCHEDULE				PART II - CONTRACT CLAUSES			
	A	SOLICITATION/CONTRACT FORM			I	CONTRACT CLAUSES	
	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	
	D	PACKAGING AND MARKING		PART IV - REPRESENTATIONS AND INSTRUCTIONS			
	E	INSPECTION AND ACCEPTANCE			K	REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS	
	F	DELIVERIES OR PERFORMANCE			L	INSTRS., CONDS., AND NOTICES TO OFFER	
	G	CONTRACT ADMINISTRATION DATA			M	EVALUATION FACTORS FOR AWARD	
	H	SPECIAL CONTRACT REQUIREMENTS					

CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE

17.  CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return \_\_\_\_\_ 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 referred to by number or reference herein. (Attachments are listed herein.) 18.  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 condition 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.

19A. NAME AND TITLE OF CONTRACTOR (Type or print) Office of Sponsored Programs 20A. NAME OF CONTRACTING OFFICER Sheila Bumpass

19B. NAME OF CONTRACTOR BY [Signature] 19C. DATE SIGNED 9/28/09 20B. UNITED STATES OF AMERICA BY [Signature] 20C. DATE SIGNED 9/28/09

SUNSI REVIEW COMPLETE

TEMPLATE - ADM001

OCT 02 2009

ADM002

## SECTION C - DESCRIPTION/SPECIFICATIONS/STATEMENT OF WORK

TITLE: Automation and HSI Complexity in Advanced Reactors

### BACKGROUND

This project is a part of the "Human Factors in Nuclear Reactors" program initiated by the NRC Office of Nuclear Regulatory Research (RES). The objective of the program is to provide technical basis, guideline, and assessment tools to facilitate the NRC's safety and licensing activities. The NRC staff reviews the human factors engineering (HFE) programs of applicants for construction permits, operating licenses, standard design certifications, and combined operating licenses. This helps to ensure that personnel performance and reliability are appropriately supported. Given the trend of increasing use of automation in nuclear power plant (NPP) control stations, this project focuses on developing assessment tools specifically for evaluating the safety impacts of control room automation systems. The BACKGROUND section of this Statement of Work will first introduce the program then describe the specific research needs and technical approaches to the goal.

The nuclear community is currently at a stage where existing control stations of NPPs are undergoing various forms of modernization, new and advanced reactors are being built to support power generation for decades to come. This trend introduces new reactor and system designs, new tools to support plant personnel, and changes to NPP staffing configurations. The concepts of operation and maintenance for this new generation of plants are likely to be quite different from those employed in today's plants. It is important that the potential impact on these developments is evaluated and understood by prospective operators and regulators responsible for determining the acceptability of new designs to support human performance in maintaining plant safety. It is also important for regulators to have assessment tools that assist in determining the acceptability of new designs.

In order to ensure the appropriate application of technology to support human performance and plant safety, it is important for the NRC staff to have the appropriate technical bases, guidelines, and assessment tools for evaluating the technological advances in terms of their potential negative and positive effects. Prior NRC research on advanced reactors resulted in a report titled, "Human Factors Considerations with Respect to Emerging Technology in Nuclear Power Plants" (NUREG/CR-6947). This effort identified the human performance areas that need additional information and tools for evaluating new technologies. It also prioritized the areas based on potential safety impact. Interestingly, a similar set of areas were identified by the Organization for Economic Cooperation and Development Work Group of Human and Organization Factors (WGHO) on: "Future Control Station Designs and Human Performance Issues in Nuclear Power Plants." The group proposed eight broad topic areas which might warrant further research. Also, similar research needs were defined in the "Technology Roadmap on Instrumentation, Control, and Human-Machine Interface to Support the "Advanced Nuclear Energy Programs" developed by Department of Energy. Subsequently, RES developed the road map to systematically address the high-priority topics, as illustrated in the diagram below.

automation to the functioning of human-system-interfaces (HSI). The following are several examples of potential new automation systems in advanced control rooms:

*Intelligent Agents* that are computer functions performing information processing tasks for operators in a semi-autonomous or fully-autonomous manner. They can be adaptive to changing plant conditions and can be independent from personnel.

*Computerized Operator Support Systems* that use predictive models and fast-time simulations to provide plant personnel with decision support.

*Computer-based Procedures* (CBPs) that may offer support for procedure maintenance, configuration management, and procedure use. As sensor input and control capabilities are made available to computerized systems, it becomes feasible for CBPs to incorporate expanded monitoring and control functionality. NRC's previous research effort has established substantial knowledge bases for evaluating safety impacts of emerging NPP automation technologies on human performance, yet the agency needs additional assessment tools for effectively and efficiently determining the acceptability of new automation designs. Such assessment tools should specify the features of automation that need to be evaluated, the minimal and sufficient levels of information details to be used for evaluation, and the metrics of human performance to which the automation will be evaluated against. Finally, the tools need to be experimentally tested to elucidate the safety impacts of the evaluation metrics.

One important aspect of automation is "Levels of automation" (LOA), referring to the relative roles and responsibilities of human and automation agents in the performance of a specific function or task. Regulators will need to determine whether the LOA in a new design is acceptable from the safety perspective. While there have been many definitions of LOA in the literature, and some definitions have been implemented in other industry domains, they have not been defined and validated for nuclear plant operations. Moreover, most definitions of LOA in the literature are based on the allocation of system functions between human and automation without addressing the aspects of human information processing. Thus, it is difficult to relate such defined levels to the impacts on human performance. Lately, the Human and Automation Lab at MIT developed a model of human-automation interaction that decomposes LOA into three dimensions: data generator, decision-making moderator, and decider. These dimensions correspond to human information processing. Thus, the descriptions of an automation system in these dimensions may allow regulators to evaluate whether automation and human operators can safely perform given tasks at the specified LOA. Therefore, research is needed to assess available methods of LOA, identify the ones applicable for NPP regulators, adapt them to off-the-shelf tools for NRC's license application review, and experimentally test and validate the tools.

The impact of automation on human reliability is another research area that needs to be addressed. Many of NRC's regulatory activities now follow a risk-informed approach in which the acceptability of the proposed designs or changes to operating plants considers probabilistic risk analysis (PRA). An important part of PRA is human reliability analysis (HRA). The modern HRA takes the characteristics of the operating context into account, the human error being considered as the consequence of a mismatch between the components of a global socio-technical system. Thus, most of the HRA methods presently in use consider the features of the operating context as the main contributors on the human performance in operation. Yet, the current HRA methods need to include new features of automation. In order to do this, several fundamental questions need to be addressed: What features of automation contribute to human reliability, what are the impacts of the features on human performance, and how should the HRA methods incorporate the features and account for the impacts? Research is needed to address such fundamental aspects to enhance HRA of advanced reactors.

perspective, what is the impact of complexity on human performance, how can the impact be assessed, and how can human reliability associated with complexity be predicted? This project will address these questions through the following approach: 1) Provide a technical basis and guidelines for evaluating HSI complexity of plant systems, 2) develop assessment tools to measure complexity, 3) conduct experiments to elucidate the impacts of complexity on the safety aspects of human performance, and 4) provide insights and recommendations on how to predict human performance error caused by complexity.

Research in the MIT Humans and Automation Lab (HAL) focuses on interactions of human and automation in complex systems. The lab has performed many projects on human-automation interactions for US government agencies and industries such as National Aeronautics and Space Administration (NASA), Federal Aviation Administration (FAA), Ford Motor Company, Office of Naval Research, and the U.S. Army. The lab's general approach in these projects has been developing assessment methods for given issues and conducting human-in-the-loop simulation experiments. The lab has built experimental facilities to test human supervisory control systems. Therefore, the lab is the best choice to perform this project. This statement of work describes HAL's responsibilities.

## OBJECTIVE

The overall level of automation in new NPPs can be expected to be much higher than in today's plants. Regulators will need to determine whether the level of automation in a new design is acceptable from the safety perspective. The objective of the automation topic of this project is to facilitate NRC's safety and licensing activities by developing assessment tools for evaluating the safety impacts of automation and human performance in advanced reactors. The NRC staff will use the tools to determine the acceptance of automation systems to ensure that the systems meet the NRC's HFE safety criteria.

HSI complexity of computerized systems in new and advanced reactors can introduce human performance errors and affects NPP safety. The objective of the complexity topic of this project is to develop a technical basis and guidelines for evaluating the safety aspects of HSI complexity as well as methods to assess the impacts of complexity on human performance.

The resulted technical basis, guidelines, and tools will be used in NRC's licensing and safety activities such as license application review, inspection, and risk-informed decision-making.

## SCOPE OF WORK

The tasks for the two topics in this project will be described separately. Tasks A 1-3 are for the automation topic.

### Task A 1: Develop metrics of automation evaluation for NPP control rooms

Many human performance considerations associated with the use of automation have been raised in the literature. Methods assessing these considerations include generic measures such as workload, situation awareness, trust, and task-specific measures. However, the relationship between these measures is unclear, including construct validity, and the applicability for NPP systems. The goal of this activity is to develop a minimal but sufficient set of metrics to assess NPP automation and its interaction with operational personnel. Subtasks to achieve this goal include:

1 a) Review literature to generalize human performance considerations associated with automation and assess their applicability to the NPP domain.

1 b) Review literature and develop metrics of automation evaluation to assess the roles of personnel and automation; identify methods and tools that measure each metric, analyze the

Tasks B 1-4 are for the complexity topic.

Task B1: Develop technical basis and review guidelines for evaluating NPP HSI complexity and its safety aspects

The goal of this task is to identify factors that contribute to complexity in plant systems, functional tasks, HSI, and operator information processing in order to develop review guidelines. A knowledge base is needed to understand how complexity of plant systems propagates through HSI to impact operator's performance and how to mitigate the complexity and its propagation. Activities to achieve the goal include:

1 a) Review and analyze the complexity literature - There has been considerable research in the area of perceived complexity in a number of industrial and academic domains that can be analyzed to determine its applicability to NPP design and operations.

1 b) Obtain Subject Matter Expert (SME) input - Contacting SMEs currently studying complexity would ensure the most current approaches and that models of complexity are identified.

1 c) Conduct review of operational experience - Review NPP accident/incident reports and possibly contact operators and NRC inspectors to understand complexity in NPP operations.

1 d) Develop a descriptive model of complexity in plant systems, functional tasks, HSI, and information processing of operations crew, and work with the NRC research staff to develop a guideline for evaluating complexity of NPP control room systems.

Deliverables: A NUREG/CR March 1, 2010

Level of Effort: (professor) month and  
0.5 Senior Staff 6 Research Scientist (postdoctoral staff) months

Task 82: Develop measures (methods or tools) to assess HSI complexity

Measures to assess complexity are needed to be used as part of a safety evaluation. This effort will focus on measures of HSI complexity because NPP systems and functional tasks impact operational personnel through HSI. Input from the literature, subject matter experts, and the complexity models can be used as the technical basis to develop the measures. Activities to achieve the goal include:

2a) The measures should be adaptable to the level of information details available.

2b) The measures may take several forms depending on cost/benefit requirements. For example, a simple checklist can give a quick, simple assessment; a questionnaire may require participants of operations crews; while experimental measures require development of test interface, scenario, and tasks, as well as expertise in data collection and analysis.

2c) The measures should accommodate different types of HSI in NPP systems. The safety-related HSIs in NPP control rooms include alarm systems, control systems, computer-based procedures, and decision-support systems. The effect of complexity on operational personnel can vary with these systems.

Deliverables: NUREG/CR November 30, 2010

Level of Effort: 1 Senior Staff months and  
Part I of a 6 Research Scientist months

Expected results:

The results of Task A 1-3 for the automation topic will be documented in two NUREG/CRs, a Letter Report to the NRC, and the software of the test beds for NPP control system simulations. The NUREG/CRs will document the methods and tools applicable to evaluating control room automation systems, as well as the experimental design, test beds, and results that link the methods/tools to human performance. Insights and recommendations to the HRA of control room automation will also be documented in a Letter Report to the NRC. In addition, the NRC research staff will develop a user's guide to facilitate knowledge transfer of this project to NRC operations.

The results of Task 81-4 for the complexity topic will be documented in two NUREG/CRs, a Letter Report to the NRC, and the software of the test beds simulating human-system interfaces of NPP control systems. The NUREG/CRs will document the technical basis, guideline, methods and tools applicable to evaluating safety aspects of HSI complexity in NPP control rooms, as well as the experimental design, test beds, and results that link the methods/tools to human performance. Insights and recommendations to complexity in HRA will also be documented in a Letter Report to the NRC.

RESEARCH QUALITY

The quality of NRC research programs are assessed each year by the Advisory Committee on Reactor Safeguards. Within the context of their reviews of RES programs, the definition of quality research is based upon several major characteristics:

Results meet the objectives (75% of overall score) Justification of major assumptions (12%) Soundness of technical approach and results (52%)  
Uncertainties and sensitivities addressed (11 %)

Documentation of research results and methods is adequate (25% of overall score)  
Clarity of presentation (16%)  
Identification of major assumptions (9%)

It is the responsibility of the contractor to ensure that these quality criteria are adequately addressed throughout the course of the research that is performed. The NRC project manager and technical monitor will review all research products with these criteria in mind.

TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED

The required technical qualification to perform this project includes a high level of knowledge of human-automation and HSI studies, extensive experience in developing assessment tools/methods, strong experience and available infrastructure to perform human performance experiments of complex human supervisory control systems.

LEVEL OF EFFORT

7 senior staff months and  
27 research scientist months  
27 graduate student months  
6 undergraduate student months

REPORTING REQUIREMENTS

The following reports are required:

Task A1: Develop metrics of automation evaluation for NPP control rooms:  
NUREG/CR report

May 1, 2010

TaskA2: Develop methods of evaluating LOA and experimental testing:

photographs do not print well.

If you choose 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 Microsoft Word 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.

#### DELIVERABLES/SCHEDULES AND/OR MILESTONES

The final deliverable will be 2 NUREG CR and 1 Letter Report that describe the findings from Tasks A1-3, 2 NUREG CRs and 1 Letter Report that describe the findings from the Tasks 81-4.

Task A1: Develop metrics of automation evaluation for NPP control rooms: NUREG/CR report	May 1, 2010
Task A2: Develop methods of evaluating LOA and experimental testing: NUREG/CR report	Aug 31, 2011
Task A3: Insights into HRA of automation: Letter Report	Nov 30, 2011
Task 81: Develop metrics of complexity evaluation for NPP control rooms: NUREG/CR report	March 1, 2010
Task 82: Develop assessment tools: NUREG/CR report	Nov 30, 2010
Task 83: Develop experimental testing: NUREG/CR report	Aug 31, 2011
Task 84: Insights into complexity in HRA: Letter Report	Nov 30, 2011

#### MEETINGS AND TRAVEL

The following travel is planned:

- 5 meetings (2 persons) to meet with the NRC Project Manager, other NRC *staff*, and other stakeholders in Rockville, MD.
- 1 international trip (2 persons) to Halden Reactor Project and possibly France to obtain information of control room automation systems needed for Task 2.
- 5 domestic trips (2 persons) to observe the NRC TTC simulators and possibly industry simulators as well as nuclear power plant operations.
- 2 domestic trips (2 persons) to attend a scientific/technical meeting pertinent to the project.

#### NRC-FURNISHED MATERIAL

None

#### TECHNICAL DIRECTION

Technical direction will be provided by the Project Manager, Dr. Jing Xing, who can be reached at:  
U. S. Nuclear Regulatory Commission Mail Stop:  
C4A07M  
Washington, DC 20555-0001  
Phone: (301) 251-7580

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



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Telephone Number: 301-251-7580

(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.

(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 2 (OCT 1999)**

(a) For this contract, the ceiling amount reimbursable for indirect costs is as follows:

INDIRECT COST POOL	RATE	BASE PERIOD	
F&A Indirect Rates			
DATES		RATE TYPE	RATE
28 Sept 2009 – 27 Sept 2011		MTDC	[REDACTED]
Employment Benefit Rates and Base			
DATES		RATE TYPE	RATE
28 Sept 2009 – 27 Sept 2011		Reduced Rate/Part Time	[REDACTED]
28 Sept 2009 – 30 Jun 2010		Research Rate/Full Time	[REDACTED]
1 July 2010 – 27 Sept 2011		Research Rate/Full Time	[REDACTED]
Vacation		RATE TYPE	RATE
28 Oct 2009 - 27 Sep 2011		Vacation Rate	[REDACTED]

(b) In the event that indirect rates developed by the cognizant audit activity on the basis of actual allowable costs result in a lower amount for indirect costs, the lower amount will be paid. The Government may not be obligated to pay any additional amounts for indirect costs above the ceiling rates set forth above for the applicable period.

**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

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.

(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 therefore (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

right to have the contractor add the following disclaimer that states "Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the NRC". If the NRC does not agree with the publication, it will not be responsible for publication costs. Publication costs shall be borne by the contractor.

#### **H.4 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.5 GOVERNMENT FURNISHED EQUIPMENT/PROPERTY - NONE PROVIDED (JUN 1988)**

The Government will not provide any equipment/property under this contract.

#### **H.6 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.7 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.

52.204-4	CERTAIN FEDERAL TRANSACTIONS PRINTED OR COPIED DOUBLE-SIDED ON RECYCLED PAPER	AUG 2000
52.204-7	CENTRAL CONTRACTOR REGISTRATION	APR 2008
52.209-6	PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT	SEP 2006
52.215-2	AUDIT AND RECORDS--NEGOTIATION ALTERNATE II	JUN 1999
52.215-8	ORDER OF PRECEDENCE--UNIFORM CONTRACT FORMAT	OCT 1997
52.216-11	COST CONTRACT--NO FEE ALTERNATE I (APR 1984)	APR 1984
52.216-15	PREDETERMINED INDIRECT COST RATES	APR 1998
52.217-2	CANCELLATION UNDER MULTIYEAR CONTRACTS	OCT 1997
52.219-8	UTILIZATION OF SMALL BUSINESS CONCERNS	MAY 2004
52.222-3	CONVICT LABOR	JUN 2003
52.222-21	PROHIBITION OF SEGREGATED FACILITIES	FEB 1999
52.222-26	EQUAL OPPORTUNITY	MAR 2007
52.222-35	EQUAL OPPORTUNITY FOR SPECIAL DISABLED VETERANS, VETERANS OF THE VIETNAM ERA, AND OTHER ELIGIBLE VETERANS	SEP 2006
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	SEP 2006
52.222-50	COMBATING TRAFFICKING IN PERSONS	FEB 2009
52.223-6	DRUG-FREE WORKPLACE	MAY 2001
52.223-15	ENERGY EFFICIENCY IN ENERGY-CONSUMING PRODUCTS	DEC 2007
52.225-13	RESTRICTIONS ON CERTAIN FOREIGN PURCHASES	JUN 2008
52.227-1A	AUTHORIZATION AND CONSENT ALTERNATE I (APR 1984)	DEC 2007
52.227-2	NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT	DEC 2007
52.227-11	PATENT RIGHTS - RETENTION BY THE CONTRACTOR	JUN 1997
52.227-14	RIGHTS IN DATA--GENERAL ALTERNATE I (JUN 1987) ALTERNATE II (JUN 1987) ALTERNATE III (JUN 1987) ALTERNATE IV (JUN 1987) ALTERNATE V (JUN 1987)	DEC 2007
52.228-7	INSURANCE--LIABILITY TO THIRD PERSONS	MAR 1996
52.232-17	INTEREST	OCT 2008
52.232-22	LIMITATION OF FUNDS	APR 1984
52.232-23	ASSIGNMENT OF CLAIMS	JAN 1986
52.232-25	PROMPT PAYMENT	OCT 2008
52.232-33	PAYMENT BY ELECTRONIC FUNDS--CENTRAL CONTRACTOR REGISTRATION	OCT 2003
52.233-1	DISPUTES	JUL 2002

(i) Those recorded costs that, at the time of the request for reimbursement, the Contractor has paid by cash, check, or other form of actual payment for items or services purchased directly for the contract;

(ii) When the Contractor is not delinquent in paying costs of contract performance in the ordinary course of business, costs incurred, but not necessarily paid, for--

(A) Supplies and services purchased directly for the contract and associated financing payments to subcontractors, provided payments determined due will be made-

(1) In accordance with the terms and conditions of a subcontract or invoice; and

(2) Ordinarily within 30 days of the submission of the Contractor's payment request to the Government;

(B) Materials issued from the Contractor's inventory and placed in the production process for use on the contract;

(C) Direct labor;

(D) Direct travel;

(E) Other direct in-house costs; and

(F) Properly allocable and allowable indirect costs, as shown in the records maintained by the Contractor for purposes of obtaining reimbursement under Government contracts; and

(iii) The amount of financing payments that have been paid by cash, check, or other forms of payment to subcontractors.

(2) Accrued costs of Contractor contributions under employee pension plans shall be excluded until actually paid unless-

(i) The Contractor's practice is to make contributions to the retirement fund quarterly or more frequently; and

(ii) The contribution does not remain unpaid 30 days after the end of the applicable quarter or shorter payment period (any contribution remaining unpaid shall be excluded from the Contractor's indirect costs for payment purposes).

(3) Notwithstanding the audit and adjustment of invoices or vouchers under paragraph (g) of this clause, allowable indirect costs under this contract shall be obtained by applying indirect cost rates established in accordance with paragraph (d) of this clause.

(4) Any statements in specifications or other documents incorporated in this contract by reference designating performance of services or furnishing of materials at the Contractor's expense or at no cost to the Government shall be disregarded for purposes of cost-reimbursement under this clause.

(c) Small business concerns. A small business concern may receive more frequent payments than every 2 weeks.

(d) Final indirect cost rates.

(1) Final annual indirect cost rates and the appropriate bases shall be established in accordance with Subpart 42.7 of the Federal Acquisition Regulation (FAR) in effect for the period covered by the indirect cost rate proposal.

(h) Final payment. (1) Upon approval of a completion invoice or voucher submitted by the Contractor in accordance with paragraph (d)(5) of this clause, and upon the Contractor's compliance with all terms of this contract, the Government shall promptly pay any balance of allowable costs and that part of the fee (if any) not previously paid.

(2) The Contractor shall pay to the Government any refunds, rebates, credits, or other amounts (including interest, if any) accruing to or received by the Contractor or any assignee under this contract, to the extent that those amounts are properly allocable to costs for which the Contractor has been reimbursed by the Government. Reasonable expenses incurred by the Contractor for securing refunds, rebates, credits, or other amounts shall be allowable costs if approved by the Contracting Officer. Before final payment under this contract, the Contractor and each assignee whose assignment is in effect at the time of final payment shall execute and deliver--

(i) An assignment to the Government, in form and substance satisfactory to the Contracting Officer, of refunds, rebates, credits, or other amounts (including interest, if any) properly allocable to costs for which the Contractor has been reimbursed by the Government under this contract; and

(ii) A release discharging the Government, its officers, agents, and employees from all liabilities, obligations, and claims arising out of or under this contract, except--

(A) Specified claims stated in exact amounts, or in estimated amounts when the exact amounts are not known;

(B) Claims (including reasonable incidental expenses) based upon liabilities of the Contractor to third parties arising out of the performance of this contract; provided, that the claims are not known to the Contractor on the date of the execution of the release, and that the Contractor gives notice of the claims in writing to the Contracting Officer within 6 years following the release date or notice of final payment date, whichever is earlier; and

(C) Claims for reimbursement of costs, including reasonable incidental expenses, incurred by the Contractor under the patent clauses of this contract, excluding, however, any expenses arising from the Contractor's indemnification of the Government against patent liability.

### **I.3 52.222-39 NOTIFICATION OF EMPLOYEE RIGHTS CONCERNING PAYMENT OF UNION DUES OR FEES (DEC 2004)**

(a) Definition. As used in this clause--

"United States" means the 50 States, the District of Columbia, Puerto Rico, the Northern Mariana Islands, American Samoa, Guam, the U.S. Virgin Islands, and Wake Island.

(b) Except as provided in paragraph (e) of this clause, during the term of this contract, the Contractor shall post a notice, in the form of a poster, informing employees of their rights concerning union membership and payment of union dues and fees, in conspicuous places in and about all its plants and offices, including all places where notices to employees are customarily posted. The notice shall include the following information (except that the information pertaining to National Labor Relations Board shall not be included in notices posted in the plants or offices of carriers subject to the Railway Labor Act, as amended (45 U.S.C. 151-188)).

#### **Notice to Employees**

Under Federal law, employees cannot be required to join a union or maintain membership in a union in order to retain their jobs. Under certain conditions, the law permits a union and an employer to enter into a union-security agreement requiring employees to pay uniform periodic dues and initiation fees. However, employees

(f) The Department of Labor publishes the official employee notice in two variations; one for contractors covered by the Railway Labor Act and a second for all other contractors. The Contractor shall--

(1) Obtain the required employee notice poster from the Division of Interpretations and Standards, Office of Labor-Management Standards, U.S. Department of Labor, 200 Constitution Avenue, NW, Room N-5605, Washington, DC 20210, or from any field office of the Department's Office of Labor-Management Standards or Office of Federal Contract Compliance Programs;

(2) Download a copy of the poster from the Office of Labor- Management Standards website at <http://www.olms.dol.gov>; or

(3) Reproduce and use exact duplicate copies of the Department of Labor's official poster.

(g) The Contractor shall include the substance of this clause in every subcontract or purchase order that exceeds the simplified acquisition threshold, entered into in connection with this contract, unless exempted by the Department of Labor Deputy Assistant Secretary for Labor-Management Programs on account of special circumstances in the national interest under authority of 29 CFR 470.3(c). For indefinite quantity subcontracts, the Contractor shall include the substance of this clause if the value of orders in any calendar year of the subcontract is expected to exceed the simplified acquisition threshold. Pursuant to 29 CFR Part 470, Subpart B--Compliance Evaluations, Complaint Investigations and Enforcement Procedures, the Secretary of Labor may direct the Contractor to take such action in the enforcement of these regulations, including the imposition of sanctions for noncompliance with respect to any such subcontract or purchase order. If the Contractor becomes involved in litigation with a subcontractor or vendor, or is threatened with such involvement, as a result of such direction, the Contractor may request the United States, through the Secretary of Labor, to enter into such litigation to protect the interests of the United States.

#### **I.4 52.249-14 EXCUSABLE DELAYS (APR 1984)**

(a) Except for defaults of subcontractors at any tier, the Contractor shall not be in default because of any failure to perform this contract under its terms if the failure arises from causes beyond the control and without the fault or negligence of the Contractor. Examples of these causes are (1) acts of God or of the public enemy, (2) acts of the Government in either its sovereign or contractual capacity, (3) fires, (4) floods, (5) epidemics, (6) quarantine restrictions, (7) strikes, (8) freight embargoes, and (9) unusually severe weather. In each instance, the failure to perform must be beyond the control and without the fault or negligence of the Contractor. "Default" includes failure to make progress in the work so as to endanger performance.

(b) If the failure to perform is caused by the failure of a subcontractor at any tier to perform or make progress, and if the cause of the failure was beyond the control of both the Contractor and subcontractor, and without the fault or negligence of either, the Contractor shall not be deemed to be in default, unless--

(1) The subcontracted supplies or services were obtainable from other sources;

(2) The Contracting Officer ordered the Contractor in writing to purchase these supplies or services from the other source; and

(3) The Contractor failed to comply reasonably with this order.

(c) Upon request of the Contractor, the Contracting Officer shall ascertain the facts and extent of the failure. If the Contracting Officer determines that any failure to perform results from one or more of the causes above, the delivery schedule shall be revised, subject to the rights of the Government under the termination clause of this contract.