AWARD/CONTRACT

1. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 350)	RATING	PAGE OF PAGES
		1 | 154

2. CONTRACT (Proc. Inst. Ident.) NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQUEST/PROJECT NO.
NRC-26-96-265	JUN 12 1996	AED-96-265

5. ISSUED BY	CODE	6. ADMINISTERED BY (If other than Item 5)	CODE
U.S. Nuclear Regulatory Commission Division of Contracts Tab#1; MS T-7-I-2 Washington, DC 20555			

7. NAME AND ADDRESS OF CONTRACTOR (No., street, city, county, State, and ZIP Code)	8. DELIVERY ☐ FOB ORIGIN ☒ OTHER (See below) Destination
Simulation, Systems & Services Technologies Company 8930 Stanford Blvd. Columbia, MD 21045-4752	9. DISCOUNT FOR PROMPT PAYMENT None
	10. SUBMIT INVOICES (4 copies unless otherwise specified) TO THE ADDRESS SHOWN IN: ITEM 5

CODE	FACILITY CODE

11. SHIP TO/MARK FOR	CODE	12. PAYMENT WILL BE MADE BY	CODE
See Section F.		U.S. Nuclear Regulatory Commission Division of Accounting and Finance GOV/COM Accounting Section Washington, DC 20555	

13. AUTHORITY FOR USING OTHER THAN FULL AND OPEN COMPETITION:	14. ACCOUNTING AND APPROPRIATION DATA
☐ 10 USC 2304(c)( ) ☐ 41 USC 253(c)( )	See page 5

15A. ITEM NO.	15B. SUPPLIES/SERVICES	15C. QUANTITY	15D. UNIT	15E. UNIT PRICE	15F. AMOUNT
	See Section B				
	15G. TOTAL AMOUNT OF CONTRACT				$ 2,554,062.00

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	SEC.	DESCRIPTION	PAGE(S)
		PART I - THE SCHEDULE	
X	A	SOLICITATION/CONTRACT FORM	
X	B	SUPPLIES OR SERVICES AND PRICES/COSTS	
X	C	DESCRIPTION/SPECS/WORK STATEMENT	
X	D	PACKAGING AND MARKING	
X	E	INSPECTION AND ACCEPTANCE	
X	F	DELIVERIES OR PERFORMANCE	
X	G	CONTRACT ADMINISTRATION DATA	
X	H	SPECIAL CONTRACT REQUIREMENTS	

	SEC.	DESCRIPTION	PAGE(S)
		PART II - CONTRACT CLAUSES	
X	I	CONTRACT CLAUSES	
		PART III - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACH.	
X	J	LIST OF ATTACHMENTS	
		PART IV - REPRESENTATIONS AND INSTRUCTIONS	
	K	REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF OFFERORS	
	L	INSTRS, CONDS, AND NOTICES TO OFFERORS	
	M	EVALUATION FACTORS FOR AWARD	

CONTRACTING OFFICER WILL COMPLETE ITEM 17 OR 18 AS APPLICABLE

17. ☒ CONTRACTOR'S NEGOTIATED AGREEMENT (Contractor is required to sign this document and return 3 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 soliciation, if any, and (c) such provisions, representations, certifications, and specifications, as are attached or incorporated by 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 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.

19A. NAME AND TITLE OF SIGNER (type or print)	20A. NAME OF CONTRACTING OFFICER
Jerry Jen Vice President	Mary H. Mace Contracting Officer

19B. NAME OF CONTRACTOR	19C. DATE SIGNED	20B. UNITED STATES OF AMERICA	20C. DATE SIGNED
BY _____ (Signature of person authorized to sign)	6 June 1996	BY _____ (Signature of Contracting Officer)	6-12-96

D702

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PART I - THE SCHEDULE

SECTION B - SUPPLIES OR SERVICES AND PRICES/COSTS

B.1 PROJECT TITLE

The title of this project is as follows:

ANALYTICAL SIMULATORS FOR RUSSIA AND UKRAINE

[End of Clause]

B.2 BRIEF DESCRIPTION OF WORK (MAR 1987)

The Contractor shall provide Gosatomnadzor (GAN) of Russia and the Nuclear Regulatory Administration (NRA) of Ukraine with an integrated system of appropriate computer hardware and software (including licensing agreements) known as an analytical simulator including testing, documentation, hardware and software maintenance, and training of designated personnel in the use of the analytical simulator. The simulators will simulate the operation and reactions of various nuclear power plant systems in Russia and the Ukraine.

[End of Clause]

B.3 CONSIDERATION AND OBLIGATION--COST PLUS FIXED FEE (JUN 1988)

(a) The total estimated cost to the Government for full performance of the Basic Contract (Section C.1.5 and exercised optional features - see B.7) is $2,554,062, of which the sum of $2,382,779 represents the estimated reimbursable costs, and of which $171,283 represents the fixed fee.

(b) There shall be no adjustment in the amount of the Contractor's fixed fee by reason of differences between any estimate of cost for performance of the work under this contract and the actual cost for performance of that work.

(c) The amount currently obligated by the Government with respect to this contract is $2,554,062.

(d) The total estimated cost to the Government for Option One Kursk 4 (Section C.1.6) is $1,187,554 for which the sum of $1,108,748 represents the estimated reimbursable costs, and of which $78,806 represents the fixed fee.

(e) The total estimated cost to the Government for the option for the provision of software updates for the Option 1 hardware

B.3 (Continued)

site (Section C.1.5.1.1) is $3,392 for which the sum of $3,158 represents the estimated reimbursable costs, and of which $234 represents the fixed fee.

(f) The total estimated cost to the Government for the optional hardware feature for student station monitoring for the Option 1 hardware site (Section C.1.5.1.5) is $6,585 for which the sum of $6,128 represents the estimated reimbursable costs, and of which $457 represents the fixed fee.

(g) The total estimated cost to the Government for the option for the training material development for the Option 1 Kursk 4 (Section C.1.5.1.6) is $44,220 for which the sum of $41,130 represents the estimated reimbursable costs, and of which $3,090 represents the fixed fee.

(h) The total estimated cost to the Government for Option Two Rovno 1 (Section C.1.7) is $855,449 for which the sum of $799,255 represents the estimated reimbursable costs, and of which $56,194 represents the fixed fee.

(i) The total estimated cost to the Government for the option for the training material development for the Option 2 Rovno 1 (Section C.1.5.1.6) is $44,220 for which the sum of $41,130 represents the estimated reimbursable costs, and of which $3,090 represents the fixed fee.

[End of Clause]

B.4 **INCORPORATION OF PORTIONS OF TECHNICAL PROPOSAL**

The following sections and responses from S3 Technologies' technical proposal dated January 26, 1996 and revisions thereto submitted in response to solicitation RS-AED-96-265 are hereby incorporated by reference into and made a part of this contract.

Revised Best And Final Offer (BAFO) dated 5/10/96

Responses to Technical Issues

Item No. 10, 11, 31, 26, 43, 46, 52

New Pricing Issues **Pricing and Administrative Issues**

Item No. 10 **Item No. 30, 33**

Response to Discussion List dated 4/16/96

Technical Issues

Item No. 3, 5, 8 (Same as 5)

B.4 (Continued)

Item No. 10, 11 (Include Breakdown of course materials and training methods)
Item No. 12, 18, 19, 24, 26, 29, 30, 39, 45 (Part about interpreter)
Item No. 50, 51, 67

Technical and Management Proposal dated 1/26/96

Sections

C.1.5.1.6
C.5.4
C.5.4.2
C.7.2.1(c)
C.8.0
C.9.5(a) - Table C.9.5-1
C.9.16(c)
C.9.18
C.10.2.11 (Exclude Table)
C.10.2.12 (Exclude Table)
C.10.2.14
C.10.2.15
C.12.1
C.13.1
C.13.7
C.14.1.2
C.14.1.3
C.14.4.3

[End of Clause]

B.5 INCORPORATION OF SMALL BUSINESS SUBCONTRACTING PLAN AND REPRESENTATIONS AND CERTIFICATIONS

a. The Small Business and Small Disadvantaged Business Subcontracting Plan submitted by Simulation, Systems, and Services Company dated May 14, 1996 is hereby approved and incorporated into and made a part of this contract. It is attached to this contract at Section J.

b. Part IV (Sections K, L, and M) of the solicitation is hereby removed from this document. Section K as completed by the Contractor is hereby incorporated into this contract by reference.

[End of Clause]

B.6 INCORPORATION OF SOFTWARE LICENSE AGREEMENT

The executed non-exclusive software license agreement between the NRC and the Contractor for the contractor's proprietary software

B.6 (Continued)

to be provided with the analytical simulators furnished under this contract is hereby incorporated and made a part of this contract. A copy of the agreement is attached at Section J Attachment 7.

[End of Clause]

B.7 EXERCISE OF OPTIONAL FEATURES CONCURRENT WITH AWARD OF BASIC CONTRACT

The separately priced optional features for Student Station Monitoring (3 sites - C.1.5.1.5), Software Updates (3 sites - C.1.5.1.1), and Training Material Development (Zaporozyhe only - C.1.5.1.6) are hereby exercised concurrent with award of the basic contract. The estimated cost and fixed fee for these optional features has been included in the estimated cost and fixed fee of the basic contract as set forth in Section B.3. New separately priced line items for Student Station Monitoring (1 site - C.1.5.1.5) and Software Updates (1 site - C.1.5.1.1) have been established in the contract for the Kursk 4 Option 1 hardware site and may be exercised concurrently with the Kursk 4 Option 1. New separately priced line items have also been established for Training Material Development (C.1.5.1.6) for Option 1 - Kursk 4 and Option 2 - Rovno 1, and they may be exercised concurrently with those options. The optional feature for the Modeling of Instruments with Override Control (C.1.5.1.3) is included with the basic contract at no additional cost to the Government. Optional features for Cycle Rate Change (C.1.5.1.2) and for the In-core Detector Signals (C.1.5.1.4) are hereby deleted from this contract.

[End of Clause]

B.8 APPROPRIATION AND ACCOUNTING DATA

1. 31X0200.67M 67M60817202 BOC:252A
R7025 PER1 $500,000
U7021 PER1 $350,000
U7021 PER2 $350,000

2. 31X0200.67M 67M50700000
R9425 PER2 BOC:252A $287,100
U9421 PER3 BOC:251B $ 25,000
U9421 TVL1 BOC:2110 $ 50,000
U9421 TRNG BOC:252A $110,000

3. 3172X1093.67M 67M40022000
R9525 PER1 BOC:252A $150,000
R9525 PER2 BOC:252A $ 53,240
R9525 PER3 BOC:251B $ 25,000
R9525 TVL1 BOC:2110 $ 32,100
R9525 TRNG BOC:252A $120,000

B.8 (Continued)

R9525 EQPT BOC:3190 $290,000

4. 3172X0200.1093.67M 67M40023000
R9625 EQPT BOC:3190 $ 75,000
U9621 EQPT BOC:3190 $136,622

[End of Clause]

Section C - Description/Specifications/Work Statement

C.1 Background

As a result of agreements established during 1992 in Lisbon, Portugal in meetings involving U. S. Secretary of State and foreign counterparts, the U. S. has entered into a program to provide technical assistance to improve nuclear safety in Russia and Ukraine. This agreement has commonly become known as the "Lisbon Initiative." One part of the Lisbon Initiative is associated with activities involving the U. S. Department of Energy (DOE) and the operating organizations in Russia and Ukraine. The other part of the Lisbon Initiative is associated with activities involving the U. S. Nuclear Regulatory Commission (NRC) and its counterpart nuclear regulatory organizations Gosatomnadzor (GAN) of Russia and the Nuclear Regulatory Agency of the Ukrainian Ministry of Environmental Protection and Nuclear Safety (NRA). The NRC Technical Training Center in Chattanooga, TN has the lead for technical assistance associated with establishment of a regulatory training program for GAN and NRA.

GAN and NRA lack the necessary tools for training of GAN and NRA staff personnel in areas such as Nuclear Power Plant (NPP) basic systems and components, physics of NPP transients, operation of technological processes at NPP in normal, abnormal and emergency modes, and incident analysis. The Analytical Simulator will provide GAN and NRA with such a tool. To provide these capabilities the Analytical Simulator will be based on high-fidelity, state-of-the-art, reactor simulation models.

The Analytical Simulator will be a networked set of workstations that simulate the response of the nuclear power plant through the use of high fidelity simulation models. Workstations are used for the simulation computations, for student (or user) control of plant equipment through a graphical user interface, and for the instructor station. The scope of the simulation is the same as that of a full scope simulator.

C.1.1 Objective

The objective of this procurement is acquisition of the integrated system of appropriate hardware and software (including licensing agreements) known as the Analytical Simulator, including testing, documentation, and training of designated personnel in the use of the Analytical Simulator (hereafter referred to as "the Simulator"). The anticipated

primary uses of the Simulator will be training of GAN and NRA personnel, validation of operator licensing examinations, analysis of operational events, and evaluation of operating and emergency procedures. A description of the systems to be modeled and the performance requirements for each are described in detail in this specification. All models must be provided in a high level programming language and may be either modifications of existing advanced models previously developed by the Contractor, or models developed specifically for this project.

The simulation models shall be portable (i.e. site license) such that they could be executed on different Unix-based platforms not directly associated with the Simulator since GAN and NRA intend to utilize these simulation models for a variety of training and analysis purposes.

C.1.2 Scope of Work

The Contractor shall perform the following tasks:

C.1.2.1 The Contractor shall provide and integrate the simulation hardware described in Section C.5.

C.1.2.2 The Contractor shall develop, install, integrate and test models for the systems listed in Section C.8. The performance requirements for the modeled systems are specified in Section E. The Contractor shall maintain the systems hardware and software during the period of this contract.

C.1.2.3 The Contractor shall provide training as described in Section C.4 to a combination of GAN, NRA and NRC personnel as determined by the NRC.

C.1.2.4 The Contractor shall provide documentation of the Simulator as listed in Section E. This will include documentation of all data used to develop and validate the simulation models used in this Simulator.

C.1.2.5 The Contractor shall provide all model development tools used in the development, installation, integration, and testing of the Simulator models to the Government and the GAN and NRA. The Contractor training will include use of all model development tools.

C.1.2.6 The Contractor shall perform Factory and Site Acceptance Tests as listed in Section E.

C.1.2.7 The Contractor shall prepare all necessary paperwork and obtain all necessary approvals or licenses from the Department of Commerce (and any other proper authority) to export, ship and deliver the required deliverables herein defined to their final destination.

C.1.3 Simulation Sites:

The Contractor shall provide one Analytical Simulator to GAN in Moscow, Russia, one Analytical Simulator to the Donskoy region office in Novovoronezh, Russia, one Analytical Simulator to NRA headquarters in Kiev, Ukraine and a site license for the simulation software for use by the NRC Technical Training Center in Chattanooga, TN and Rockville, MD. In addition the contractor shall provide a site license for the simulation software for all other NRC, GAN and NRA sites. If exercised by the Contracting Officer via a separate option, the Contractor shall also provide identical an Analytical Simulator for the office of the North-European Region of GAN in St. Petersburg, Russia.

C.1.4 Reference Plants:

The Contractor shall provide the models and software needed to model the Zaporozhye Unit 5 VVER 1000/320 nuclear power plant (NPP) and the Balakovo Unit 4 VVER 1000/320 NPP as the reference plants for the initial software load. If exercised by the Contracting Officer via separate options, the Contractor shall also provide Analytical Simulator software loads that would represent the RBMK 1000 and the VVER 440/213. These software models shall be based on the following reference plants:

VVER 1000/320:	Zaporozhye Unit 5
VVER 1000/320:	Balakovo Unit 4
RBMK 1000	Kursk Unit 4
VVER 440/213:	Rovno Unit 1

C.1.5 Basic Contract

The Contractor shall develop for and provide to GAN and NRA headquarters and to the Donskoy Region office of GAN an Analytical Simulator (hardware and software) which simulates the Zaporozhye Unit 5 and the Balakova 4 NPP in accordance with the specifications in Section C and the schedule in Section F. The Contractor shall provide all hardware and

software maintenance for this Simulator in accordance with Section C. The Contractor shall provide training to GAN, NRA and NRC personnel in accordance with Section C. The Contractor shall provide a site license for the software for use by the NRC at the NRC Technical Training Center in Chattanooga, TN and Rockville, MD. The contractor shall provide a site license for the simulation software for all other NRC, GAN and NRA sites

C.1.5.1 Optional Features:

Per Section B of the contract, optional features C.1.5.1.1 and C.1.5.1.5 for the three basic contract hardware sites have been exercised concurrent with the award of the basic contract and are therefore to be considered part of the basic contract. Optional feature C.1.5.1.3 is included as part of the basic contract at no additional cost to the Government. Optional feature C.1.5.1.6 for Zaporozyhe is exercised concurrent with the award of the basic contract and is, therefore, part of the basic contract. New separately priced line items for remaining hardware sites and software loads have been established for C.1.5.1.1, C.1.5.1.5 and C.1.5.1.6 per Section B and may be exercised as indicated in Section I. Optional features C.1.5.1.2 and C.1.5.1.4 have been deleted from the contract.

C.1.5.1.1 Option for Provision of Software Updates

The Contractor shall provide updates on all software supplied by the computer vendor and software vendor as updates are released by the vendor, beginning from the date of delivery of the software to the Contractor, and continuing through the contract period. The Contractor shall notify the Government when updates are released by the vendor, and when they have been applied to the Simulator's software.

C.1.5.1.2 Deleted

C.1.5.1.3 Optional Software Feature for Modeling of Instruments with Override Control (included with basic contract)

All individual transmitters within the scope of simulation shall be modelled with component override capability to:

1) Fail output to any value within the range.

2) Insert positive or negative inaccuracy into the transmitter output.

C.1.5.1.4 Deleted

C.1.5.1.5 Optional Hardware Feature for Student Station Monitoring

The Contractor shall provide in the instructor station the capability to monitor any of the student workstation displays.

C.1.5.1.6 Option for Training Material Development

The Contractor shall develop training methodology and supply methodological documentation to facilitate more effective training of GAN and NRA personnel using the Simulator as discussed in Section J Attachment 9.

C.1.6 Option One

Exercise of this option may be made unilaterally by the Government during the period starting with the beginning of the ninth (9th) month and ending at the end of the twelfth (12th) month after the contract effective date. If this option is exercised, the Contractor shall provide in accordance with the schedule in Section F and specifications in Section C an additional Analytical Simulator, identical to the ones built to meet the requirements of the basic contract, to the North European Region of GAN in St. Petersburg. The Contractor shall provide all hardware and software maintenance for this Simulator as well as continuing these maintenance services for the Simulators delivered as a part of the basic contract. The Contractor shall provide Simulator training to GAN personnel at the North-European regional sites. The Contractor shall develop, install, test, and maintain on all Simulators simulation software for RBMK 1000 Kursk Unit 4 NPP. The Contractor shall install the RBMK 1000 Kursk Unit 4 software on the GAN and NRA headquarters Simulators and the North European Region of GAN Simulator. The Contractor shall train GAN and NRA personnel on the use and operation of these software models in accordance with Section C. The Contractor shall provide a site license for the software for use by the NRC at the NRC Technical Training Center in Chattanooga, TN. The contractor shall provide a site license for the simulation software for all other NRC, GAN and NRA sites.

C.1.7 Option Two

Exercise of this option may be made unilaterally by the Government during the period starting with the beginning of the seventeenth (17th) month and ending at the end of the

twentieth (20th) month after the contract effective date. If this option is exercised, the Contractor shall continue to provide hardware and software maintenance for all Simulators and installed software models. The Contractor shall develop, install, test, and maintain on all Simulators simulation software for the VVER 440/213 Rovno 1 in accordance with the specifications in Section C and the schedule in Section F. The Contractor shall install the VVER 440/213 Rovno software on the GAN and NRA headquarters Simulators and the North European Region and Donskoy Region of GAN Simulators. The Contractor shall train GAN and NRA personnel on the use and operation of these software models in accordance with Section C. The Contractor shall provide a site license for the software for use by the NRC at the NRC Technical Training Center in Chattanooga, TN. The contractor shall provide a site license for the simulation software for all other NRC, GAN and NRA sites.

C.2.0 Codes and Standards

C.2.1 Required Codes And Standards

All work shall meet all the requirements for design, construction, assembly, and testing given in the latest applicable NEMA and ASME standards, or equivalent, at the date of contract award. All work performed must comply with all applicable portions of the codes, standards, and regulations listed below. Compliance shall be with the latest version of the codes, standards, and regulations as of the date of contract award. The applicable portion of the code, standard, or regulation is the entire regulation unless specific portions are deemed applicable or not applicable in the following paragraphs.

a. The intent of 10 CFR parts 21 "Reporting of Defects and Non-Compliance" by which is meant the following:

If either during construction or thereafter, a defect is discovered by the manufacturer or his suppliers that could lead to erroneous training of the GAN or NRA regulatory staff (to a degree which would cause the Simulator to no longer meet the requirements of ANSI/ANS 3.5), then notification of such defect(s) shall be made to the Government, GAN and NRA. This will require the Contractor to retain documentation of the Simulator(s) being supplied in order to determine if problems they discover are applicable to the Simulator(s) provided under this specification. This will be

in effect for a period of nc 'ess than 5 (five) years from the delivery of the Simulator.

b. ANSI/ANS 3.5-1993, "Nuclear Power Plant Simulators for Operator Training"

All portions are applicable except paragraphs 5.2 and 5.3 on Simulator update design data and Simulator modifications

c. IAEA-TECDOC-685, "Simulators for Training Nuclear Power Plant Personnel"

d. RG 1.149, "Simulation Facilities for Use in Administration of NRC Operating Tests"

All portions are applicable except paragraph C.4 on Simulator update design data.

e. ANSI 3.9, "FORTRAN"

f. ANSI/NFPA 70, "National Electrical Code"

g. ANSI/ANS 10.3-1986, "Guidelines for the Documentation of Digital Computer Programs"

h. ANSI Y14.1, "Drafting Standards"

i. ISA-S61.1, "Industrial Computer Systems FORTRAN for Executive Function, Process I/O, & Bit Manipulation"

j. ANSI/NFPA 75, "Protection of Electronic Computer/Data Processing Equipment"

k. ANSI MC8.1, "Hardware Testing of Digital Process Computers"

l. IEEE STD 730, "IEEE Standard for Software Quality Assurance Plans"

m. IEEE STD 828, "Software Configuration Management Plans"

n. ANSI/IEEE-ANS-7-4.3.2, "Applicable Criteria for Programmable Digital Computer System in Safety Systems of Nuclear Power Generating Stations"

o. ASME NQA-2 P2.7, "QA Requirements of Computer Software for Nuclear Facilities Applications"

p. NRC Reg. Guide 1.152, "Criteria for Programmable Digital Computer System Software"

q. ANSI/IEEE-1033, "Application of IEEE to NP"

r. ANSI/IEEE-1042, "Guide to Software Configuration Management"

s. NSI/IEEE 829, "Standard for Software Test Documentation"

Specifically in the area of software Validation and Verification.

t. ANSI-C2-90, National Electrical Safety Code

u. ANSI Y32.2-1975, Graphic Symbols for Electrical and Electronic Diagrams

v. ANSI Y32.16-1975, Reference Designations for Electronics Parts and Equipment

w. NEMA ICS-1988, General Standards for Industrial Control and Systems Rev. 2, 1990

x. UL 478-84, UL Standard for Safety Information Processing and Business Equipment

y. ANS 3.1-87, Selection, Qualification and Training of Personnel for Nuclear Power Plants

z. IEEE 488.1-87, Standard Digital Interface for Programmable Instrumentation

aa. ANSI/ISA RP 55.1-71, Hardware Testing of Digital Process Computers, Recm. Practice (R 1983)

ab. IEEE 583-82, Standard Modular Instrumentation and Digital Interface System (CAMAC)

ac. IEEE Std 983, "Guide for Software Quality Assurance Planning"

ad. Local Laws, Regulations, and Codes as furnished by the GAN and NRA within 90 days of contract award.

ae. INPO 86-026 "Guidelines for Simulator Training"

af. EPRI NP-3873 "Analytical Simulator Qualification Methodology"

ag. NUREG/BR-0617 "Software Quality Assurance Program and Guidelines"

A copy of these codes and standards and any other codes or standards used as the basis of design shall be supplied as part of the deliverable Simulator data base.

C.2.2 Other Codes and Standards for Reference

The Contractor shall be aware of and consider the applicable parts of other standards and reference guides that the Contractor uses in design efforts relative to the plant, computer systems, and data base management systems. The Contractor shall justify in writing to the Government for its concurrence during the course of the contract those references listed below which are deemed not to be applicable in whole or in part:

a. ANSI X3.1, "Synchronous Signaling Rate for Data Transmission"

b. ANSI X3.12, "Vocabulary for Information Processing"

c. ANSI X3.24, "Signal Quality at Interface Between Data Processing Terminal Equipment and Synchronous Data Communication Equipment for Serial Data Transmission"

d. ANSI X3.4, "Code for Information Interchange"

e. ANSI Y14.15, "Electrical and Electronic Diagrams, Including Supplements Y14.15a-1970 (R1973) and Y14.15b-1973"

f. ANSI/IEEE Std 91, "Graphic Symbols for Logic Diagrams (Two State Devices)"

g. Bulletins 1-10, "Designers Guide on Electromagnetic Compatibility (EIA)"

h. EIA Std RS-363, "Standard for Specifying Signal Quality for Transmitting and Receiving Data Transmission at the Interface with Non-synchronous Data Communication Equipment"

i. EIA Std RS-404, "Standard for Start-Stop Signal Quality Between Data Terminal Equipment and Nonsynchronous Data Communication Equipment"

j. Mil Std 471, "Maintainability Verification/Demonstration/Evaluation"

k. Mil Std MIL-HDBK-217, "Reliability Stress and Failure Rate Data for Electronic Equipment"

l. IEEE Std 352, "Guide for General Principals of Reliability Analysis"

m. IEEE Std 830, "Guide for Software Requirements Specifications"

n. INPO TQ -504, "Good Practice for Simulator Configuration Management Systems"

C.3.0 Project Organization

The Contractor shall establish a Project Team headed by a Project Manager. The Contractor shall have in place a clearly defined organizational structure within which the project team will be able to obtain resources to complete this project.

C.3.1 Project Manager

The Contractor shall assign an experienced Project Manager to the contract. The Contractor Project Manager shall have overall responsibility for directing all of the Contractor's work, and shall be vested with all the necessary authority to carry out primary liaison between Contractor, Government and GAN and NRA. Any replacement of the Project Manager is subject to the clause entitled "Key Personnel."

C.3.2 Minutes of Meetings and Telephone Conversations

The Contractor shall provide the Government with minutes of all meetings and teleconference communications wherein any commitments, agreements, reviews, or approvals were made by either party. The minutes of meetings shall be provided to the Government no later than 10 business days following the date of meeting. The minutes of teleconference communications shall be provided to the Government no later than 5 business days following the date of the communication. The Government will have an equal amount of time to take exception to the Contractor's minutes. If no exceptions are taken within ten calendar days, then the minutes are accepted.

C.3.3 Project Team Information

A joint team meeting between the Government, Contractor, GAN and NRA to answer any remaining questions will be scheduled within the first month of the contract to review all purchase documentation and to eliminate any possible misunderstandings.

C.3.4 Project Communication

Normal project correspondence to the Government shall have the following distribution: two full copies to the GAN, two full copies to NRA, one full copy to the Contracting Officer and one copy to the Project Officer.

Within the first three months of the contract, the Contractor shall establish electronic and mail transfer between Contractor, Government, GAN and NRA. This electronic communications system shall be capable of maintaining all project correspondence and schedules, which shall be kept up to date throughout the project. The preferred method for this electronic communications system will be use of the Internet.

An electronic communications system shall also be used to send project review documentation and any other information requiring review, comment, and approval. This system or another system shall be capable of read and write access to any CPU in the Simulator computer complex. The systems shall be supplied to the GAN and NRA and installed in the headquarters of GAN in Moscow and NRA in Kiev. The system shall be compatible with systems available at the Government site in Chattanooga, Tennessee.

C.4.0 Training

C.4.1 General

Within 60 days of contract award, the Contractor shall submit a training program plan consisting as a minimum of the material outlined in this section and a recommended location for the training courses. The programs shall contain courses that will allow the GAN, NRA and the Government personnel to gain sufficient experience in the operation and maintenance of the Simulator.

Before any courses are finalized, the Contractor shall submit for approval a recommended curriculum of training activities which shall include, for each course, a course syllabus, recommended student qualifications and

prerequisites, and the number of instructors required for each course.

The Contractor shall provide a location for the training courses. The Contractor shall also provide transportation to and from the training site, and lodging and meals while at the training site for the Russian and Ukrainian course participants. The training provided shall include a combination of classroom and on-the-job training. The Contractor shall also include a proposed schedule for this training. All classroom training courses shall be finished one month before the Final Acceptance Test. For all training, an interpreter shall be provided by the Contractor. GAN and NRA personnel who will maintain, modify, and operate the Simulator shall be included in the on-the-job training.

A detailed course outline shall be submitted to the Government, NRA and GAN for approval 2 months before any of the courses begins.

C.4.2 Instructor Training

The Contractor shall provide an instructor training course to familiarize not less than a total of eight (8) Simulator instructors from GAN, NRA and the Government with the control functions and their unique capabilities and limitations, to assist these instructors in the training of personnel. As a minimum,the following topics shall be covered:

a. Modeling of plant systems
b. Simulator operations (steady-state, transient, startup and shutdown, malfunction, etc.)
c. Design and organization of instructor station
d. Instructor station functions
e. Hardware concepts for instructors
f. Software concepts for instructors

C.4.3 Software Maintenance Training

The Contractor shall provide software training for not less than a total of eight (8) software engineers from GAN, NRA and the Government in the use of operating system software supplied by the computer vendor, and also for all software products developed or purchased by the Contractor and its subcontractors for use in the Simulator.

This training shall cover details of the internal design and the external user interface. It shall provide GAN and NRA

personnel with the skill and expertise to troubleshoot and correct software problems and to implement new models or software changes.

As a minimum, the following topics shall be covered:

a. FORTRAN 77

All control and input/output (I/O) statements; function and subroutine calls; run-time library calls; equivalence, COMMON, and DATA statements; specific enhancements to the FORTRAN standard; calling conventions for interface with Assembler subroutines; and operating system services that can be called from FORTRAN.

b. Simulator Programming Languages Other Than FORTRAN 77 (Such as C or C++)

Program structure, the form and constituents of C (as an example) declarations for variables, functions, types, expressions and assignments, statements, functions, preprocessor directives and programs. Programming with mixed languages, and operating system service callable from C language.

c. Simulator Operating System Software

Introduction to the operating system, text editors, file system, file manipulation, system command, shell scripts, programming environment, source code control system utilities, and the system administrator functions.

d. Utilities

Text editors, task linking, object libraries, console operator commands, and system generation.

e. Simulator Executive And System Software

f. Individual Simulation Models

The training shall cover, in detail the theory of the mathematical model design in addition to the details of the software.

g. Simulation Model Development Tools

The training will cover in detail the theory and use of all simulation model development tools used in the development of simulation models for the Simulator.

h. Instructor Station Software

i. Simulation Support Software Required for Software Maintenance

j. Simulation Software Design, Troubleshooting, and Modification Procedures

k. Simulator Software Testing System

l. Interprocessor Communication Software

m. Simulator Configuration Management System (CMS)

n. Hardware Concepts for Software Users

Basic computer system architecture and functional units, interrupt and I/O processing theory, system configuration, and memory subsystem. This course shall be designed to provide an understanding of basic hardware concepts that will aid in configuring handlers, writing applications programs to interface with the hardware, and in communicating with hardware personnel.

o. Documentation system, including the use of equipment and software to maintain electronically stored documentation

C.4.4 Training of Hardware Maintenance Personnel

The Contractor shall provide training for up to a total of eight (8) hardware engineering and maintenance personnel from GAN, NRA and the Government in the maintenance, troubleshooting, and repair to all computer equipment supplied with the Simulator. It shall be assumed that the Government GAN or NRA personnel receiving this training have no experience maintaining and troubleshooting computer equipment. The Contractor shall provide hardware training for all Simulator hardware manufactured by the Contractor or his subcontractors. The training shall provide the Government GAN and/or NRA personnel with the knowledge and expertise to troubleshoot and repair malfunctioning

equipment to the smallest replaceable unit (subassembly, circuit card, component, etc.). As a minimum, the following topics shall be covered:

a. CPU Architecture and Maintenance

This course shall provide the Government, GAN and NRA hardware maintenance and engineering personnel with the skills needed to efficiently operate, test, adjust, and troubleshoot the Simulator computer system to the board level. Topics shall include theory of operation, computer organization and characteristics, system integration, physical layout and packaging, instruction set, all levels of diagnostics, and troubleshooting.

b. Simulator I/O system

c. Testing and diagnostic software

d. Use of any test equipment furnished with the Simulator

e. Software Concepts for Hardware Users

This course shall provide the Government GAN and NRA hardware and maintenance personnel with the fundamental operating system skills necessary to perform system checkout, software installation, and aid in system troubleshooting. A basic overview of the operating system, task structure, interactive processing, and operator console operations shall be included.

f. Maintenance of the Peripheral Subsystem

This course shall provide the Government GAN and NRA maintenance and engineering personnel with the skills needed to efficiently operate, test, adjust, troubleshoot, and perform field maintenance on all peripheral and communications equipment supplied with the Simulator.

C.4.5 Training Materials

The Contractor shall provide six copies of all course materials at least two months before the course begins. NRC will be given one month to comment on this material. Approval of the course material is required two weeks before course begins.

The Contractor shall also submit six additional sets of the training materials used in each training course specified in this section as directed by the NRC. GAN and NRA will use this material for future training of personnel.

C.5.0 Simulation Hardware

C.5.1 General

The Simulator shall be a computer-based system consisting of student/user consoles, an instructor station, the simulation computer, power equipment, protection systems, interconnecting cabling, test equipment, and consumables.

C.5.2 Student/User Consoles

The hardware configuration shall provide for seven (7) operator stations which allow for independent manipulation of the plant via CRT interface. The plant systems with all information about simulated plant regimes based on calculations in the models shall be displayed on color monitors through mimic diagrams of the simulated systems. Such simulation diagrams must be in Cyrillic or Latin characters for ease of use by GAN and NRA. A minimum of 50 displays shall be provided for sufficient system representation and interface.

The student (or user) shall be able to change the status of all simulated equipment directly from the simulation diagrams (mimic diagrams) using a keyboard or mouse.

C.5.3 Instructor Station

A dedicated instructor station shall provide the capability to enter simulator malfunctions, perform remote plant functions not normally performed from the control room, and have the capability to do the following:

a. Snapshot
b. Freeze
c. Backtrack
d. Monitor Critical Parameters in Graphic Formats
e. Designate/Establish Event Triggers

It shall include keyboards, pointing devices, and monitors as necessary to allow for modification and enhancement of the models. The computer shall be a state-of-the-art 32 bit or larger word size computer. The instructor station shall include a laser printer. The printer shall be capable of printing in color and with a minimum resolution of 300 dpi.

It shall conform to industrial standards in terms of hardware and software.

C.5.4 Simulation Computer

The simulation computer is the central processing unit(s) which run the simulated plant models. It shall include keyboards, pointing devices, and monitors as necessary to allow for modification and enhancement of the models. The computer shall be a state-of-the-art 32 bit or larger word size computer. It shall conform to industrial standards in terms of hardware and software. The computer shall have a floating point co-processor and all dynamic calculations shall be done by using floating-point arithmetic where appropriate.

C.5.4.1 The computer system shall be able to adequately perform the following:

a. Control the simulation process.

b. Realistically reflect the real-time responses of the student (or user) manipulations of the plant controls mimics.

c. Maintain control functions of peripheral devices and their associated functions.

d. Retain I/O transfer rates so that responses observable in the Simulator are not distinguishable from those of the reference plant.

e. Provide an environment for software development and maintenance.

f. Have built-in diagnostic functions.

C.5.4.2 The CPU spare time shall be available such that both of the following requirements shall be met;

As a minimum, 30 percent spare time for each CPU within the computer system shall be available in a basic simulation cycle during maximum load operation. The basic cycle is the time interval in which any application software programs are executed once. This cycle cannot exceed (0.1) second. Also, 10 percent spare time for each CPU shall be provided within each of the shortest computing cycles.

The requirements shall be accomplished for real time operation of the Simulator. The real-time capability of simulation shall not be affected during the tests.

The Contractor shall provide methods to check CPU spare time which can be used to show or prove the that there is CPU spare time, as defined above.

C.5.4.3 There shall be an inherent capacity for at least 100 percent memory expansion without the addition of a new cabinet, chassis, or the modification of software addressing schemes.

C.5.4.4 Each computer system shall be provided with the required I/O controllers. Within 60 days after contract award, the Contractor shall inform the Government by letter of the spare capacity in data communication. The Simulator shall use TCP/IP communication protocol.

C.5.4.5 The diagnostic unit shall be an integral part of the CPU, or a separate unit. It shall be usable both on- and off-line. The functions of this unit shall include, but are not limited to, checks of RAM and ROM failure, floating point co-processor failure, data link buffer, and CPU reset of watchdog timers.

C.6.0 Data

C.6.1 Design Data Base

It is recognized that the fidelity of simulation of a nuclear plant greatly depends upon the completeness and accuracy of the data used by Contractor. In addition, the Contractor must apply the data effectively, advise the Government of how the data is applied, and document that application. It shall be the responsibility of the Contractor to collect or procure all data, necessary to simulate or stimulate required systems and meet the criteria of this specification. The Contractor shall clearly define all data and take full responsibility for its collection and reproduction. The Contractor shall provide a data-requirements list.

C.6.1.1 Government, GAN and NRA Review and Acceptance

The Government reserves the right to review, for acceptance, any data utilized by the Contractor in developing of the design data base. The review and acceptance of any Simulator design data base drawings, procedures, references, specifications, or data by Government, GAN or NRA shall not constitute partial or complete approval of any design, material, equipment, or program which does not meet the physical, functional, or performance criteria established in this Specification.

C.6.1.2 Data Base Management

The Contractor's data collection and control program shall be a part of the configuration management system described in Section C.7.4 The Contractor shall provide samples of instructions, procedures, and forms designed to facilitate the collection, collation, logging, and transmission of data for review. The complete set of data base management programs used to catalogue, generate, modify, and manipulate the design data base shall be provided to the Government, GAN and NRA within 30 days after contract award to allow tracking of the data and use of the program so as to minimize problems during the database collection and the project management process.

C.6.1.3 Data Base Report

The Contractor shall prepare and submit a logically ordered and usable data base report by the time prescribed in Section F. A freeze date for the design data will be recommended in the report. It shall list all data to be submitted for review and approval by the Government, GAN and NRA immediately following the data freeze date and before any system coding. The report, at a minimum, shall list: data by source and type, receipt date, name, sheet number, revision, Contractor's control number, and explicit use within the Simulator. The report shall be formatted in a manner to facilitate its review and the determination that the report is accurate, and that the data listed therein is properly defined and retrievable by persons designing, building, and maintaining the Simulator. All data used or referenced in the design, construction,

programming, documenting, and testing of the Simulator shall be included in the data base report. Data from all sources shall be listed. Further, the data base report should state any restrictions to which a particular item might be subject, (e.g. copyright, proprietary restriction).

The tracking of use of data (in or by a system or hardware unit) shall be done to the lowest sub-assemblies of hardware or software where the data was (is to be) utilized, including multiple entries where a single data item was used in more than one system or hardware unit.

Both the final data base report and the complete program set used to generate, modify, and manipulate the data shall be supplied to the Government, GAN and NRA as part of the Simulator support software.

C.6.1.4 Government Supplied Data

Transmittal to Contractor by the Government, GAN or NRA of any design or performance data, if it occurs, shall not relieve the Contractor of the responsibility of obtaining other necessary data, or data that is proprietary to any designer or manufacturer of the components, systems, or software.

C.6.2 Freeze Date for the Design Data

System or specific data to be supplied after the freeze date will be mutually agreed on. Before the freeze date, the Contractor shall submit, monthly, for review, a complete and accurate listing of that design data which is currently in the Contractor's possession. This listing shall be formatted and sorted in a manner to facilitate a review and the determination that the listing is accurate, and that the data listed thereon is properly defined and retrievable by persons designing, building, and maintaining the Simulator. Review of this data listing by the Government, GAN or NRA shall not relieve the Contractor of the responsibility of obtaining other necessary design data that the Government did not provide or that is proprietary to or in the control of other designers or manufacturers of components or system.

Within seven days following the data freeze date, the Contractor shall submit a data base report to the

Government, GAN and NRA. The Government will approve the data base report or return it with comments. Review and approval of the data base report will include form, format, accuracy, the adequacy of the data, and the acceptability of the source.

C.6.3 Data Not Used by the Contractor

Data which has been logged into the accepted data base report and is determined by the Contractor not to be applicable to the Simulator project shall be removed from the data base report by the Contractor. Any data so treated shall first be identified to the Government, GAN and NRA, along with a justification for its removal. The Government has the right to approve the removal of any listed data.

C.6.4 Specification Data

Any data supplied with the Specification or award of the contract is not intended as design data for developing the Simulator. Design data for development shall be considered final only after the freeze date, as described herein.

C.7.0 Simulator Software Requirements

C.7.1 General Requirements

a. All Simulator software, which are described in this section and elsewhere, shall be provided in both source and binary form.

b. All software licenses shall be provided so that the Government can, if desired, contract software maintenance to other, third-party Contractors.

c. The Government considers Simulator development tools as one of the key factors for effective technology transfer, as well as for the performance and maintenance of the Simulator. The Contractor shall provide license for and source code for all the following:

- Simulator development tools (C.7.7.4.2 through 7.7.4.5)
- Executive system software (C.7.3)
- Configuration management system software (C.7.4)
- Instructor station software (C.7.6)

C.7.2 Operating System Software Requirements

C.7.2.1 Operating System Software

a. The Contractor shall use an industrial standard-type operating system (o/s) with real-time capability on the Simulator computer and the instructor-station computer supplied from a computer vendor.

b. The Contractor shall provide a Simulator Operating System with real-time functions capability for the proposed computers.

c. The operating system software supplied shall provide all software handlers/drivers for various peripheral devices to set up communication between the application programs and the devices. These handlers shall provide priority queuing for individual devices, maintenance of internal device status tables that record changes in operation of the devices due to errors, and a mechanism for reporting to system personnel the status of all system devices.

d. The Contractor shall avoid the following items to the extent possible and shall obtain the Government's approval before implementing any of them:

1) Applications bypassing the normal I/O control of the O/S

2) Device drivers not supplied by the computer vendor but required for the Simulator or computer complex to operate properly

3) Modification or additions to the O/S or I/O drivers

4) Applications accessing O/S data structures directly, bypassing o/s service calls

5) Applications involving modification or replacement of the normal O/S utilities, support programs, or language compilers.

e. The Contractor shall obtain approval for the items noted above by submitting a list of these items with the Preliminary design specification for the Simulator Software Implementation.

f. All software language compiler(s) employed in creating the Simulator's LAN (see C.5.4.4) including O/S utilities and support software (e.g. run-time library, graphic library, program development tools, and other library) shall be included in the total software package.

g. The Contractor shall supply the source code of the software supplied by the computer vendor, as far as possible.

C.7.2.2 Operating System Features

The following are required features for the operating systems:

a. Support for real-time, event-driven, multi-task applications in a high-priority foreground environment, with a timesharing, interactive, multiprogramming capability in a background environment

b. Virtual memory management, mapped memory management, or support for multi-level task overlays

c. Dynamic memory allocation, including dynamic inclusion of a shared code or data section.

d. All O/S services, including task activation/control and resource management, can be accessed via system service calls from appropriately privileged tasks.

e. Memory-resident subroutine library support

f. Support for on-line program development

g. Support for multi-CPU parallel processor configuration and inter-processor shared memory

h. File management support

i. Global common-memory support

j. Automatic scheduling of multiple jobs across the available processors for improving transparent throughput

k. Computer complex network support

C.7.3 Requirements for the Executive System Software

a. The executive system shall be fully integrated to support the execution, development, and testing of real-time simulation model software.

b. The executive system shall run on the host simulation computer.

c. This system shall be designed and implemented under the Simulator's operating system environment, as specified in Section 7.2. The system shall take full advantage of the Simulator's operating system and Simulator operating system utilities, and shall also fully use the real-time capability.

d. The system shall have a window-based, multi-tasking, menu-driven, software environment.

e. Protection and security features shall be included to prevent unauthorized access to the protected area and accidental loss of data.

f. The executive system shall include all the essential elements to support a powerful and user-friendly real-time simulation environment. The following supporting functions shall be included in the executive system:

1) The database management function shall be furnished to control the simulation software database by providing maintenance for the software modules and symbols information. The database shall provide control information for the run-time environment, assign global addresses for symbols, maintain cross reference information, and respond quickly to an on-line query during all phases of development, testing, and operation.

2) A real-time debugging function shall be furnished as a powerful, user-friendly software system which provides a set of commands for monitoring and

controlling real-time simulation models. Break-pointing capability also shall be provided. All program variables and constants in the global database shall be modifiable on-line. The real-time debugger shall also have some basic instructor-station functions, such as reset, snapshot, freeze/run, and step. It shall allow the user to manipulate the malfunctions and remote functions for making system stand-alone tests.

3) The real-time executive shall be furnished to control and execute the simulation programs.

4) An individual system executive shall be provided to facilitate the stand-alone testing of individual simulation programs during development and modification without affecting the real-time environment.

5) A scanner function shall be provided to resolve the address assigned to each simulation module. It shall scan a module in source code and properly validate each symbol defined in the database, check the source-code language syntax, and then, assign a proper address for each symbol declared in the database.

6) A function for real-time synchronization control shall be included to fully integrate the control and timing functions required by the simulation environment.

7) A linker function shall be included to allow the user to link simulation modules into a real-time executive for the Simulator.

C.7.4 Configuration Management System

The Contractor shall use a Configuration Management System (CMS) that meets the requirements of the standards listed in Section 2 (including ANSI/ANS 3.5, ANSI/IEEE-828 and ANSI/IEEE-1042) as a minimum. The CMS shall be designed to support effective training as well as to be used as a dynamic tool, intended as an integral part of a Simulator project from its initial design to end-of-life.

C.7.5 Application Software Requirements

The Simulator application programs are identified as those program modules which are required to simulate the functions of plant systems

C.7.5.1 Software Design

a. Modularity:

1) The Contractor shall employ a modular framework in the design to permit additions or deletions to the program without modifying other modules.

2) Each plant subsystem shall be defined and implemented as a separate, self-contained module. The modules shall be sufficiently accessible and well defined to permit field modifications by the GAN and NRA engineers.

3) The Contractor shall provide access to all mathematical expressions to make changes in programs.

4) The models shall generate all data and variables required for output to external devices, or needed by other programs within the computer.

b. Object-Oriented Design

1) The Contractor shall design the Simulator software so that all simulated plant components and their associated control-room controls and indicators are controlled by standard handlers or subroutines.

2) A standard program shall be used for repetitive use of same components.

3) The plant components for which this requirement applies are:

- Valves
- Motors/Pumps
- Controllers
- Electrical Breakers
- Other plant components with control room indicators or controls

c. Expandability

Refer to Section C.5.4.2 for spare CPU processing time requirements.

d. The programs shall be protected from unintentional destruction by power failure, tampering with the computer operator's controls, or erroneous data or program entry.

C.7.5.2 Program Language and Programming Format

a. The Contractor shall be responsible for assuring that all programmers use standard formats and techniques for programming. Programs which do not adhere to these standards will not be accepted.

b. The formats may vary, as required, by the use of different languages (i.e. FORTRAN 77, C) or different program requirements (e.g., executive system software and plant models).

C.7.5.3 Setpoint Common

Plant operating parameters that are normally constant shall be placed in a globally accessible COMMON area separate from other simulation variables, and shall be initialized with a FORTRAN BLOCK DATA program or equivalent. All program modules using these setpoints shall reference this COMMON area.

C.7.5.4 Nomenclature

a. All program nomenclature must be based on a standardized alphanumeric system that identifies the plant system to the design documentation.

b. The device hardware tab shall be used as the software label whenever possible within the limitations on the permissible number of characters imposed by the computer system.

c. The only exceptions to the standard nomenclature allowed are in those Simulator programs that already have acceptable nomenclature through years of use in Analysis or design programs, or in related industrial applications.

d. This standard nomenclature shall reflect the reference plant system and component identifiers.

C.7.5.5 Variable Names

a. Software variable shall be named using a consistent convention.

b. Variable names shall indicate the calculating module and type of parameter (i.e., temperature, pressure, and flow, etc.).

c. If the compiler allows more than eight characters to uniquely name a variable, then the Contractor should, where necessary, use the extended variable naming facility to implement the variable naming convention to clearly indicate the variable function.

C.7.6 Software Requirements for the Instructor Station

C.7.6.1 Introduction

a. The instructor station shall use the state-of-the-art computer software and hardware technology.

b. The design shall be based on a high-resolution graphics engineering workstation which has multi-task and multi-window (x-window) capability.

c. The software shall be developed under a compatible Simulator operating system with a real-time capability as the one in the host simulation computer.

d. Some of the additional required features are described below:

1) User Friendliness:

This system shall be designed to accommodate both the occasional and expert user. With menu-driven techniques, the system shall provide the occasional user with information or options to access the instructor station in a step-by-step fashion. With the command control techniques, the expert user shall be able to type in the command.

The instructor station shall have a context-sensitive help feature for its operation. Pull-down menus, pop-up windows, graphic sliders, and a context-sensitive help feature shall be employed to simplify the instructor's interaction. Conveniences such as programmable function keys and expert command, shall be provided to minimize the transaction time of the instructor's interventions.

2) Transportability:

The entire software system shall be transportable to another computer platform which uses a compatible operating system and software language.

3) Flexibility:

Modularized/Layered programming techniques shall be built into the software system of the Instructor Station. Advanced development of software packages shall be easily integrated and adapted into the existing software.

4) Multiple Windowing Capabilities:

The instructor station software shall be developed under an X-window environment. Users shall be allowed to work with multiple processes simultaneously, each in a separate window. Each window, with its process, shall be an independent entity. The instructor station CRT shall be able to simultaneously display different graphics, such as monitored parameter trending, simulation diagrams or malfunction summary pages.

The instructor shall be able to view the instructor station display with read-only privilege on the same CRT so that the functions available in both environments can be accessed simultaneously.

C.7.6.2 Requirements for the Design of the User Interface

a. The user interface of the instructor station shall be designed with menu-driven and X-window-based technology. The user interface shall include manipulation of the pop-up menu, pull-down menu, and side-bar

menu with inputs from the computer keyboard/mouse/touch screen/dedicated function keyboard.

b. All the displays on the instructor station shall be generated using X-window-based graphics. This graphics software shall be an interactive, menu-driven package. The user shall be able to create the static background, the dynamic foreground objects, and define the selectable target area on display.

c. All the displays shall be arranged in a hierarchical fashion, from overview to detailed displays. Starting from the "tableau", the command button shall be selected.

d. Expert mode commands also shall be available for the instructor to enter the commands directly through the keyboard.

e. The design of the user interface shall be based on the following list of principles:

1) The interface shall be consistent throughout all the instructor station functions. The instructor shall be able to access all the functions in a similar manner, such as control window, pull-down menu, side-bar menu or expert mode commands.

2) The interface shall keep the user aware of what is going on in the process. A feedback message shall be provided to the instructor after each instructor's action. The message may be a warning or request for an input. Once the instructor selects a command button, the command button shall be highlighted. While the action is being processed, the cursor shall change to another symbol, showing an inactive mode.

3) Various techniques shall be provided to access the instructor station functions. The menu technique shall be available for the occasional user while, the expert-mode command shall be available for expert users.

4) The interfaces shall include access to the help menu. The context-sensitive help

feature shall be available for the instructor to access the help database which shall provide general information and the required input format of the selected item.

5) The color scheme for the instructor station display, such as pull-down menu, pop-up menu, control window, command button and dynamic indication shall be consistent.

C.7.6.3 Software & Maintenance Features

a. The instructor stations shall provide for the following:

1) Software Maintenance

- Process model development and validation - Executive-system software maintenance for the simulation computer
- Instructor station software maintenance

b. All the Simulator development/maintenance support tools described in Section C.7.7.4 for the design, development, execution, test, and maintenance of the Simulator's software and hardware shall be accommodated and integrated in the instructor station.

C.7.6.4 Maintenance/Development Support Software (Simulator Development Tools)

C.7.6.4.1 General

a. The Contractor shall provide the necessary system model development software (tool), test programs, diagnostic and other utility programs which are required to maintain the Simulator software and hardware.

b. The computer vendor's utility software also shall be provided. Such software includes compilers with mathematical and scientific subroutine libraries, linker, editor, and debugger.

c. For each automatic code generator, the Contractor shall provide:

1) Graphic front end (or graphic editor described in Section 7.7.4.2) that is associated with the automatic code generator.

2) Model test environment (Section 7.7.4.4) that is associated with the automatic code generator.

d. Simulator development tools, described in Sections 7.7.4.2 through 7.7.4.5, shall be integrated as much as possible.

C.7.6.4.2 Graphic Editor

a. The graphic editor shall possess a CAD-type interactive graphic capability with full pan, zoom, and extend features and shall use predefined graphic Icon's (pumps, valves, flow restrictors, etc.) as the input vehicle. The graphic editor shall create schematic input to the automatic code generation system.

b. One universal graphic editor shall be used for any graphics used in Software maintenance and development work.

c. For each automatic code generator, the Contractor shall provide shall provide:

1) Object Editor: The object editor shall be able to create or modify a generic model and its graphic symbol of plant baseline objects, like pumps, valves, relays, and register them in the object library.

2) Model Editor: The model editor shall be able to construct a system model using graphic symbols and links from the baseline object libraries and entering object parameters (or constants).

C.7.6.4.3 Automatic Model Generation Tools

a. To enhance the maintainability of software, the Contractor shall provide automatic code generators for the following model classes which are used during development of the Simulator software:

1) Library of objects (standard generic programs)

2) Single-phase incompressible fluid thermohydraulics

3) Single-phase compressible fluid thermohydraulics

4) Two-phase homogeneous thermohydraulics

5) Two-phase non-homogeneous thermohydraulics

6) Sequential logic

7) Network logic

8) Process (analog) control system

9) Electrical network

10) Multi-node containment system

b. The automatic code generator package shall allow easy, error-free development and modification of the Simulator software by engineers who are familiar with the operation and design of the plant.

c. The package shall be written in high level language

d. All modules, variables, and constants shall be maintained in a data-base management system, with automatic cross references.

e. This system shall generate a simulation program source-code with design data references, database variables, and

simulation constant files.

f. The requirements for the automatic code generator or package are the following:

1) The schematic diagram(s) of a model with one or multiple types (e.g. hydraulics objects and control objects mixed) created by graphic editor shall be taken as an input by the automatic code generator.

2) This package shall include an object library to store the baseline models (or objects) for model development.

3) This package shall have the necessary connections to the configuration control system to control the level of revision and modification of models or handlers.

4) This package shall automatically generate both the structured source code and data points in the data base.

5) This package shall translate raw data into simulation model input data.

6) This package shall include constant-value calculation subroutine modules in a library.

7) This package shall automatically generate specific documentation.

C.7.6.4.4 Model Test Environment

a. The Simulator test environment shall have simulator executive system functions, debugging functions supplied by the vendor of the computer, and the following functions (mostly instructor station functions) to provide the maintenance engineer with an environment to support system model debugging, tests (stand-alone and integration) and validation.

1) To monitor the performance of the system model, the schematics of the hydraulic, electrical, control, and logic systems which are created by graphic editor, must dynamically respond to the simulation model on the instructor station for integration tests.

2) It must dynamically display, in diversified form, the following:

- The numerical readouts,
- The change of color,
- The change of size,
- The change of position, etc.

3) It must simultaneously display and allow browsing among adjacent schematics (including different kinds, such as hydraulic schematic to control schematic) and through interface variables.

4) It must allow the trend display of simulation variables to dynamically respond to the simulation model the host simulation computer for integration tests.

5) It must allow control actions by manipulating the ICONs in the schematics.

6) It must provide control and monitoring of program execution, using basic instructor station functions such as reset, snapshot, freeze/run, and step.

7) It must allow the user to manipulate the malfunctions and remote functions.

8) It must allow the display and modification of the object (or plant component) parameters.

9) It must allow display and modification of the model boundary conditions (external variables).

C.7.6.4.5 Computer Diagnostics

The following computer diagnostic programs shall be provided:

a. Computer and Peripheral Test Program

1) The complete library of test and diagnostic programs provided by the computer vendor shall be supplied to Government, GAN and NRA with the relevant documentation. These programs shall test the CPU (a complete instruction set including floating-point operations), the bus, the private and shared memory modules, all communication and peripheral controllers, and all peripheral equipment. The diagnostic programs shall display clear messages on an operator's console.

2) The test programs shall be sufficiently powerful to help solve problems which may arise in multi-processor configurations such as, but not limited to, bus contention, priority conflicts, and signal timing problems.

3) If additional equipment is necessary to load and/or display test results they shall be included in the Contractor's recommended list for special equipment.

4) Off-line, stand-alone programs are acceptable but preference will be given to systems which can permanently monitor the configuration status of the computer while the simulation is running.

5) The Contractor shall provide diagnostic programs for any peripheral device or system component that is not covered by a computer vendor diagnostic program.

b. Interface Test Program

The Contractor shall supply a test program for the interface system. It is mandatory that basic functions, i.e. detection and reporting of failures at the board level, are available in on-line programs. If special test equipment is necessary, it shall be included in the Contractor's recommended list for special equipment.

c. Software Test Program

Diagnostic routines shall be provided to monitor internal software program loops, computer program stalls, and other software or hardware malfunctions. When a software or hardware malfunction or fault is detected, a message shall be displayed on the system console.

C.7.6.4.6 Simulator Hardware Diagnostics

a. On-line test and diagnostic programs shall be provided to verify proper operation of equipment and to effectively detect failure of equipment. These test and diagnostic programs shall encompass all the student workstations and the instructor station. They shall be controlled from the instructor station or from a remote device.

b. Diagnostic routines also shall be provided to alarm when the computer's temperature is too high, a computer program stalls, or when the software or hardware malfunctions or faults. Upon activation of a malfunction or fault, there shall be an audible alarm or buzzer located in the instructor station which can be silenced. This alarm also shall activate if the computer comes to a halt.

c. The capability shall be provided to execute the diagnostic software from the instructor station, without the Simulator software being active.

C.7.6.4.7 Simulator Software Diagnostics

a. A diagnostic program shall be supplied to verify the proper loading and operability of the Simulator software/hardware integrated package.

b. This program shall be executed at initial start-up so that all software and hardware system components are verified operable and ready to run, and shall display a message on the instructor station indicating that the Simulator is "ready-to-run".

c. The program also shall display a message on the instructor station if any component is malfunctioning, and shall identify the component.

d. A diagnostic routine shall be supplied which detects computer faults (stalls or halt) and activates an audible alarm and visual indicator on the instructor station. It must be possible to disable this alarm at the instructor station.

C.8.0 Plant Systems to be Modeled (Scope of Simulation)

The Simulator shall model all plant systems required to operate the reference plant in normal, abnormal, transient and emergency operations. At a minimum models for the systems identified below must be included. The scope of simulation should be at least equal to that of a full scope simulator. Specific requirements for system models are described in Section C.10. The system below are those necessary for VVER-1000 plants. (VVER reference TAG number are listed after some systems for reference) For reference plants other than the VVER-1000 design, the scope of simulation shall include a similar set of systems.

C.8.1 Primary Systems

Reactor Core Physics(YC)
Reactor Control
Ex-Core Neutron Flux Measurement Systems(AKNP)
In-Core Measurement Systems(SVRK)
Control Rod Drive Manual Individual and Group Control(PG & IU)
Reactor Power Controller (ARM)

Reactor Power Limiter Controller (ROM)
Reactor Power Accelerated Throw Down System (URB)
Reactor Protection System (AZ)
Preliminary Reactor Protection System (PZ#1 & 2)
Reactor Coolant System (YA)
Reactor Coolant System Logic
Steam Generators (YB)
SG Power Operated Relief Valves (TX50,60,70,80)
SG Atmospheric Dump Valves (TX50,60,70,80)
Main Steam Check Valves (TX50,60,70,80)
Main Steam Isolation Valves (TX50,60,70,80)
SG Blowdown System (RY)
Reactor Coolant Pumps (YD)
RCP Motor
RCP Lube Oil System (YD50,60)
RCP Lower Bearing Cooling Loop (YD11,21,31,41)
RCP Seal Water System (YD51,52,53,54)
RCP Bypass Coolant Purification System (TC)
Pressurizer (YP)
Pressurizer Spray (YP11,12,13)
Pressurizer Heaters (YP10)

Pressurizer PORV (YP21,22,23
Pressurizer Relief Tank (YP20)
Primary Emergency Steam GAS Removal System (YR)
Primary Chemical and Volume Control
Makeup and Letdown System (TK)
Makeup Pump Lube Oil System (TK30)
Coolant Purification System (TE10,20)
Chemical Injection System (TE20)
Boron Solution System (TB10,30)
Clean Condensate System (TB40,TN)
Coolant Drainage and leakage Collection System (TY)
Hydrogen Burnup System (TS10)
Gas Purification System (TS20)
Reactor Building Floorwater System (TZ)
Spent Fuel Cooling System (TG)
Component Cooling System (TF)
Nitrogen Supply System (TP,UG)
Containment Ventilation System (TL)
Containment Compartments Recirculation Cooling System (TL01)
Air Purification System (TL02)
Reactor Upper Unit Cooling System (TL03)
Central Room Cooling System (TL04)
Reactor Pit Cooling System (TL 05)
Air Exhaust System (TL22)
Air Supply Dampers (TL24)
Auxiliary Service Water (VB)

C.8.2 Safety and Control Systems

High Pressure Boron Injection System (TQ13,14,23,24,33,34)
Residual Heat Remove System (TQ12,22,32)
Emergency Cooling System(TQ10)
Containment Spray(TQ11,21,31)
Containment Ventilation System
Steam Generator Emergency Feed Water System (TX 10,21,31)
Compressed Air for Containment Isolation System (UT)
Reactor Building Fire Protection System (UJ11,12,13)
Service Water (QF,VF)
Emergency Diesel Generators (GV,GW,GX)
6 & 0.4 KV Reliable Power Supply Units (BV,BW,BX,CV,CW,CX)
Un-interruptible Power Supply Units (ABP)
Hydraulic Accumulators (YT)
Radiation Monitoring
System of Precautionary and Emergency signaling
System of Technological Mending and Blocks
System of Automatics
System of Remote Control
System of Control of Functional Groups
Managing Systems of Safety
Systems of Radiation Control

C.8.3 Balance of Plant Systems

Main Steam System (RA)
- Main Steam Lines (RA)
- Turbine Bypass System (RC)
- Main Steam Line Drainage (RT,SH)

Main Auxiliary Steam
Auxiliary Steam Vents and Drains
Main Turbine (SA,SE)
- Turbine Electrohydraulic Control (SE,EGSR)
- Turbine Lube Oil System (SC)
- Turbine Hydraulic Lifting System (SC)
- Main Condenser (SD)
- Turbine Seal and Vacuum System (SG,SD)

Moisture Separator/Reheater System (RB,RN)
Feedwater System (RL)
- FW Turbine Driven Pump (SA51,55,RL41,42,51,52)
- FW Turbine Driven Pump Condenser (SD51,52,RW51,52)
- FW Turbine Driven Pump Lube Oil System (SC51,52)
- FW Turbine Driven Pump Vacuum & Seal System (SG/SD)
- FW Auxiliary Pump (RL51,52)
- FW Deaerators (RL20)
- FW High Pressure Heaters (RD/RN)

Main Condensate System (RM)
- Main Condensate Pumps (RM)
- Main Condensate Demineralization System (RE)

Low Pressure Heaters (RM,RN)
Condenser Evacuation
Steam Supply System (RQ)
Secondary Side (Heaters, etc) Drainage System (RT)
BOP Computer Bases Control System (ASUT)
Circulating Water System (VC)
Service Water System (VB,VC)
Main Generator
Main Generator Seal Oil System (SU)
Main Generator Cooling Systems (SS,ST)
Main Generator, Voltage Regulator and Exciter (GT)
In-Plant Electrical Distribution System
Fire Protection System

C.8.4 Other Considerations

The basics for simulation model design shall be actual reference plant data such as piping and instrumentation diagrams, electrical schematics, alarm and component statistics, system functional diagrams, plant operating and emergency procedures, and design data.

The plant system models must provide for both normal, abnormal, transient and emergency conditions over the entire plant range. All system models must be designed to interface with all other models as appropriate and provide a realistic overall plant simulation. The simulation models must have the fidelity to meet the applicable portions of ANS 3.5 and IAEA TECDOC 685 for model accuracy in steady state conditions and must provide correct trends and responses for transient conditions.

C.9.0 Simulator Control Systems

C.9.1 Introduction

a. The hardware and software requirements for the instructor station are given in Sections 5 and 7, respectively. The development of the software for the instructor station shall be the responsibility of the Contractor. However, the Government will work with the Contractor during the design phase in order to mutually agree on the details of the design.

b. The overall goal of the Simulator is to realistically reproduce a control room atmosphere for the purpose of training regulatory staff in the operation of the plants and to provide the regulatory staff a tool for the evaluation of operational procedures. To facilitate

this training, the Simulator shall incorporate, as a minimum, the following instructor functions specified.

c. The instructor shall be able to activate the instructor functions in three ways: by an instructor station control means, by clicking icons on the master control tableau, and by keying the expert-mode commands on an alphanumeric keyboard.

1) The expert mode commands and syntax shall be designed to be consistent and easy to use. It shall have a means to activate the instructor functions and to access any instructor station display without going through the menu hierarchy.

2) The instructor shall be able to activate a master control tableau of all instructor functions by a instructor station control means, or by accessing through a command button (ICON) on the instructor station CRT display. Then, this master control tableau shall direct the instructor to those displays required to conduct and control the instructor functions.

d. All the titles on schemes, formats, menu, notes and comments presented at the instructor's station should be in Russian and English, if possible.

C.9.2 Initialization

a. The instructor shall be able to begin dynamic simulation by initializing the Simulator to the desired initial condition (IC), which is chosen from the preassigned ICs, snapshot ICs, and backtrack ICs.

b. Initialization of an IC shall cause the plant parameters to change correspondingly to the chosen values. No changes in the computer program nor in wiring shall be needed to change the parameter values.

C.9.3 Run/Freeze

Provision shall be made to run and freeze a dynamic simulation at any time.

C.9.4 Snapshot

a. The instructor shall have the capability to initiate a snapshot of the particular Simulator conditions at any instant without interrupting any dynamic simulation in

progress. The snapshot capability shall also be functional while the Simulator is in the freeze mode.

b. The software of the instructor station shall be designed so that the number of snapshot ICs to be stored is limited only by the available disk space. However, the Contractor shall provide, with the Simulator disk, space for 80 snapshot ICs as a minimum.

c. The date and time of snapshot shall be recorded at each initial condition. The capability also shall be provided to identify the initial condition with up to 400 bytes of identifying text and to display this text at the instructor station.

C.9.5 Preassigned ICs

a. The Contractor shall provide with the Simulator, as a minimum, 20 preassigned ICs, in addition to the 80 snapshot ICs, which represent the different plant configurations so that training can immediately begin. These IC's will be part of the added IC points described in Section C.11.1.

b. The preassigned ICs shall be protected in the following way. The preassigned ICs shall not be inadvertently destroyed by such instructor functions as snapshot and backtrack. The ICs shall be reconfigured by the use of a manual protection override mechanism. Any IC of snapshot IC and backtrack IC shall be able to be configured as a preassigned IC.

c. Whenever the Simulator is initialized at an IC, and dynamic simulation subsequently initiated, the Simulator shall exhibit smooth, steady-state performance for all preassigned initial conditions. Tolerances for the steady-state performance are described in Section E, and the Government shall have the right to determine and approve them for each preassigned IC.

C.9.6 Malfunctions

a. The instructor shall be able to control all simulated malfunctions from the instructor station. Section C.12 gives a detailed discussion of the allocation for component malfunctions and system malfunctions. However, for future expansion, the maximum number of the malfunctions shall be limited only by available memory.

b. The failure of redundant components shall be considered as a single generic malfunction. The instructor shall be able to select any combination redundant component failures.

c. All design basis accidents and abnormal operational transients included in Appendix A, "Preliminary List of Simulator Failures" shall be simulated to reflect actual plant responses and not "worst case." A list of malfunctions and their causes and effects shall be submitted for the Government's approval.

d. Simulation of malfunctions shall completely and accurately reflect the total integrated plant response and all applicable control room indications and alarms. The sequence of events following malfunctions shall respond to any action taken by the operator and shall persist until corrected by the operator, or the malfunctions are terminated by the instructor or by themselves.

e. The instructor shall be able to activate a malfunction either with or without a time delay. The delay time shall be adjustable in one second resolution up to 2 hours. It shall be possible to introduce up to 30 non-conflicting malfunctions with different delay times.

f. The Simulator shall include the capability for the instructor to introduce specified failures to the types of simulated components. This feature must apply to components that are handled generically in the modeling software. As a minimum, the following types of failures shall be included:

1) Simulated pumps

- loss of motor power
- loss of control power
- failure to start (auto-start)
- failure to manually start
- spurious start/trip
- false overcurrent trip

2) Simulated valves

- fail as is
- fail to specified position (0-100 %)
- loss of motive or control power, as applicable
- loss of air, as applicable

3) Simulated electrical buss

- loss of power (supply breaker open)

4) Simulated large breakers

- fail open
- fail closed
- fail as is
- fail to reset

5) Simulated controllers

- fail as is
- fail to specified position (0-100%) in auto or manual
- loss of power
- oscillation

6) Simulated transmitters
- fail as is
- fail high/low
- fail to specified position (0-100%)
- drift

g. An event triggering feature shall be provided to automatically initiate any malfunctions when a predefined dynamic event occurs. The instructor shall be able to easily create and execute this feature.

h. Activation of malfunctions shall be possible from graphic diagrams, tableau index, and data base queries as well as by expert commands. Graphic diagrams for the malfunctions shall have the following capabilities:

1) Dynamic system status shall be shown through color, numeric indicators, and various other graphic techniques, such as bar graph, trend plots, and changes in icon shape.

2) Graphic selections/activations of malfunctions shall be provided.

3) An off-page connector shall allow the instructor to access functionally related displays.

4) Pan and zoom capabilities shall be provided to allow a detailed display of areas of interest.

i. The capability shall be provided for 30 malfunctions to be active at a time, and to be selected to initiate simultaneously or sequentially at times selected by the instructor using an adjustable time-delay feature and by an event trigger, as described above in paragraphs e and g, respectively.

j. The capability shall be provided to ramp variable malfunctions over their full range of severity.

C.9.7 Remote Functions (Local Operator Actions)

a. Remote functions shall be provided to control components and systems that are operable outside the main control room and essential in the operator training. The Contractor shall reserve a minimum of 100 spare spaces for additional remote functions to be used later by the Government, GAN or NRA. The maximum number of the remote functions for future expansion shall be limited only by available memory.

b. Even though a remote function may have two or more discrete states controls, it shall be counted as only one remote function. For such components as the manual valves and local controllers, variable-type remote functions shall be provided for the instructor to introduce the valve positions and controller settings through the specified ranges. The variable-type remote function for a component or system shall be counted as one of the required number of remote functions.

c. Remote functions shall be able to be manipulated from graphic diagrams, tableau index, and data base queries as well as by expert commands. Remote functions on graphic diagrams shall be identified by a color different from other equipment. Graphic features for the remote functions shall have the following capabilities:

1) The Dynamic status of the system shall be shown through color, numeric indicators, and various other graphic techniques such as bar graphs, trend plots, and changes in icon shape.

2) Graphic selections/activations of remote functions shall be provided.

3) An Off-page connector shall give the instructor access to functionally related displays.

4) Pan and zoom capabilities shall be provided to allow detailed display of areas of interest.

d. All remote functions that change the state of systems or equipment shall have individual response times over which these changes will occur. When the remote function(s) are inserted, the dynamic simulation shall be consistent with the new state of the plant.

C.9.8 Annunciator Control

The instructor shall be provided with soft switches for master "silence", "acknowledge" and "reset" located on the instructor station display. The soft switches shall control all the annunciators in functionally the same way as those on the student workstations.

C.9.9 False Alarm

A false alarm shall be a spurious alarm without the actual occurrence of a malfunction of associated equipment or system. Simulated annunciators (a minimum of 50 alarms) shall be available to be separately activated by this function. The time-delay provisions previously described for malfunctions are required for this function. It shall be possible to input multiple false alarms.

C.9.10 Backtrack

a. There shall be a backtrack capability that periodically records the conditions of the Simulator during a training exercise, while not in freeze, so that the instructor can initialize the Simulator to a previous point in the exercise.

b. The backtrack feature shall record the conditions of the Simulator on a disk file once every minute or alternate frequency chosen by the instructor. The clock time and problem time (time out of freeze since the beginning of the exercise) shall be included in each backtrack condition. The backtrack file shall be sized to contain the latest backtrack condition plus the previous 59 conditions (nominally the previous one hour of problem time).

c. The instructor shall be able to select a backtrack condition by specifying one of following:

1) minutes to go back

2) latest recorded condition

d. Once a backtrack condition is selected, the instructor shall be able to manually step forward or backward through the full 60 conditions. The displays of a backtrack on the instructor station CRT shall include the clock time, problem time, and backtrack record number.

e. The Simulator computer system shall be able to down load all the backtrack conditions via a removable hard disk, CD ROM, or others means at all times even after the simulation has been halted.

C.9.11 Instructor/Operator Action Monitor

a. The Contractor shall provide an instructor/operator action monitor to record and display all the instructor activated functions (e.g. malfunctions, remote functions, overrides), and control room actions (control of switches and potentiometer settings and other operator actions) during a specified period.

b. Each recorded action shall be tagged with the occurrence time resolved to 0.1 second, as a minimum. The most recent actions shall be capable of being displayed on the instructor station CRT and updated dynamically as new action occurs. The instructor also shall be able to obtain, on demand, a complete or partial printout of recorded actions on the instructor station printer.

c. The record size shall be adequately determined to record the instructor/operator actions for an hour during an active training exercise. As a minimum, the Contractor shall assume an average rate of one action per second for the entire hour. The Contractor shall submit design details for the Government's approval with the preliminary design specification for the instructor station.

d. The Contractor shall provide the capability to save all or portions of the record of instructor/operator action, along with a minimum of 400 bytes of identification text on the permanent disk file(s). The number of the record files shall be limited only by the amount of disk space available. As a minimum, the Contractor shall reserve enough disk space for 20 full record files.

C.9.12 Replay

a. The replay function shall allow the instructor to review with the trainee the previous Simulator operations during up to the last 60 minutes by one minute intervals. During the replay, the Simulator shall give the same responses as those in the previous operation. The instructor shall be able to stop/restart the replay at any time.

b. The Contractor shall also provide a replay feature which uses the records stored by the backtrack and the instructor/operator action monitor. In the replay mode, the normal I/O and instructor functions shall be replaced with the operator and instructor actions in the replay record. The replay action data shall be keyed to the backtrack ICs in a way that will allow the instructor to initiate the replay at any desired point of 60 backtrack ICs.

C.9.13 Automated Scenario Execution (ASE)

a. ASE shall allow the instructor to create and execute various user-defined scenarios for a training exercise. The exercise scenario shall consist of a set of instructor functions which define a training exercise. All these functions shall be in the form of the expert mode commands.

b. An event-triggering feature shall be provided to automatically initiate any instructor function(s) by the dynamic events of the simulation. The ASE shall also be able to create and execute the event trigger scenario. It shall be possible to define any number of events in a scenario.

c. Using the ASE, the instructor shall be able to create various scenarios interactively from the graphic diagrams. In addition, the instructor shall be able to create the scenarios using a text editor. As a minimum the ASE shall have the following features:

1) Special programming shall not be required to create the scenarios.

2) Complex expressions involving multiple variables, arithmetic operators, logical operators, and nesting shall be supported.

3) A scenario library editor shall be provided. A

browser shall allow the instructor to select the scenario(s) from the library.

C.9.14 Parameter Monitoring

a. Provisions shall be made for the instructor to monitor the simulated plant conditions through the instructor station CRT displays, such as the simulation diagrams, trend displays, and numeric displays. The displays shall be updated once a second, as a minimum, unless otherwise specified. The updating time interval shall be adjustable by the instructor.

b. The simulation diagrams shall display, at least, the values of all process parameters (pressure, flow, temperature, level, etc.) which are displayed on the student stations, and also the on/off status for all simulated motors, pumps, valves, and circuit breakers.

c. The instructor shall be able to select up to 24 parameters for a trend display which may consist of several pages. Deviations from the alarm limits which are assigned by the instructor shall be identified on the trend plot by colors. Data for trends shall be updated four times per second, even though the display is updated once a second. Appropriate weighting shall be suggested by the Contractor and approved by the Government.

d. The scale of the time and value axes for each trend plot shall be individually adjustable by the instructor. The scale of the value axis shall be equal, by default, to the control room indication, where applicable. The default time-scale shall be 60 minutes. The time interval shall always be displayed. The trend plot shall be scrolled from right to left. The time axis shall "float" in time, so that the latest time intervals always can be displayed.

e. The trend function shall be able to retain the latest 600 scanning data for each of the monitored parameters, regardless of the displayed time axis. The instructor shall be able to produce a hard copy output of the trend plots on the color print of the instructor station.

f. For numeric display, the capability shall be provided to simultaneously display a minimum of 20 parameters per page. Color identification of the alarm limit deviations shall be provided.

g. It shall be possible to select parameters for the trend and numeric displays. The Contractor shall submit a proposed selection method to the Government for review and approval with the preliminary design specification of the instructor station.

h. The instructor shall be able to compose a list of monitoring parameters and to store the list in a disk file. The number of such files shall not be limited except by available disk storage. Spaces for a minimum of 20 files shall be provided with the Simulator. The instructor station shall also have the capability to list the name of the files which have been created.

C.9.15 Time Scaling

a. The Simulator shall be able to operate in three distinct modes: fast-time, real-time, and slow-time. The real-time mode shall be the normal simulation mode of operation and shall apply to all systems.

b. The fast-time mode shall accelerate the dynamic simulation by approximately 10 times of the real-time rate to observe slow transients or shorten time-consuming activities. Fast-time operation is required only for the selected systems, with all other simulation remaining in real-time. As a minimum, the reactor's power response to the effects of xenon, heatup of reactor and turbine, and the establishment of a condenser vacuum shall be included in the fast-time simulation.

c. After award of contract, the listing of events/system which can be affected by fast-time shall be finalized and submitted to the Government for final review and approval with the preliminary design specification of the instructor station.

d. Slow-time simulation is an expansion of real-time events that provide an apparent increase in the interval for fast-changing transients characterized by short-time constants. All dynamic systems shall operate at approximately one-eighth to one-tenth of real-time rates, except the Plant Monitoring System, annunciator system, the instructor station functions, and computer network capability.

C.9.16 Startup/Shutdown

Provisions shall be made at the instructor station to automatically startup and shutdown the Simulator system. By the startup/shutdown function key(s) and control icon(s), both the simulation computers and the instructor station computers shall be automatically loaded/unloaded with all the programs for a training session.

C.9.17 Detection of System Stall

a. The status of Simulator operations shall be indicated on the student stations and the instructor station.

b. On the student stations, the freeze/run modes and abnormal conditions shall be recognized easily by the designated light(s) or dialogue box. A dialogue box shall be included to display on the instructor station CRT the abnormal conditions, such as out of simulation limits.

C.9.18 External Parameters

a. Provisions shall be made for the instructor to monitor and change the values of identified external parameters within the specified ranges at any time. These external parameters shall be treated as the boundary conditions. As such, the variation of an external parameter shall be reflected in the simulation.

b. As minimum, the following parameters shall be included in the external parameters.

1) grid frequency and voltage

2) cooling water temperature

3) ambient temperature and pressures

C.10.0 Modeling

C.10.1 General

a. The Simulator shall be capable of reproducing all operational aspects of the reference power plant. It shall respond to the student/user actions during any normal, abnormal, transient or emergency operation. The Simulator must be capable of initiating any of the transients from any initial condition.

b. The Simulator shall include integrated system simulation of those systems specified in Section C.8. System models shall simulate all interfaces with other simulated systems and provide a realistic, integrated plant simulation for normal, abnormal, transient and emergency conditions within tolerances specified in Section E. Accuracy criteria, based on plant data or other appropriate sources, shall be provided with the system models, where applicable.

c. As a minimum, the following requirements for the Simulator performance shall be satisfied:

1) The Simulator shall be capable of simulating continuously, and in real-time, a complete hot or cold start up to full-load condition, load-modulation (both manual and automatic), and a shutdown to a hot or cold condition.

2) The Simulator shall provide the transient responses caused by changes in various pressures and flows, moderator temperature, fuel temperature, fission product inventory, and rod positions. In addition, the Simulator shall be capable of simulating variations in operating and transient conditions that occur at several discrete points within the fuel cycle.

3) The Simulator shall simulate parameters corresponding to the particular operating conditions, display these parameters on the appropriate computer displays, and provide the proper alarm or protective system action when predetermined limits are approached or exceeded. The Simulator responses shall not depart from actual plant response in any aspect that would mislead the trainee or cause an inappropriate action by the student (or user).

4) The Simulator shall permit the student (or user) to complete any part of the pre-startup procedures conducted at the control room panels. These pre-startup preparations shall include verification of trip and alarm settings, and operational checkout of critical systems or equipment.

5) The Simulator shall be able to respond correctly to all procedures appropriate to control room operation including emergency operating procedures.

6) Simulated malfunction effects shall be realistic and represent the result of defined equipment failures or other specifically identified causes. The variations of external parameters described in Section C.12 shall be taken into account to simulate the corresponding plant systems. It is necessary to simulate the remote function components/systems to achieve full plant simulation fidelity.

C.10.2 Specific Features of Simulation Models

The following are features that shall be incorporated into all applicable simulation models.

C.10.2.1 Pumps

a. Pump models shall realistically model the onset and effects of cavitation.

b. Pump models shall model pump performance during startup, during coastdown, and with flow in either direction.

c. Pump models shall realistically model the effects of transfer of pump heat to the pumped fluid in cases where the amount of heat transferred is deemed to be significant.

d. Pump models shall model the effects of pump starting current on the electrical system, and the effects of grid voltage and frequency on the pump performance during starting and running conditions, where significant.

e. Pump models shall realistically model parallel or series combinations of pumps.

f. Pump models shall realistically model two phase flow in either direction, where appropriate.

g. Pump model shall be divided into centrifugal, positive displacement pumps, and any other necessary types.

C.10.2.2 Valves

a. Valve models shall accommodate different opening and closing stroke times.

b. Valve models shall incorporate nonlinear flow

vs. position characteristics where appropriate.

c. Valve models shall accommodate throttling characteristics.

d. Air-operated valve models shall incorporate the effect of operating air pressure.(loss of operating air)

e. Valve models shall realistically simulate flow of steam, and liquid, the effects of differential pressure, and seat leakage, where appropriate.

f. Motor- and solenoid-operated valve models shall incorporate the availability of control and motor power, as appropriate.

g. Safety and relief valve models shall realistically model reactor blowdown and refill, as well as, single- and two-phase flow.

h. Models of remotely operated valves shall include appropriate open, close, and modulation stroke times.

C.10.2.3 Flows

a. Conservation laws shall be maintained in flow calculations.

b. Flow calculations shall accurately model the effects of temperature and mixing transport delays where it is significant.

c. Independent flow paths shall be included wherever there is the possibility of isolation of individual lines in the reference plant systems.

d. Models of fluid systems shall include provisions for modeling normal system leakage.

C.10.2.4 Tanks

a. Tank fluid level and pressure calculations shall account for actual tank geometry and elevation.

b. Tank energy balance models shall include the effects of heat transfer (including heat to ambient), condensation, flashing, spray, and relief flows, if appropriate.

c. Tank models shall include computation of total mass and fluid and vapor masses.

d. Tank models shall accurately calculate pressures in water-solid conditions.

C.10.2.5 Heat Exchangers

a. Heat exchanger models shall realistically model the effects of changing flow rates, flow direction and zero flow, temperatures of both primary and secondary fluids, clogging and fouling, noncondensable gases, and thermal capacitance of fluids and metal.

b. Two-phase heat exchangers shall incorporate regions of superheat, saturation, and subcooling, as appropriate.

c. Non-equilibrium, two-phase, fluid models including the consideration of interfacial heat transfer between vapor and liquid, shall be provided, as appropriate.

d. Accurate heat transfer models including the consideration of tube-metal heat resistance, and tube-surface (inside and outside) heat resistance shall be provided.

C.10.2.6 Circuit Breakers

Circuit breaker models shall include the effects of control power availability, lockout relays, charging springs, and anti-pumping and control and protection logic.

C.10.2.7 Electrical Systems

a. The electrical system simulation shall include all buses (including all instrument buses and all primary motor control centers).

b. The conditions on all buses shall accurately reflect the current drawn by connected loads, including starting surges.

c. Synchronization modeling shall include effects of frequency, voltage, and phase difference.

d. Electrical loads shall accurately reflect the effects of supply voltage and frequency.

e. Battery and DC bus voltages shall reflect the effect of discharge rate and total discharge.

f. Current and power calculations shall accurately account for both real and reactive current flows.

C.10.2.8 Radioactivity

a. Radioactivity transport shall be modeled in water, steam, and air systems, including the effects of source activity, decay, and flow through and between systems.

b. The effect of filters on radioactivity transport, including activity buildup in the filters, shall be simulated.

c. Radioactivity in sumps and tanks shall be accurately modeled.

d. Radioactivity transfer from the primary side to the secondary side shall be accurately modeled.

e. The level of detail shall be such that the radioactivity detectors and any sampling systems will respond as expected.

C.10.2.9 Conductivity and Boron Concentration

a. Boron concentration transport shall be modeled in water systems, including the

effects of source concentration and the flows through and between systems.

b. The effects of filters and demineralizers shall be included (e.g., depletion of boron due to ion exchanger action.)

c. The concentrations of boron in tanks and sumps shall be accurately modeled.

C.10.2.10 Student/User Console Simulation.

The student/User Consoles shall be capable of displaying the following information to the trainees in real time. All controls necessary to operate the Simulator in normal, abnormal, transient and emergency conditions shall be included in the Simulator.

a. Control room instrumentation, meters, recorders, annunciators, or any other type of readout driven by the process variables that are included in the scope of simulation and calculated in the software system programs.

b. Controls will enable the student to control the plant, change the functions of controllers, introduce and withdraw main protection and blocks, change conditions of operating protections and blocks, change sets of operational warnings and emergency signals.

c. The simulation of process sensors shall, where appropriate, include the effects of ambient and process conditions. This includes density variations for water level indicators.

d. Indicating/recording devices shall not be paralleled on common analog output mimics unless they are paralleled in the reference plant.

e. The students must have the ability to display parameters during all modes of plant operation from the student console.

f. Simulated systems shall be presented on the student console or other video displays with menu aids to show: mnemonic fragments of control and electric systems; design diagrams and control means for systems and equipment; diagrams for testing the functions of main protection and blocks with the aid of simulation signals. It shall also be possible to create mnemonics and change the state of blocks, control systems, electrical equipment, and automatic control systems of the simulated NPPs.

g. All text shown on student consoles shall be in Russian or Russian and English.

C.10.2.11 Core Neutronics Model

The core model shall include, as a minimum, the following features:

a. Realistic behavior of neutron flux and reactor thermal-hydraulics during start up, normal operation, transient operation, and shutdown of the simulated plant. In addition, accident and emergency conditions shall be simulated, including anticipated transients without scram (ATWS).

b. The model shall be able to discretely calculate the simulated neutron flux along the vertical axis of each fuel assembly, and incorporate thermal-hydraulic feedback. A radial flux distribution shall be calculated at each axial node. The nodalization scheme should assure that continuous axial flux distribution will be calculated for each radial node in symmetric and asymmetric flux conditions.

c. A three-dimensional calculation shall be proposed which includes:

1) Nodal neutron balance calculations using either a one-and-one-half or two neutron groups model.

2) Space-time-kinetics with 6 delayed groups.

3) Thermal-hydraulic feedback.

4) A minimum of 7 axial nodes and one radial node for each fuel assembly.

d. The core data from the reference plant shall be incorporated into the Simulator. Constants shall be generated and incorporated to provide three (3) age-dependent initial condition sets for the core.

1) Beginning of Life
2) Middle of Life
3) End of Life

e. Reactivity feedback calculations (e.g., fission yields, fission product decay constants, etc.).

f. Dynamic axial and radial Xenon calculations that include asymmetric control rod patterns, moderator density, void, and Doppler feedback. Xenon oscillations shall be calculated for all power and core age conditions.

g. Core thermal-hydraulics simulation shall be capable of representing two-phase flow in the fuel channel-fuel rod region (including the effects of rod shadowing).

h. Effect of subcritical multiplication on neutron flux during reactor/plant start-up.

i. Calculations of the ex-core detector signals based on neutron flux in the reactor core nearest the detectors.

C.10.2.12 NSSS Thermohydraulic Model

The NSSS model shall be a thermohydraulic model of the primary coolant system including pressurizer, reactor coolant pumps, and steam generators for VVERs (and equivalent scope for RBMKs). This model will include all

2) Space-time-kinetics with 6 delayed groups.

3) Thermal-hydraulic feedback.

4) A minimum of 7 axial nodes and one radial node for each fuel assembly.

d. The core data from the reference plant shall be incorporated into the Simulator. Constants shall be generated and incorporated to provide three (3) age-dependent initial condition sets for the core.

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i. Calculations of the ex-core detector signals based on neutron flux in the reactor core nearest the detectors.

C.10.2.12 NSSS Thermohydraulic Model

The NSSS model shall be a thermohydraulic model of the primary coolant system including pressurizer, reactor coolant pumps, and steam generators for VVERs (and equivalent scope for RBMKs). This model will include all

emergency core cooling systems and shall be fully integrated with the reactor core model and all other simulated systems.

The Contractor shall provide a straightforward method that Government, GAN or NRA personnel can utilize to:

a. Modify the NSSS model when design changes are made and

b. Update or expand the NSSS system boundary conditions.

When the Contractor delivers the NSSS thermohydraulic model, the Contractor shall demonstrate its accuracy by providing comparisons to engineering best-estimate code results, measured data from the reference plant, and selected experimental test facilities.

The NSSS model shall address and be based on physical processes and state-of-the-art methods. The model calculations shall be valid over the entire operating range. In addition, the model shall be valid for emergency operating procedure (EOP) scenarios and core voiding (uncovered) conditions resulting from multiple failures and abnormal transients (e.g., anticipated transient without scram with a loss of coolant accident or MSIV closure).

The following lists the physical phenomena which shall be addressed and included in the advanced NSSS thermohydraulics model. This list is not intended to be a complete list of methods and physical processes.

1. Single- and Two-Phase Flow.

   a. Natural and forced circulation with flow reversal resulting from pump trip or shaft seizure.

   b. Tracking reactor coolant-system boron, fission product radioactivity, noncondensable gas in the coolant, and their release paths.

c. Effects of reactor coolant pump operation: trip, coastdown, rotational inertia, and changes in pump speed.

d. Abnormal reactor coolant pump effects: cavitation, two-phase flow, flow reversal, and rotor seizure.

e. Release and tracking of hydrogen from Zircaloy-water reaction.

f. Two-phase flow through open relief valves and line breaks.

g. All fluids can be any combination of liquid, vapor, or noncondensable gas.

h. The gaseous components may flow with a different velocity from the liquid.

i. The gaseous components and liquid may flow in opposite directions (counter-current flow) (as can liquids and gases of different densities).

j. Complete thermal non-equilibrium (five equation with drift flux or six equation model) with rate of phase change and consideration of heat transfer between liquid and gas (for example, independent temperature of gas and liquid).

k. Formation and tracking of the different liquid levels in the NSSS system and ECCS.

1. Best estimate of critical flow through the pressure relief valves and line breaks.

m. Small leaks and breaks can be calculated in the lines and piping modeled (e.g. steam leaks from the reactor vessel or associated piping).

n. Feedback effects from the containment during leaks, breaks, and large ruptures (temperature, pressure).

o. Asymmetric loop behavior; stratification in horizontal pipes; loop seal clearing; steam voids in upper plenum; etc.

2. Heat Transfer

a. Heat transfer for the core components, reactor vessel internals, and important piping is calculated including internal heat capacity of the structure.

b. Heat transfer between:

1) Coolant and piping vessel

2) Fuel element and coolant

3) Radiation from fuel to coolant

c. The effects of nitrogen or other gases on heat transfer shall be accurately calculated.

d. Heat-transfer regimes shall predict heat transfer to single-phase liquid or vapor, and two-phase water systems.

e. Condensation effects in the steam generator and moisture separators.

f. Effects on the heat transfer caused by void fraction and liquid level (stratified fluid).

g. Release of heat from Zircaloy-water reaction.

h. Fuel temperatures calculated (radially averaged, surface, and centerline).

i. Fuel-clad temperature calculated (inside and outside).

j. Gap conductance calculated.

k. Wall-heat transfer considers conduction, convection for single-phase liquid and vapor, radiation, and boiling.

l. Boiling modes encompass subcooled, nucleate, transition, critical heat flux, film, and complete dryout or superheating heating of steam.

m. Provisions shall be made to use proprietary correlations.

o. Heat input from reactor coolant pumps and heat loss in piping is calculated.

C.10.2.13 Reactor Coolant Pump

The reactor coolant pump model shall reproduce the following phenomena:

a. Trip, coast down, and change in pump speed.

b. Cavitation, two-phase flow, flow reversal, sheared shaft, and rotor seizure.

C.10.2.14 Pressurizer (for VVERs)

The pressurizer model shall reproduce the following phenomena:

a. Minimum of two-region, non-equilibrium models.

b. Mixture level and collapsed level tracking.

c. Water-steam interface and wall effect.

d. Condensation effect by spray and evaporation effect by heater.

e. Noncondensable gas effect.

f. Full solid and complete empty operation.

C.10.2.15 Steam Generator

The steam generator model shall reproduce the following phenomena:

a. Minimum of three-region, non-equilibrium model (subcooled, saturated-liquid, and steam).

b. Accurate recirculation flow rate.

c. Steam separator effect.
d. Swelling and shrink simulation.

e. Accurate downcomer level.

f. Full solid operation considering overfilling.

g. Tube-uncover effect and complete dry-out operation.

h. Noncondensable gas effect.

C.10.2.16 Severe transients

The Simulator shall reproduce mechanisms which may lead to fuel damage including clad oxidation and hydrogen generation.

C.10.2.17 Plant Monitoring and Control Systems

The Contractor shall provide modeling for the following plant monitoring and control systems:

a. Plant Monitoring System

b. Reactor Control and Protection System

c. Radiation Monitoring System

d. Turbine Control System

e. Turbine-Generator Monitoring System

f. Fire Protection System

g. Plant Annunciator System

h. Technological Protection and Blocking System

i. Automatic Regulators System

j. Neutron Flux Monitoring System

k. In-core Monitoring System

l. Functional Group Control System (partially)

m. Electric Relay Protection and Control System, and

n. Safety Control System

C.10.2.18 Capabilities of the Electrical Distribution System

a. The Contractor shall provide the capability for the instructor to open or close all AC and DC power supply breakers to each electrical bus.

b. All 1st group reliable power at 6.0 KV and 0.4 KV AC switchgear lockout reset from the Control Room breaker control switches shall be simulated.

c. The Simulator shall be able to simulate electrical backfeeding of switchgear in accordance with the reference plant procedures for recovery operations.

C.10.2.19 Plant Process Instrumentation

a. Appropriate instruments shall be modeled to include the effects of setpoint, power supply, hysteresis, and deadband.

b. All Process Controller P and I drawing characteristics within the scope of simulation shall be correctly modelled.

c. Instrument loop components shall correctly respond to failures of power supply.

d. The effects of post-LOCA containment temperature on instrumentation shall be modeled.

C.10.2.20 HVAC Systems

The HVAC systems being simulated shall model the transport of radioactive nuclides throughout the associated systems during simulated malfunctions which are expected to release radioactive materials to the atmosphere.

C.10.2.21 Containment

The following modeling shall be provided by the Contractor for the containment system (Equivalent systems will be modeled for the RBMKs) :

a. The containment model shall be a multi-node model to accommodate accurate calculations of temperature, pressure, hydrogen, pipe leaks and break, and radionuclide transport.

b. The removal of containment heat via sprays, fan coolers, and its conduction to structures shall be simulated.

c. The inventory in the containment sumps shall be modeled to accurately output to the sump level indicators.

d. Heat sources to the containment including pressure vessel and piping should be included. The effects of safety relief valve actuations shall be modeled.

C.10.3 Systems to be Simulated

C.10.3.1 Systems Requiring Full Simulation

Based on the training requirements of GAN and NRA and the scope of hardware on the Simulator, full simulation shall be required on the systems described in Section C.8. The scope of simulation of each of these systems shall be sufficient to support the controls and indications used in the Simulator Control Mimics.

C.10.3.2 Systems Requiring Limited Simulation

Based on the training needs of GAN and NRA, limited simulation may be used for some NPP systems. The scope and depth of the simulation shall be equivalent to that of full scope simulators.

C.11.0 Simulator Initial Conditions

C.11.1 General Information

The Simulator shall be able to be initialized at any of the Initial Condition points. The Simulator shall be capable of using a minimun of two hundred initial conditions. Additionally, a utility program shall be provided which will allow instructors to archive initial condition data sets to magnetic tape, and to retrieve these data sets from tape, both individually and in a block. The first initial condition shall be default initial condition for a "snapshot." The twenty (20) initial conditions shall be protected by a double protection code so that they cannot be overwritten from the instructors console, either by the snapshot function or by the archive retrieval function.

C.11.2 Initial Condition Generation

The Base Initial Condition (ICs) listed below shall be the basis for all other IC points. A small subset of these base IC's shall be established by calculation during model development. The method used and a brief general description of how to calculate the initial establishment of all internal and external variables in the base IC shall be provided by the Contractor. Any procedures used in establishing new initial conditions shall be fully documented and delivered with the Simulator. The methodology to be used for establishing base ICs shall be fully described. All other Simulator ICs (except the special ICs identified in section C.11.3) shall be established from these ICs by actual real-time operation of the Simulator.

The fuel-burnup status for the base ICs shall be as follows:

a. BOL; 5% burnup with >200 effective full-power hours of operation,

b. MOL; 40% burnup,

c. EOL; 80% burnup.

Base IC's:

1. Cold Shutdown - Pressurizer Solid
2. Cold Shutdown - Pressurizer with Steam Bubble
3. 0% Power - Just Prior to Criticality BOL
4. 0% Power - Just Prior to Criticality MOL
5. 0% Power - Just Prior to Criticality EOL
6. 0% Power - Just Prior to Criticality with Xenon Peaking
7. Just Prior to Turbine Loading
8. Just Prior to Generator Online
9. 25% Power - BOL
10. 50% Power - BOL
11. 75% Power - BOL
12. 100% Power - BOL
13. 25% Power - MOL
14. 50% Power - MOL
15. 75% Power - MOL
16. 100% Power - MOL
17. 25% Power - EOL
18. 50% Power - EOL
19. 75% Power - EOL
20. 100% Power - EOL

C.11.3 Special ICs

C.11.3.1 The Contractor shall develop a post-refuelling shutdown IC for the unit similar to the BOL IC, except that the Reactor will experience positive temperature coefficients

C.11.3.2 The Contractor shall develop a "coastdown (stretch)" full power IC for a unit with a core age of approximately 105%

C.11.4 Initial Conditions To Be Generated For Testing

Starting from ICs as defined above, the Simulator will be maneuvered during the Acceptance Test Procedure (ATP),to establish ICs which will be specified by the Government as permanent (double-protected) IC points. These IC points will generally be those which will support later stages of the ATP.

C.11.5 Initial Condition Core-Ageing

The Contractor shall develop a method to rapidly affect ageing of the core so that MOL, EOL and Coastdown ICs can be developed from BOL ICs without having to maneuver the plant through real time fuel depletion.

C.11.6 Initial Condition Procedures

The Contractor shall develop, as deliverable documentation, procedures for: Development of ICs, Control of Protected ICs, Stability Checks for New ICs, Archiving and Retrieval of ICs, and (if appropriate) Ageing of ICs.

C.12.0 Malfunctions and Instructor-Directed Actions

C.12.1 Malfunction Philosophy

To meet the requirements of malfunction scenarios, a minimum number of system level malfunction scenarios should be agreed upon by the Contractor and the Government in the preliminary design review. For component failure, the Simulator shall have the capability for a large number of malfunction scenarios (details to be agreed upon by the Contractor and the Government in the preliminary design review).

Simulated malfunctions of plant equipment and/or system malfunctions shall be introduced through simulated failures at the component level and at the system level. Each component (e.g. circuit breaker, motor-operated valve, controller) model shall incorporate a set of failures as preliminarily described herein. A listing of components as well as the titles of system-level failures and specific causes shall be agreed upon by the Government and the Contractor in the time frame noted within the Project Schedule.

Component failures, Instructor-Directed Actions (IDA) and system level failures shall be individually combined into "malfunction scenarios" and stored on computer disk memory using the on-line scenario edit capability of the Simulator Instructor Station (refer to section C.9.14). The Simulator shall have a capability to store an additional 200 malfunction scenarios. The Contractor shall be responsible for selecting the malfunction scenarios (with the review and approval of the Government) based upon:

- ANSI/ANS 3.5, American National Standard: "Nuclear Power Plant Simulators For Use In Operator Training;"

- NUREG - 1258, "Evaluation Procedure for Simulation Facilities Certified Under 10 CFR 55;"

Simulation of all component and system level failures, individually and in combination as malfunction scenarios, shall be complete and accurate, reflecting the total integrated response of the plant, operators' actions or inactions, and all applicable control room indications and alarms. Component and system level failures shall be modeled within the equations representing the physical phenomena occurring within the

respective system or component. No predetermined or pre-recorded response to component or system failures shall be used.

All malfunction scenarios shall persist until they are corrected or terminated by the instructor. Secondary effects, as well as primary ones from the initiation of malfunction scenarios shall be simulated. For example, a 6 kv bus fault as a primary effect shall also include the secondary effects of a reactor trip caused by loss of a reactor coolant pump due to the bus fault. Modeling of failures shall include the responses for no corrective action, improper corrective action, and proper corrective action by the trainee.

C.12.1.1 Malfunction Removal

Whenever possible, removal of a malfunction scenario (or one of its component or system failures) from the Simulator shall bear some relationship to correction of the related fault in the reference plant. If the failure would require shutdown of the plant to initiate repairs (e.g. a piping rupture or pump seizure), then the Simulator must be re-initialized to clear the failure (or backtracked to a snapshot of pre-fault conditions). If the equipment in the reference plant must be shutdown and/or isolated to effect repairs, then the simulated failure should not be able to be removed until the equipment is shut down and isolated (re-initialization shall always be an option). If the failure of a piece of equipment could be alleviated without a change in the operating status of the reference plant, then removal of such a failure shall be permitted at any time, and the operation of the equipment shall immediately be returned to normal.

C.12.1.2 Default Severity for Variable Malfunctions

The Contractor shall provide a default severity value for variable component and system level failures, based on the assumption the instructor forgot (or chose not) to enter a severity value. If no severity value will clearly produce a large near-term change in simulated plant conditions, the automatic default severity value shall be that one which would be most commonly used by the instructor, or would represent the magnitude of the fault or condition most likely to occur in the reference plant. The Government reserves the right to approve all values of default failure severity.

C.12.2 Malfunction Requirements

Unless a component or system failure is specifically limited by the Government to identified components, the instructor shall have the capability to fail any one or all redundant components (pumps, etc) in any number or in any combination. Failures for redundant components (such as a sheared shaft on pump A or B) shall be considered by Government as only one generic component failure. Each variable component and system failure shall have an associated individual value of degradation. The actual range (in engineering units) of the variable malfunction shall be supplied in documentation by the Contractor. The Government shall have the final determination of which system and component failures are variable.

A listing shall be developed of component failures, system level failures, and malfunction scenarios. Following contract award, meetings between Government and Contractor, in accordance with the Project Schedule, shall be held to develop the final listings.

C.12.2.1 Identification of Component Level- Failure

The following component level failures shall be provided by the Contractor for all important components. These failures are to be part of the basic component models. The Contractor shall provide additional components and associated failure modes.

a. Remotely Controlled Circuit Breakers:

1) Spurious breaker trip due to internal failure in the trip logic.

2) Spurious breaker closure due to internal failure in the closing logic.

3) Mechanical seizure of breaker in its current position.

4) Failure of breaker spring charging motor. Breaker will trip but cannot be re-closed.

b. Motor-Operated Valves:

1) Blown fuse in valve control-power circuit resulting in loss of valve position indication, as well as inability to electrically position the valve.

2) Automatic open signal failure. Valve may be opened manually but automatic open signals have no effect.

3) Automatic close signal failure. Valve may be closed manually but automatic close signals have no effect.

4) Mechanical seizure of valve in its current position, resulting in activation of thermal overload if valve movement is attempted or in progress.

5) Fail to position (simulating local manual override)

c. Centrifugal Pumps

1) Break in shaft between pump impeller and prime mover. Prime mover operates normally at no load condition. Impeller is free to "windmill"in fluid steam.

2) Rapid seizure cf pump impeller. Prime mover is stopped with the pump.

3) Variable degradation of pump head for a given value of impeller speed and flow.

d. Positive Displacement Pumps

1) Break in shaft between pump and prime mover. Prime mover operates normally at no load condition.

2) Rapid seizure of pump. Prime mover is stopped with pump.

3) Variable degradation of pump flow for a given discharge head due to internal leakage (seals, internal bypass valves).

e. 380 Volt Motors

Winding electrical ground for 380 volt motors which are controlled from the control room; 380 volt grounds are indicated in the control room.

f. Heat Exchangers

1) Variable severity of fouling of the tube side. Overall Heat transfer coefficient and hydraulic admittance of tubes are both affected.

2) Variable severity of leakage between tube and shell sides. Leakage affects conductivity and activity of fluids as applicable, in addition to mass inventory and performance of heat exchanger.

3) Variable severity tube rupture.

g. Air Operated valves

1) Positioner (or pilot valve) failure; valve ramps to full open position and will not respond to electrical control.

2) Loss of Operating air supply:valve ramps to full open position and will not respond to electrical control.

3) Valve mechanically seizes in current position.

4) Failure of valve to fully close.

5) Fail-to-position (simulating local manual override)

h. Major Check Valves

1) Check valve open seizure; check valve seizes at full open position when moved to that position by fluid flow while this failure is active.

2) Check valve closed seizure; check valve seizes at full closed position when moved to that position by fluid flow while this failure is active.

3) Variable severity check valve leakage; valve leakage during back-seat condition is a function of failure severity value.

i. Major Mechanically Activated Safety and Relief Valves

1) Variable severity leakage; valve seat leakage is a function of failure severity value.

2) Valve open failure; valve trips to full open position when failure is activated and remains there independent of system pressure.

3) Valve close failure; valve remains in fully closed position independent of system pressure while failure is active.

4) Variable valve performance; mass flow rate through open valve is a function of failure severity level.

j. Local Process Controllers (i.e., external to Control Room)

1) Variable controller failure; output signal is set equal to the severity value. If no severity is entered, controller output remains at the value existing just prior to the failure initiation.

2) Variable severity controller instability; controller in a periodic manner. Magnitude of oscillation is a function of failure severity; period of oscillation is determined by separate model constant for each type of local process controller.

k. Control Room Process Control Hardware

1) Variable device failure (automatic mode). Identical to k.1 above except affects only the automatic (and, if applicable, cascade) mode output of controllers and automatic/manual stations. The device functions normally in the manual mode.

2) Variable severity controller instability; controller automatic (and, if applicable, cascade) mode output oscillates in periodic manner. The magnitude of the oscillation is a function of failure severity; the period of oscillation is determined by a separate model constant for each type of process controller.

1. Process Transmitters

1) Variable severity transmitter failure; transmitter output set equal to severity value in percent of span. If no severity value is entered, the transmitter output is frozen at the value existing just prior to failure activation.

2) Variable severity transmitter offset; transmitter output is offset from the process value by a constant percentage equal to the severity value entered (+ or -).

C.12.2.2 Identification of System Level Failures

In order to meet the malfunction scenario requirements for the training programs, the Contractor shall provide system-level failures which supplement the component-level failures previously noted in Section C.12.2.1. The following generic types of system-level failures shall be provided by the Contractor as well as the additional system level failures set forth at Section J Attachment 8.

a. Variable severity leaks and ruptures in all major piping systems;

b. Phase-to-phase electrical fault on all simulated electrical buses;

c. Individual ground faults on each DC circuit fed by control room DC distribution circuit breaker panels. DC distribution ground faults are indicated in the plant control room;

d. Control rod drive system failures;

e. Control rod position indication system failures, including the ability to blow the position indicator fuses;

f. Main turbine control system failures;

g. Main generator and associated voltage regulator failures;

h. Nuclear instrumentation system failures;

i. Diesel generator as well as associated voltage regulator failures;

j. Variable severity reactor core fuel failure;

k. Electrical grid failures, including voltage and frequency transients as well as complete loss of grid load; and

l. Fires in specific locations within the plant; simulation of fire protection system response as well as specific effects on other systems and/or equipment.

C.12.3 Instructor Directed Actions

The Contractor shall supply three levels of Instructor Directed Actions (IDA):

- Local Operator Actions (LOA);
- Environmental Effects;
- Plant Performance Changes.

The list of instructor directed actions will be finalized during the preliminary system design reviews. The Contractor shall provide a sufficient number of LOA to allow the instructor to perform all functions of an auxiliary operator that meets the requirements of ANS 3.5. Additionally, sufficient time and memory shall be provided to allow expansion of LOA, Environmental Effects, and Plant Performance Changes to 150% of the number delivered with the Simulator.

C.12.3.1 Local Operator Actions

Local Operator Actions (LOA) shall include such "auxiliary operator" functions as valve manipulation, remote electrical device operation, and other equipment operation accomplished outside of the control room and at remote control and shutdown stations. The Contractor shall provide a sufficient number of LOA to permit operation of the simulated plant using the reference plant procedures.

C.12.3.2 Environmental Effects

The Contractor shall enable the instructor to adjust environmental parameters including temperature, pressure, cooling water inlet temperature, etc.,and external plant parameters such as electrical grid characteristics.

C.12.3.3 Plant Performance Changes

The Contractor shall enable the instructor to insert Plant Performance Changes. These Changes shall be consistent with VVER maintenance and/or refueling operations, and may include changes to all simulated control and protection system setpoints.

C.13.0 Documentation

C.13.1 General

The Contractor shall furnish complete documentation for all software and hardware for the Simulator. All documentation is subject to Government review and approval. All documentation, intended for use by GAN and NRA shall be provided in English and in Russian. All documentation will be provided with each of the Simulators. This will include, as a minimum, Simulation Model Design Report, Instructor Station User's Manual, Instructor Station Technical Manual, Simulator Software Maintenance Guide, Simulator Hardware Documentation, Final Design Data Base Report, Performance Test Documentation, Simulator Instructional Methodology Support Documentation and all reference Plant Procedures.

The Simulator documentation shall be organized to meet the design data requirements as identified in ANSI/ANS 3.5, IAEA-TECDOC-685 and NRC Regulatory Guide 1.149. The reference material and plant data used to design and validate the Simulator shall be fully documented. The reference materials which are referred to in the documents shall also be submitted.

The documentation and engineering drawings delivered to the Government, GAN and NRA shall be in electronic and hard copy form.

A comprehensive document index shall be provided, separated into functional areas, with descriptions of each item. The index shall also serve as a guide to the drawing such that it is possible to locate any drawing using the index.

Engineering drawings for equipment manufactured by the Contractor or its subcontractors, not delivered in electronic form, shall be delivered on a permanent and reproducible medium.

Unless otherwise stated, the Contractor shall furnish two bound copies of all documentation and drawings delivered in electronic form and three bound copies of all other

documentation. All preliminary design documents submitted for review and approval during the Preliminary Design Review shall be furnished as part of the Simulator documentation.

It is acknowledged that much of the information contained in the preliminary design specifications is duplicated in other documentation required by this section. The Contractor is encouraged to use information contained in the preliminary design specifications to generate the documentation described in this section. It should be noted, however, that the purpose of the preliminary design specifications is to (1) provide the design guidelines for development of the Simulator software, and (2) serve as auditable QA documents which are used to verify that the design guidelines approved in the Preliminary Design Review, and modified in later reviews, are being followed. The purpose of the Simulator documentation described in this section is, on the other hand, to aid in the utilization and maintenance of the Simulator and its software.

C.13.1.1 Preliminary Design Report (PDR)

The Contractor shall submit a preliminary design report for the Government's approval in accordance with the schedule in Section F. The report shall include the Simulator Computer System Preliminary Design Specification (C.13.16), Simulation Model Preliminary Design Concept Specifications (C.13.3), Simulator Software Preliminary Design Concept Specification (13.2), and any additional information needed to finalize the simulator design. In addition, the Contractor will discuss/provide the following items in the report:

a. How the Contractor intends to achieve the data needs.

b. Details of the operating system, a discussion of this Simulator operating system's ability to satisfy the real-time function capability, including usage of real-time function calls by Simulator executive system, a discussion of O/S utilities and support software including GUI (Graphic User Interface), and of window-based software tools.

c. The source code of the software supplied by the computer vendors.

d. Configuration Management System.(CMS)

e. The guidelines that will be employed in choosing programming languages and the rationale for these guidelines.

C.13.2 Simulator Software Preliminary Design Concept Specification

Prior to the Preliminary Design Review Meeting, the Contractor shall submit a preliminary design concept document describing the Simulator software implementation design in detail for Government review and approval. The document shall describe the implementation of each topic discussed in this section in addition to the following specification areas:

a. Execution flow and control of simulation modules (Simulator executive),

b. Inter-module communication,

c. Measurement of CPU spare time,

d. Error/exception detection and handling,

e. Simulator software modular design,

g. Non-FORTRAN coded applications,

h. Compilation, linking/loading of simulation modules,

i. Component control subroutines,

j. Event-driven component simulation, and

k. trainee console I/O.

C.13.3 Simulation Model Preliminary Design Concept Specifications

The Contractor shall provide preliminary software design concept specifications, detailing the mathematical models proposed for use in the plant simulation on a plant-system model basis. The specifications shall contain descriptions and explanations of algorithms used for the simulation of plant systems and equipment. The specifications shall specifically include:

a. Development methodology,

b. Scientific theory, physical laws, and first principles applied in development of the mathematical model,

c. Numerical techniques used to implement the mathematical model,

d. Scope of simulation including the explanations and rationale for assumptions and simplifications, and boundaries and limitations of model,

e. Identification of malfunctions simulated by the model,

f. Identification of all plant system components, indicating which components are simulated,

g. Identification of all alarms and process computers, associated with the model, indicating which points are simulated,

i. Identification of all design data to be used in model development, and

j. Model cycle (or iteration) rate.

The specification shall provide sufficient information to enable Government engineering and operations personnel to evaluate the system design concept and, especially, the interaction of process parameters and the effects they produce on one another. It shall also address software modular design and organization detailing the purpose of each module in the plant system model and estimated memory and time requirements for each module.

Preliminary design concept specifications shall be submitted to the Government for review and approval prior to conducting the Preliminary Design Review Meeting.

C.13.4 Simulation Model Design Report

Each system model shall be documented by a Simulation Model Design Report (SMDR). The SMDR shall contain the information described in the following paragraphs. This report is the final version of simulation model section of preliminary design concept specifications.

C.13.4.1 Model Identification

This section shall provide the model name and its function, such as: "Feedwater System - Logic and Control." It shall give the author's name, the computer memory requirements, and the average and worst case CPU times, and shall provide an area to record revision information.

C.13.4.2 System Description and Scope of Simulation

The System Description is a brief narrative describing the plant system (or a portion) that the module simulates. It shall describe the software design approach, define areas that are not simulated or only partially simulated, and state any assumptions or simplifications that were applied to the model as a whole.

C.13.4.3 Mathematical Models

The description of each mathematical model shall be divided into three areas:

a. Analytical formulation and simplifications,

b. Numerical formulation, and

c. Program implementation.

C.13.4.4 Reference Bibliography

This section contains a list of documents referenced by other sections of the SMDR.

C.13.4.5 Program Symbol List

This section contains a list of all program variable names used in the module together with a short description, engineering units, and value if the variable appears in a data or parameter statement.

C.13.4.6 Subroutine Documentation

All instances where subroutines are used by more than one program shall be documented. As a minimum, the subroutine listings shall include a program design document, a software program listing, and, where applicable, hierarchy diagrams, as well as:

a. A list, in alphabetical order, of the subroutines included in the report. Page or paragraph numbers shall be included to allow this list to act as an index to the section describing any individual subroutine.

b. A description of the purpose or function of the subroutine and what it accomplishes.

c. A description of the calling sequence for the subroutine including all inputs and outputs together with their type and units. The range of inputs over which the subroutine returns valid outputs shall also be provided.

d. A description of the method of computation, numerical approach, or algorithm used.

e. A description of any data structures used.

f. An indication of which outputs must be saved as part of an initial condition.

g. For numerical computations, the accuracy of the outputs.

h. An estimate of execution time for the subroutines.

i. A list of other subroutines called from this subroutine.

j. Values returned for invalid inputs.

C.13.4.7 Model Interface List

This section describes how the model interfaces with other modules, the instructor station, and the trainee consoles I/O. It shall include a list of:

a. Variables that serve as inputs to the model, grouped by system module,

b. Variables calculated by the model that serve as inputs to other modules,

c. Trainee consoles and I/O points accessed by the model,

d. Annunciator mimics activated by the model,

e. Process and PMS computer points simulated by the model,

f. Instructor-activated functions the model responds to (malfunctions, etc.).

C.13.4.8 Data Reference List

This list shall contain document numbers, revision level, date document(s) received, and type and source of document.

C.13.4.9 Malfunctions List

This list shall include malfunction number, title, type, physical description, and equation number where the malfunction is computed.

C.13.4.10 Remote Functions List

This list shall contain remote function number, title and type (i.e., digital, variable), true/false states, and equation number where remote function is utilized.

C.13.4.11 Simulated System Diagrams

Each Simulation Model Design Report (SMDR) shall contain engineering drawings showing the associated simulated system and simulation flow charts. Process module SMDRs shall contain P&ID. Logic and control module SMDRs shall contain logic drawings and/or transfer function drawings. Electrical systems SMDRs shall contain single-line schematics and electrical load drawings. The Contractor shall submit a list of proposed drafting symbols to create the simulated system diagrams to the Government for review and approval.

Each simulated component, device, annunciator, and computer point shall be shown on the drawings and shall be identified by its Government tag number and by the corresponding model variable name. Variable names used to represent flows, pressures, temperatures, levels, control signals, and electrical power shall be placed on the drawing in the vicinity of the physical quantity represented by the variable. An arrow shall be drawn from the name to the point on the drawing where the physical quantity exists, if needed for clarity.

C.13.4.12 Design Data

Each SMDR shall list the design data used by the Contractor to develop the model.

C.13.4.13 Software Program Listing

The Contractor shall furnish a complete "source" (programming level language) of all software programs in electronic form. It is the intent of GAN and NRA to regenerate (reassemble or recompile) the executable object code from this electronic form as part of an exercise for future Simulator maintenance. The software program listing shall be prepared in a well-commented form for each module, program, or subroutine used by the Contractor in connection with the design, operation, testing, or debugging of the Simulator.

C.13.5 Plant Monitoring and Control Systems Software

The plant monitoring system software documentation shall consist of a design document and program listing and shall include, in addition to items defined elsewhere in this specification, the following:

a. A description of the techniques used to access the CRTs and keyboards, including data conversion algorithms, subroutines, and data formats.

b. A clear explanation using diagrams, tables, sketches, or other appropriate means for each data structure.

c. The method and software used to initialize the data shall be indicated, as well as the source of the initializing data. The meaning, programming label, size, and use of each field in the structure shall be provided.

d. An overview of the software structure shall be provided, indicating what major tasks exist under the operating system and their functions and relationships. This shall serve as a broad introduction to the detailed documentation for each task.

e. Off-line utility programs used to prepare data for these systems shall be documented in the same manner as the on-line programs.

C.13.6 Executive Software Documentation

The executive software documentation shall describe the master process (executive) that controls the overall Simulator software execution. This documentation shall describe the Simulator software execution algorithms in detail, and define the routines and variables used in the code. This documentation shall also describe the executive's interface with the operating system, Simulator application, and utility software.

The Contractor shall provide a user's manual for the Real-Time Debugging Tool. The manual shall describe the operation and use of all features available The Contractor shall also provide a technical manual which describes the implementation and internal design of the software.

The Contractor shall update the Simulator Software preliminary design concept specification to reflect the as-accepted Simulator and include this in documentation.

C.13.7 Instructor Station User's Manual

a. The Contractor shall provide five (5) copies of the Instructor Station Users Manual containing detailed descriptions of and operating procedures for the following:

1) Each piece of the instructor station hardware.
2) Each control function.
3) Simulator Initial Condition Tableau and means provided for initialization.
4) Malfunction tableau and means provided for insertion and deletion and a brief description of the effects of malfunction insertion. If the effects of the malfunction is variable based upon operator conditions, the limitations shall be included.
5) Use of the override feature.
6) Remote functions tableau and the means provided for insertion and deletion.

b. The instructor's manual shall contain a plant response section organized by plant system using GAN and NRA system numbering. It will provide the instructor with each instructor selectable

malfunction, override, or external parameter with the following information (where applicable):

1) Title of the feature
2) Feature identification
3) Description of the feature
4) Description of instructor selectable options and instructions for deleting options
5) Description of plant response to the feature (for malfunctions)
6) Any precautions regarding use of the feature and suggestions on how the feature should be employed.

c. The Contractor shall submit to the Government, for review and approval, the proposed Instructor Station Users Manual.

C.13.8 Instructor Station Technical Manual

The Instructor Station Technical Manual shall describe the design and operation of the instructor station software. This manual shall include a description of the routines and variables used in the code and the algorithms used to implement the human-machine interface. This manual shall also describe any "off-line" support programs required to create and/or maintain the instructor station displays and operator actions monitor, and shall describe the technical aspects of the test and diagnostic software.

C.13.9 Simulator Software Maintenance Guide

The Simulator Software Maintenance Guide (SSMG) shall describe Simulator startup and shutdown procedures, and procedures for making modifications or additions to the Simulator software.

C.13.9.1 Startup/Shutdown Procedure

The Startup/Shutdown Procedure shall describe the procedure recommended by the Contractor for starting up the Simulator from the following conditions:

a. Cold Start - computer complex operational but powered off. Disk drives are blank and unformatted. Simulator software is on magnetic tape

b. Warm Start - computer complex is operational and powered up, disk drives loaded with required software and operating system, but computers halted (normal daily startup).

c. Hot Restart - computer complex is operational and powered up and running under operating system with Simulator software in execution. Hot restart procedure shall describe how to remove the Simulator software from execution and restart another version of the software.

The SSMG shall also describe the procedure recommended by the Contractor to have the Simulator brought down from a running condition to the following states:

a. Hot Standby - computers running under operating system but Simulator software removed from execution.

b. Warm standby - computers powered up but halted, workstations powered off (normal shutdown).

c. Cold Shutdown - computer complex and workstations powered off.

C.13.9.2 Software Modification Procedure

The Software Modification Procedure shall describe editing, modification tracking, and linking and loading procedures that should be used to make modifications to Simulator software modules. It shall also describe the procedures to add entirely new modules or to delete existing modules. The SSMG shall additionally include user's guides for any utilities and Simulator support software furnished by the Contractor and required for proper maintenance and operation of the Simulator software.

C.13.9.3 Maintenance and Development Support Software

The Contractor shall provide a user's manual for the Simulator Software Testing System. The manual shall describe the operation and use of all features available. The Contractor shall also provide a technical manual describing the implementation and internal design of the software.

C.13.9.4 Source Code Control System User's and Technical Manual

The Contractor shall provide a user's manual for the Source Code Control System. The manual shall describe the operation and use of all features available. The Contractor shall also provide a technical manual describing the implementation and internal design of the software.

C.13.10 Computer Software Manuals

The Contractor shall provide a complete set of software reference and technical manuals for all software products supplied by the computer vendor and third-party software sources.

C.13.11 Computer Diagnostic Manuals

The Contractor shall provide a complete set of reference and technical manuals for the diagnostic software supplied by the computer vendor or other sources. The Contractor shall also provide a user's guide for the Simulator test and diagnostic software.

C.13.12 Computer Hardware Documentation

The Contractor shall provide a complete set of reference and technical manuals and user's guides for the computer equipment and peripherals. This documentation shall additionally include engineering drawings, field maintenance print sets, cable drawings, interconnection drawings, circuit registration manuals, firmware listing, computer vendor part number index, maintenance kit drawings and any other documentation available from the computer vendor necessary for proper maintenance and repair of the computer equipment and peripherals.

The Contractor shall also maintain an operation and maintenance log for the computer equipment throughout the contract period, indicating specific hardware problems encountered, their symptoms, and corrective action taken. The log shall also record any field changes, firmware revision upgrades, circuit board revision upgrades, and/or any other changes made to the computer equipment during the contract period.

The Contractor shall provide a maintenance procedures manual which describes a recommended plan of preventive maintenance for all Simulator equipment, with a list of special tools

and test equipment required for maintenance. The manual shall also include items manufactured by the Contractor or its subcontractors.

C.13.13 Simulator Hardware Documentation

The Contractor shall provide documentation for the integrated Simulator complex consisting of, as a minimum, the items listed below.

a. Trainee Console layout drawings

b. Elementary wiring diagrams.

c. Manufacturing data and drawings for all custom-manufactured Simulator hardware.

C.13.14 Simulation Variables Global Cross Reference

The Contractor shall provide a list of all Simulator variables defined in the global COMMON area. For each variable, all simulation program modules which reference the variable shall be listed. The Contractor shall also provide a global cross reference of Simulator program module usage of externals and shared subroutines.

C.13.15 Simulator Computer System Preliminary Design Specification

The Contractor shall submit a preliminary design specification describing the Simulator computer system to the Government for review and approval. The following items shall be described in detail:

a. Computer system design specification.

b. Design specification of the computer network.

c. Recommendation for spare parts and test equipment.

d. Delivery and procurement schedule recommended for Government-supplied hardware.

C.13.16 Final Design Data Base Report

a. The Contractor shall submit a database report, listing by reference number only, data actually utilized by the Contractor in the Simulator design. Such reports shall include math models,

discrepancy correction, Simulator hardware, and data and methods used in the development of tests and performance evaluations.

b. The design database report shall be prepared in a logically ordered and usable format, including as a minimum, for each piece of data:

1) Data source and type,
2) Document title (name),
3) Sheet number,
4) Revision identification,
5) Vendor document control number, and
6) Short description of data location.

c. Database order and format shall be submitted to Government for review and approval prior to full implementation by the Contractor.

d. The Contractor shall ensure that the format and content of the report satisfies the requirements of ANSI/ANS 3.5, Section 14.

e. A final design database report shall be submitted to the NRC with the final Simulator documentation. The NRC shall have the same review and approval rights for this report as contained in the final documentation submittal.

C.13.17 Instructor Station Preliminary Design Specification

The Contractor shall submit the preliminary design specification describing the design, implementation, and operation of instructor station to the Government for review and approval. As a minimum, the following items shall be described in detail:

a. Hardware configurations, arrangements and installations.

b. List of Malfunctions, including number, title, type, and cause and effect.

c. List of ICs including number, descriptions such as power level, xenon level, k_{eff}, boron concentration, fuel burn-up rates, T-avg and RCS pressure.

d. Fast simulation system list including acceleration rates.

e. External parameter list including changeable range.

f. Instructor Operations Functions including control tableau, function keys, operation methods, and remote control unit operation.

C.14.0 Installation, Spare Parts, Expendables, and Maintenance

C.14.1 Spare Capacities of Host Computer

All spare capacities shall be calculated using the formula where:

$$S = \frac{(A-U)}{A} \times 100$$

S(%) = Percent Spare,
A = available capacity (gross formatted "uncontended" capacity of the device(s))
U = used (capacity which is occupied, addressed or reserved by the system when running in real time or development mode).

Where multiple devices are utilized by the vendor to accomplish a unified task, spare requirements shall be applied to each device as well as the set of devices; e.g., if multiple processors are utilized, spare time shall be measured for each processor during a worst-case situation. The Government shall have the sole and unilateral right to define the terms under which measurements are made and to what devices spare capacity measurements apply.

All processors with 1 MB or more of memory shall be subject to the spare time and memory requirements. Virtual memory techniques shall not be used for or in real-time or development applications.

C.14.1.1 Processor Time

Timing algorithms and run-time measurements for each processor shall be provided. The spare time measurement algorithm(s) shall consider the execution time utilized by all application programs, the Simulator real-time executive(s), the real time I/O process to the Simulator control room, and the computer operating system. System spare time measurements shall be made with all processors executing their respective portions of the real time tasks

under scenarios to be defined by the Government during acceptance testing.

Sufficient processor capacity shall be provided so that both:

a. 30% spare processor time is available during worst-case loading. This time shall be distributed so that no time frame has less than 30% spare time (a frame is defined as the shortest real time cycle).

b. Multiple background tasks, limited only by memory availability, may execute in the background without affecting or degrading Simulator performance.

C.14.1.2 Main Memory

Sufficient main memory shall be supplied so that:

a. 50% spare memory is installed for expansion and other uses. If memory is divided into program and data areas, there shall be 50% spare in each area or sub area. No memory overlay techniques shall be used within the real time simulation process.

b. There shall be sufficient spare memory to accommodate the two (2) largest tasks in the Simulator, whether these are compilation, assembly or execution of real time, or support programs.

C.14.1.3 Bulk Memory

There shall be at least 50% total spare bulk memory. If multiple drives are used, there shall be no less than 50% spare per drive. Space utilized for the configuration management system and its associated data files shall be included in the "used" bulk memory for purposes of spare calculation.

C.14.2 Simulator Equipment Spare Parts

The Contractor shall provide a recommended list for a 3-year supply of spare parts, 18 months after contract award, based upon Mean Time Between Failure (MTBF) analyses, but in no case at less than a 1 to 15 ratio for all Simulator hardware. These spare parts shall include CRTs, keyboards, power supplies, connectors, fans, and controllers.

The Contractor's recommended spare parts list should be in a format compatible with the Simulator configuration management system. Each spare part shall be identified by original

manufacturer, supplier's/manufacturer's address, model, and part number, and the Contractor's part designation. Where applicable, the unique identification number shall also be included for each part on the list.

C.14.3 Expendables

A recommended list for one-year (defined as one year after the Project Schedule Ready for Training milestone) supply of expendables, shall be provided to the Government 10 months after contract award. This list of expendables shall be based on Simulator operation for 5 days per week, 16 hours per day.

C.14.4 Maintenance equipment

Adequate maintenance equipment and procedures shall be supplied with the Simulator.

C.14.4.1 Manuals and Procedures

Maintenance instruction manuals and procedures shall be furnished with the Simulator. A recommended preventive maintenance program and service schedule shall be provided.

C.14.4.2 Tools and Test Equipment

Any and all electrical, electronic, or mechanical tools or test equipment necessary for Simulator maintenance, modification, and diagnostics, together with their associated technical manuals, shall be supplied to Government at time of Simulator shipment. The Contractor's maintenance training courses shall include appropriate courseware in the care and usage of all supplied tools and test equipment.

C.14.4.3 LAN analyzer

This unit shall be able to test and troubleshoot any type of LAN computer, LAN connection, LAN protocol, etc, that is part of the Simulator.

C.14.5 Maintenance

For the duration of the contract, the Contractor shall provide preventive and on-call hardware and software maintenance for the Simulators and shall keep the equipment in good operating condition. The Contractor shall provide GAN, NRA and the Government with phone numbers for maintenance requests during normal business hours. The Contractor shall respond within 24 hours of the request for maintenance.

C.14.6 Site Preparation and Installation of Hardware

After the FAT has been completed, the Contractor shall ship the Simulator to the destination sites. The Contractor will be provided with the documentation of the dimensions and location of Simulator sites at least 60 days prior to shipment of the Simulator. This will include the location and size of ventilation supplies and power. The Contractor shall coordinate delivery and installation with the building owner. The Contractor will be responsible for any modification to the building to accommodate the Analytical Simulator. If upon receiving the above information and visiting and inspecting the site, the Contractor finds that installation of the Simulator will result in an increase to the estimated cost of the contract, the Contractor shall not proceed with installation and shall inform the Contracting Officer of the impact of installation on the estimated cost of the contract. After evaluating the situation, the Contracting Officer will provide instructions to the Contractor on installation. For cost proposal purposes, see guidance in Section L.11.

The Contractor shall be responsible for all necessary actions to physically remove the Simulator, the associated peripheral equipment, the existing inventory of spare parts, the associated furniture, the video and audio equipment, the associated training and documentation materials from the Contractor's factory and to ship it to the user site. Transport of the Simulator shall be in a manner that ensures the delivered Simulator is in the same condition as prior to shipment.

Once the Simulator and associated peripheral equipment have been relocated to the site, the Contractor shall reassemble the Simulator and the associated peripheral equipment, and make all appropriate electrical and electronic connections. The Contractor shall install the power conditioner and power distribution system. The Contractor shall connect the electrical power and electronic cables.

After the Simulator and associated peripheral equipment have been reassembled, the Contractor shall perform diagnostic testing and troubleshooting, if necessary, to determine the operating status of the Simulator.

After the completion of the installation of the Simulator at the user site the Contractor will notify the NRC, GAN and NRA that the Simulator is ready to begin Site Acceptance Testing.

C.15 NRCAR 2052.215-83 TRAVEL APPROVALS (JAN 1993)

(a) All domestic travel requires the prior approval of the project officer.

(b) All foreign travel must be approved in advance by the NRC on NRC Form 445 and must be in compliance with FAR 52.247-63 Preference for U.S. Flag Air Carriers. Foreign travel approval must be communicated in writing through the contracting officer.

[End of Clause]

SECTION D - PACKAGING AND MARKING

D.1 PACKAGING AND MARKING (MAR 1987)

The Contractor shall package material for shipment to the NRC, GAN and the NRA 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.

[End of Clause]

SECTION E - INSPECTION AND ACCEPTANCE

E.1 52.252-2 CLAUSES INCORPORATED BY REFERENCE (JUN 1988)

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.

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

NUMBER	TITLE	DATE
52.246-3	INSPECTION OF SUPPLIES - COST-REIMBURSEMENT	APR 1984
52.246-5	INSPECTION OF SERVICES - COST-REIMBURSEMENT	APR 1984

[End of Clause]

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 or other representative as the Contracting Officer may designate at the destination points in Russia, Ukraine and at the NRC.

[End of Clause]

E.3 PROJECT SCHEDULE

Within 30 days of the contract effective date, the Contractor shall prepare, and submit for approval a detailed project schedule which shall, as a minimum, identify monthly measurements of performance (by completions, not percentages) of design, development, production, testing of hardware, software, documentation, and services. The schedule shall have quality assurance hold-points and witness points, as specified in Section C. In addition, the schedule shall identify and include periods required for the Government's approval process and comply with the Contract Delivery Schedule in Section F.7. For each definable activity shown on the detailed schedule, the name of the person responsible for performance shall be shown. The Government will review the project schedule and approve or disapprove it with comments for revision within 30 days of receipt.

E.4 PROJECT REVIEWS

The Government, GAN and NRA will conduct at least two project

E.4 (Continued)

reviews of the Contractor, for each of the major parts of the project, to assure that the project is being completed on schedule and that the quality of the work preformed is acceptable. These reviews will include but not limited to software requirement review, design review, system modeling review, integrated system testing review and software configuration review. The reviews take place at the contractor site. These reviews will be in addition to the Factory Acceptance Testing and the Site Acceptance Testing.

E.5 VERIFICATION AND VALIDATION PROGRAM

The Government prefers that the verification and validation system for the Simulator be an automated program which can be used by the NRC, GAN and NRA to conduct all comparisons needed for the FAT and SAT. However, a manual procedure that provides equivalent capabilities is acceptable.

a. The Contractor shall provide a Verification and Validation (V/V) program which can be used in the instructor station.

b. A Verification and Validation (V&V) Program shall be provided which incorporates the computer program and procedures necessary for validating the simulator's performance against the best available steady-state and transient data. The comparison data used will either be the actual plant operating data, or in lieu of actual data, best-estimate analysis data. The user shall be able to enter the existing steady-state and transient data into the V&V system, using either a digitizing tablet or by typing the values in via the keyboard.

c. The system shall consist of a menu-driven interactive software package and a user-oriented input interface to minimize the effort of data entry. The V&V system shall reside in instructor-station's workstation where it will collect the simulation data and store it in a user-designated file. This file then shall be available for comparison against the best available data saved on the V&V system's files. The results of the comparison should be saved in a third file, where it will be available for generating internal reports.

d. Some additional required features are set forth in, but they are not limited to, the following:

   1) The comparison module shall be executed at any time. The package shall provide a means to quickly compare the overall simulator performance before and after a software modification.

   2) The user shall be allowed to change the setup scenario, computed by V&V for comparison. The user shall be able to

E.5 (Continued)

select the best and most suitable of the validation criteria available or evaluate the simulated transient performance.

3) The validation program shall be able to calculate the deviation between the data value and the simulated value. The time and magnitude of the maximum deviation shall be plotted and printed. The program should be capable of comparison of results with a resolution of 0.1 seconds. Because the exact moment when the transient is initiated may be difficult to define, the user shall be allowed to move the transient trend along the time axis and then execute the comparison module for a more realistic comparison.

E.6 PERFORMANCE TEST DOCUMENTATION

E.6.1 MALFUNCTION CAUSE AND EFFECT REPORTS

The Contractor shall prepare a malfunction cause and effect report for each individual malfunction. The cause and effect reports shall contain, as a minimum, the following information:

a. Name of malfunction;

b. Numbering scheme using a system agreed to by the Government;

c. Real world failures (cause), when applicable;

d. All primary effects on respective system;

e. Major secondary effects.

f. Reference document numbers for cause;

g. Reference transient curve numbers of best estimation and/or reference plant data;

h. The initial simulator condition at which the effects were written (i.e., power level).

The malfunction cause and effect reports shall be kept updated with changes to the simulator during the performance test. Any change in an original report (considered as the first revision of approved report) shall have a revision number and date. The reports shall be in both hard copy and electronic form.

E.6.2 ACCEPTANCE TEST PROCEDURE

Within six months after the contract effective date, the Contractor shall prepare the acceptance test procedure (ATP) and

E.6.2 (Continued)

submit to the Government for approval.

The ATP shall meet the intent of the codes and standards of this specification. The ATP shall be revised by the Contractor to reflect any hardware, software, or operational changes on the simulator during testing. Prior to start of factory acceptance testing by Government, the Contractor shall supply the Government with documentation of the simulator performance during Contractor's testing. This documentation shall include, as a minimum, the ATP with all steps initialized and associated values filled in. The Contractor shall also submit a list of all simulator discrepancies found during Contractor's testing. The ATP outline shall contain, as a minimum, the following:

a. Hardware configuration verification.

1) Visual inspection.
2) Documentation - wire list, etc.
3) trainee console
4) I/O test.

b. Computer systems.

1) Hardware diagnostics.
2) simulator loading and background processing.
3) Spare time and memory test.
4) Configuration.
5) simulator hardware test software.

c. Instructor station.

1) Functions.
2) Controls.

d. Individual system.

e. Performance validation.

1) Initial condition verification.
2) Normal plant evolution
   - Plant heat-up
   - Plant start-up
   - Power operation (0% - 100%)
   - Plant shutdown/cooldown
3) Transient test
   - Malfunctions
   - Comparison to reference plant data
   - Comparison to best-estimate analysis
4) Surveillance test
   - Heat balances
   - Core physics test, etc.

E.6.2 (Continued)

The ATP shall also include determination of simulator performance in accordance with the requirements of the latest version of ANSI/ANS 3.5 standard and this section.

E.7 VERIFICATION AND VALIDATION

E.7.1 GENERAL

a. Simulator response resulting from operator action, no operator action, improper operator action, automatic plant controls, and inherent operating characteristics, shall not violate physical laws of nature, such as conservation of mass, momentum, and energy. The response shall be realistic to the extent that within the limits of the validation criteria described in this section, the operator shall not discern a difference between the response of the simulator and that of the reference plant.

b. This requirement is applicable for the entire range of operations, including normal, abnormal, transient and emergency (as described in Section C).

c. Validation shall be done by comparing the simulator performance against the best available data.

d. The best available data are actual plant operating data and best-estimate engineering analysis or design data when actual plant operating data are not available.

E.7.2 SIMULATOR CAPABILITY CRITERIA

E.7.2.1 REAL-TIME

a. The execution shall be complete within the design time interval during normal operation as well as during transient operation.

b. No noticeable differences that adversely impact training shall exist between the simulator and the reference plant, as applicable, in the following respects: time-base relationships, sequences, durations, rates, and accelerations.

E.7.2.2 LIMITS OF SIMULATION

There shall be a message or graphic symbol on the relevant window at the instructor station CRT to notify the instructor when the limits of simulation have been exceeded.

E.7.2.3 STEADY STATE OPERATION

a. Simulator data and best available reference plant data shall

E.7.2.3 (Continued)

be compared at the steady state conditions where the Government with assistance of GAN and NRA decide to test, including the following steady-state power level:

1) Cold shutdown
2) Hot standby
3) 25% power
4) 50% power
5) 75% power
6) 100% power

b. The recorded computed values of the parameters shall be compared with the best available reference plant data and shall be within the tolerances noted below.

c. The computed values of parameters not itemized below shall agree within a 10% tolerance of the reference plant parameters.

d. In comparing the simulator computed values and the best available reference plant data, an additional deviation is allowed up to the documented value of the reference plant instrument error.

e. The simulator instrument error shall be no greater than that of the comparable meter, recorder, and related instrument system of the reference plant.

f. The following parameters shall match reference plant data within 2% for VVER parameters. Offerors shall propose a list of similar parameters for RBMK reference plants (see Section L.8).

1) T-avg, hot, cold
2) MWe
3) Core MWt
4) Power range nuclear instrumentation readings
5) Reactor Coolant System (RCS) pressure
6) SG pressure
7) Pressurizer level
8) Steam generator feed flow
9) RCS flow
10) SG level
11) Letdown flow
12) Charging flow
13) Steam flow
14) Turbine first stage pressure
15) Boron concentration
16) Pressurizer temperature
17) Control rod positions

E.7.2.3 (Continued)

18) Secondary plant heat balance data

E.7.2.4 STEADY STATE STABILITY

The parameters, specifically Item f of the section entitled "Steady State Operation," shall be stable. They shall not vary by more than 2% of the initial values during a continuous 60-minute period of operation at all preassigned initial conditions, including rated power.

E.7.2.5 NORMAL EVOLUTIONS

a. The following evolutions shall be performed and validated against the criteria described in Item c. of this section:

1) Heat up from cold shutdown to hot standby.

2) Unit startup from hot standby to rated power.

3) Turbine/generator startup and generator synchronization.

4) Operator conducted surveillance testing on safety related equipment and systems.

5) Operations at hot standby.

6) Load changes.

7) Start up, shutdown, and power operations with less than full reactor coolant flow.

8) Unit shutdown from rated power to hot standby and cooldown to cold shutdown conditions.

9) Unit performance testing such as heat balance, determination of shutdown margin, and measurement of reactivity coefficients and control rod worth using permanently installed instrumentation.

10) Recovery to rated power following a reactor trip.

b. The simulator performance during conduct of the normal evolution shall meet the applicable acceptance criteria stated below.

c. Acceptance criteria shall be the same as reference plant start-up test procedure acceptance criteria. Acceptance criteria shall also require that the:

1) Observable change in the parameters correspond in direction to those expected for a best estimate of normal

E.7.2.5 (Continued)

plant operation.

2) Simulator shall cause an alarm or automatic action if the reference plant would respond similarly under identical circumstances.

3) Simulator shall not cause an alarm or automatic action if the reference plant would respond similarly under identical circumstances.

E.7.2.6 TRANSIENTS

a. The simulator transient performance during conduct of plant operations, malfunctions, and major accidents shall meet the following acceptance criteria:

1) Use of applicable reference plant procedures is allowed.

2) Any observable change in a simulated parameter corresponds in direction to that expected from actual or best estimate response of the reference plant to the cause.

3) The simulator shall cause an alarm or automatic action if the reference plant would respond similarly under identical circumstances.

4) The simulator shall not cause an alarm or automatic action if the reference plant would respond similarly under identical circumstances.

b. Simulator data and best available reference plant data shall be compared by running the test from an initial condition of 100% power, steady state xenon, and decay heat with no operator follow up action for the following transients. (NRC reserves the right to add any additional transients tests.) (The following transients are for VVERs. Offerors shall propose transients for RBMK's (see Section L.8).

1) Uncontrolled extraction of regulatory bodies group

2) Actuation of MCP of the loop not working before

3) Release of a regulatory body (CPS rods)

4) Decrease of boron concentration in coolant due to failures in boron regulation system

5) Mechanical failure of MCP

6) Loss of power supply of one MCP

E.7.2.6 (Continued)

7) Loss of power supply of all MCPs

8) NPP black-out

9) Disconnecting of turbine generators from the system

10) Close of isolation valves of steam generators

11) Stop of feedwater delivery

12) High-water heater switching off

13) Steamline rupture

14) Unplanned opening of safety valve of steam generator

15) Unplanned opening of turbine bypass valve

16) Rupture of feedwater pipeline of steam generators

17) Main circulation pipeline rupture and pipeline of the primary circuit with diameter > 300 mm.

18) Unplanned actuation of safety valve of pressurizer

19) Rupture of primary circuit pipelines with diameter < 100 mm.

c. For the transients the following parameters shall be recorded simultaneously versus time with a resolution of one second or less:

- Neutron flux (percent)
- Average temperature
- Pressurizer pressure
- Narrow range pressurizer pressure
- Pressurizer level
- Pressurizer temperature
- Total steam flow (if available)
- Total feedwater flow (if available)
- Steam generator feedwater flow
- Loop flows
- Hot leg temperature (all loops)
- Cold leg temperature (all loops)
- Steam generator secondary pressure (all generators)
- Steam generator level (all generators)
- Steam generator steam flow
- Containment pressure
- Containment temperature
- Relief valve flow (if available)

E.7.2.6 (Continued)

- Surge line temperature
- Source range monitor output
- Reactor vessel level (if available)
- Saturation margin monitor output (if available)

E.7.3 STUDENT/USER CONSOLE FIDELITY

The student/user consoles shall mimic the control room displays. The mimics shall be correct in shape, color, and configuration of those of the reference plants. The control room mimics shall be sufficiently complete to allow the student to operate the plant in all modes of operation. The following shall be included:

1) Switches,
2) Controllers,
3) Meters,
4) Recorders,
5) Color,
6) Panel Layout,
7) Plant computer capabilities,
8) Annunciators,
9) Labels, and
10) Display systems.

E.8 TESTING

The testing of the simulator shall follow test procedures that include the following elements.

E.8.1 STEADY STATE TEST PROCEDURE

a. Configure simulator for normal operation and reset to the appropriate IC for test.

b. Place simulator in run.

c. Collect data using provided data acquisition facility at a minimum of 1 time per second.

d. Transfer data into spreadsheet format and plot using same scale as available reference data. If reference data is not available use reasonable scaling. Save raw data in binary and spreadsheet form.

e. Acceptance criteria is similar to standards set forth in ANSI 3.5. It will be different for different parameters.

E.8.2 OPERABILITY TEST PROCEDURE

a. Configure simulator for normal operation and reset to 100% power IC.

E.8.2 (Continued)

b. Using standard operating procedures reduce power to 75% and snap IC.

c. Using standard operating procedures reduce power to 50% and snap IC.

d. Using standard operating procedures reduce power to 25% and snap IC.

e. Using standard operating procedures reduce power to 0% and snap IC.

f. Using standard operating procedures take plant to a cold shutdown condition and snap IC.

g. Using standard operating procedures heatup RCS and bring plant to a condition just prior to criticality and snap IC.

h. Using standard operating procedures increase power to 25% and snap IC.

i. Using standard operating procedures increase power to 50% and snap IC.

j. Using standard operating procedures increase power to 75% and snap IC.

k. Using standard operating procedures increase power to 100% and snap IC.

E.8.3 TRANSIENT TEST PROCEDURE

a. Configure simulator for normal operation and reset to the appropriate IC for test.

b. Place simulator in run.

c. Initiate malfunction or other action to incite simulator response.

d. Collect data using provided data acquisition facility at a minimum of 1 time per second.

e. Transfer data into spreadsheet format and plot using same scale as available reference data. If reference data is not available use reasonable scaling. Save raw data in binary and spreadsheet form.

f. Acceptance criteria is similar to standards set forth in ANSI 3.5. It will be different for different parameters.

E.8.3 (Continued)

- Manual Reactor Trip
- Trip of One MCP
- Simultaneous Trip of All MCPs
- PORV Stuck Open
- Main Turbine Trip
- Trip of One Main Feed Pump
- Simultaneous Closure of All MSIVs
- Steam Generator Tube Rupture
- Main Steam Line Break
- Main Feedwater Line Break
- Large LOCA (> 300 mm)
- Small LOCA (< 100 mm)
- Anticipated Transient Without Scram
- Turbine Trip with ATWS
- Control Rod Drop
- LOCA following Reactor Trip
- Uncontrolled Control Rod Withdrawal
- Loss of Feedwater with Large Flow Restoration

E.8.4 MALFUNCTION LOGICAL TEST PROCEDURE

a. Configure simulator for normal operation and reset to an appropriate IC.

b. Place simulator in run.

c. Initiate malfunction.

d. Verify malfunction actually occurs.

e. Reset to appropriate IC and repeat step b through d until all malfunctions have been tested.

E.9 QUALITY ASSURANCE

E.9.1 HARDWARE QUALITY ASSURANCE

The Contractor shall implement a standard quality assurance/quality control (QA/QC) program to assure that the simulator hardware manufactured by the Contractor or his subcontractors is designed, manufactured, inspected, tested, documented, and delivered in accordance with the requirements of the contract.

Acceptance of the Contractor's quality assurance program does not relieve the Contractor of the obligation to comply with the requirements of the contract including this QA requirement. If the program is subsequently found to be ineffective or inadequate to provide QA/QC, the Government reserves the right to require necessary revisions.

E.9.1 (Continued)

All proposed program modifications shall be submitted to the Contracting Officer for review and approval. All Contractor detected nonconformances to the contract's technical requirements (such as drawings, procedures, specifications or other documents) previously accepted by the Government that have a proposed disposition of repair or use-as-is, shall be notified by means of SDDR (supplier-division-disposition-request) prior to implementation. The SDDR form is not to be used in cases where the Government has previously provided authorization to proceed using an accepted repair procedure covering a specific type of repair. However, records must be maintained for each specific repair.

1. Quality Assurance Criteria

The following QA criteria identify the minimum requirements of a QA program.

a. Procurement Control

The control for procurement of material and services, whether purchased directly by the Contractor or through its subcontractor shall include measures for:

(1) Assuring that applicable codes and standard requirements necessary to assure adequate quality are suitably included or referenced in procurement documents.

(2) Source evaluation with respect to technical and quality capability and source selection by using the results of the evaluation.

(3) Objective evidence of quality furnished by the source, this will always involve examination of products upon delivery and may require inspection at the source. Documented evidence of the conformance of purchased item to procurement requirements shall be available at the supplier's factory prior to use.

b. Inspection and Test Control

An inspection and test program shall be established and executed to assure that inspection and testing required to verify conformance of an item or activity are identified and performed in accordance with written procedures, incorporating requirements, methods, and acceptance limits. The program shall include:

(1) Characteristics, items, and activities to be inspected

E.9.1 (Continued)

or tested.

(2) Method of inspection or test.

(3) Identification of the individuals or organizations for performing the inspection or test operation, and their responsibilities and qualifications. These individuals should not be those who performed the activity.

(4) Test prerequisites such as calibrated instrumentation or adequate test equipment.

(5) Method of indication and notification of mandatory inspection hold points for witness by the Government and the supplier, as required.

(6) Acceptance and rejection criteria.

(7) Method of documenting or recording inspection and test data and results, evaluation of the results, and determination of their acceptability.

(8) Provisions for assuring that tools, gages, instruments and other measuring and testing devices are properly identified, controlled, calibrated, and adjusted at specified intervals.

(9) Provisions for indicating and maintaining the inspection and test operation status of items to prevent inadvertent use or bypassing of inspection and tests.

E.9.2 SOFTWARE QUALITY ASSURANCE PROGRAM

The Contractor shall implement a QA/QC program to assure that the simulator software is designed and coded consistent with a predefined software development methodology, changes to the software have been placed under a configuration management system, and that the software documentation is updated accordingly. The software QA/QC plan should generally follow the guidelines of Section 2 including "IEEE 730-IEEE Standard for Software Quality Assurance Plans," and the "NRC Software Quality Assurance Program and Guidelines NUREG/BR-0167" including:

a. Define the software development methodology.

b. Define a coding standard which shall include:

1) Source, object, and task file naming conventions,

2) Variable naming conventions,

E.9.2 (Continued)

3) Revision level identification,

4) Programming language statement placement and formatting,

5) Commenting and subsection identification, and

6) Programming restrictions.

c. Ensure that the software revision level is known at all times and that the object and task files can be associated with the source revision from which they were generated.

d. Define the software documentation standard.

e. Assure that the software documentation is kept current with the implementation.

f. Define the software configuration management plan.

g. Define the technical and managerial reviews and audits to be conducted, including:

1) Software Documentation Review -- periodic reviews to ensure that all changes are reflected in the preliminary design documents (see 2 below).

2) Preliminary Design Review -- evaluate the technical adequacy of the preliminary design concept expressed in the preliminary design documents. The preliminary design review may be conducted in several sessions, with each session devoted to a review the design of a particular item. For example, the preliminary design review of the Instructor Control and Monitor Functions need not be done at the same time as the Simulation Model review. The Contractor shall, however, schedule the preliminary design review for each item before any substantial software development has taken place for that item. The Contractor shall make its simulation engineers or engineering subcontractors available during the review to give technical presentations to Government engineers and to respond to questions concerning each of the simulation models and the other software and documentation to be reviewed. After award of contract, the Contractor shall submit a schedule showing the dates and times each item will be reviewed so that the Government may review and approve, and may schedule its engineers for the review. All preliminary design documents and specifications required for this review shall be submitted to Government no later than 30 days prior to the preliminary design review date for the item being reviewed. Government will

E.9.2 (Continued)

review and approve the documents or return with comments within 30 days following the preliminary design review. The preliminary design documents, as approved by Government, shall serve as the design guidelines for development of the simulator software. They shall also serve as the QA documents used to verify that the design guidelines are being followed. Any changes to the preliminary design, as expressed in the preliminary design documents, shall be approved first by Government. The preliminary design documents shall be updated during software development to reflect changes.

3) Intermediate Design Review -- evaluate the technical adequacy of any changes to the preliminary design made necessary by adverse non-integrated system test results. The Contractor shall make its simulator engineers or engineering subcontractors available during the review to answer questions from Government engineers and to describe how problems identified during the non-integrated system test were resolved and/or changes that were made to the preliminary design.

4) Integrated System Test Review -- evaluate the adequacy and completeness of the integrated system test plan used to conduct the Integrated System Tests.

5) Functional Audit -- held prior to power plant performance testing to assure that all problems identified by the integrated system test have been resolved in a technically adequate manner, all requirements presented in the contract for the simulator software and documentation have been met, and the simulator is ready for power plant performance testing. The Contractor shall make its simulator engineers or engineering subcontractors available during the audit to answer questions from Government engineers and to describe how problems identified during the integrated system were resolved.

6) Physical Audit -- held after FAT to verify that the software and its documentation are internally consistent and in the form required by the contract, and that the software is ready for shipment and the documentation is ready for final printing.

h. Define the discrepancy reporting and correcting procedures to be used for factory and onsite acceptance testing.

i. Assure that software purchased from the computer vendor or third-party sources has a reliable support system that guarantees response to submitted problem reports.

E.9.2 (Continued)

j. Assure that modifications to computer vendor or third-party supplied software are completely controlled and fully documented.

All reviews and audits shall be conducted at the Contractor's manufacturing facility. The Contractor shall submit a schedule for the reviews and audits to Government for review and approval within 30 days after award of contract. It shall be the Contractor's responsibility to conduct the reviews and audits. However, the Government reserves the right to participate in all reviews and to conduct or be present at all audits.

SECTION F - DELIVERIES OR PERFORMANCE

F.1 52.252-2 CLAUSES INCORPORATED BY REFERENCE (JUN 1988)

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.

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

NUMBER	TITLE	DATE
52.242-15	STOP-WORK ORDER Alternate I (APR 1984)	AUG 1989

[End of Clause]

F.2 NRCAR 2052.212-70 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 Section J for List of Attachments).

[End of Clause]

F.3 NRCAR 2052.212-71 TECHNICAL PROGRESS REPORT

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, Job Code Number (JCN), 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. Current Project Schedule updated to reflect progress.

b. List of activities accomplished in the month.

c. List of planned activities not accomplished and the reason.

F.3 (Continued)

d. List of activities planned for next month.

e. Deliverables, reports and meetings scheduled for the next three months.

f. Problem areas and action plans for recovery.

g. List of open items requiring response by the Contractor, Government and GAN.

h. Listing of minutes of telecon communications (determined to be significant by the Project Manager).

i. Listing of the minutes of all meetings between the Government and/or GAN and Contractor.

j. A summary of the Simulator discrepancy reports (DR) during Factory Acceptance Testing and On-Site Testing. This summary shall include the DR number, summary description, date written, engineer assignment, and status (open, closed, ready for retest, etc.).

k. Any other relevant information deemed of interest to Government or GAN.

[End of Clause]

F.4 NRCAR 2052.212-72 FINANCIAL STATUS REPORT (DEC 1995)

The Contractor shall provide a monthly Financial Status Report to the project officer and the contracting officer. Also, whenever the report references the acquisition of, or changes in status of property valued at the time of purchase at $50,000 or more, send a copy of the report to the Chief, Property Management Branch, Division of Facilities and Property Management, Office of Administration. The report is due within 15 calendar days after the end of the report period and shall identify the title of the project, the contract number, job code, project manager and/or principal investigator, the contract period of performance, and the period covered by the report. Each report shall include the following for each discrete task. In addition, the Contractor's report shall provide the information called for in items (a)(1) thru (4), (6) and (7) below for each applicable USAID reporting category and each job code (JCN) listed in Section B of the contract award document. See Section J Attachment 10 for USAID reporting category definitions and abbreviations.

(a) Total estimated contract amount.
(b) Total funds obligated to date.
(c) Total costs incurred this reporting period.

F.4 (Continued)

(d) Total costs incurred to date.
(e) Detail of all direct and indirect costs incurred during the reporting period for the entire contract.
(f) Balance of obligations remaining.
(g) Balance of funds required to complete contract.
(h) Contractor Spending Plan (CSP) status:

(1) Projected percentage of completion cumulative through the report period for the project/task order as reflected in the current CSP.

(2) Indicate if there has been a significant change 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.

(3) 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.

(i) Property Status:

(1) List property acquired for the project during the month with an acquisition cost of $500 or more and less than $50,000. Give the item number for the specific piece of equipment.

(2) List 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. Note: The same information shall 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 ($5,000 or more if purchased prior to October 1, 1995) showing the above information.

(4) In the final monthly status report provide a closeout property report containing the same elements as described

F.4 (Continued)

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 contractor shall 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 end dates for each trip, the starting point and destination, and the traveler(s) for each trip.

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 52.232-22) or the Limitation of Funds (LOF) Clause (FAR 52.232-22).

(End of Clause)

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 (4 copies)

U.S. Nuclear Regulatory Commission
Technical Training Center
Osborne Office Center
5700 Brainerd Road, Suite 200
Chattanooga, TN 37411-4017

(b) GAN Headquarters, Moscow (3 copies)

(c) NRA Headquarters, Kiev (3 copies)

(d) Contracting Officer (1 copy)

[End of Clause]

F.6 **DURATION OF CONTRACT PERIOD (MAR 1987)**
ALTERNATE 3 (MAR 1987)

Although the Government contemplates use of the system(s) (hardware and software) for the system's life of 5 years from date of installation, the term of the basic contract is from the contract effective date through 19 months from the contract effective date. The term of this contract may be extended by exercise of the options described in Section C for required amount of time necessary time to complete the option as set forth in the required delivery schedule in Section F.

[End of Clause]

F.7 **CONTRACT DELIVERY SCHEDULE**

In addition to the monthly technical progress and financial status reports to Government, GAN and NRA, the Contractor shall deliver the items or complete the tasks shown below in accordance with Sections C, E and F by the last working date of the month indicated.

Months after contract award	Event or Deliverable Item
Zaporozhye 5 Schedule	
1	Project Schedule per Section E for Zaporozhye 5 Project
3	Data base report for Zaporozhye 5 data
4	Preliminary Design Report from Contractor for hardware and Zaporozhye 5 Software
5	Project review meeting for Zaporozhye 5 project at Contractor site
7	Acceptance test procedure for Zaporozhye 5 Project
8	Training of NRA and GAN personnel by Contractor at Contractor site
10	Project review meeting for Zaporozhye 5 project at Contractor site
14	Factory acceptance testing for Zaporozhye 5 Project by Contractor, NRC, GAN and NRA at Contractor site
15	Site delivery of simulator hardware with Zaporozhye 5 software load and documentation to NRA site
15	Site delivery of simulator hardware with Zaporozhye

F.7 (Continued)

5 software load and documentation to GAN Headquarters site

12 All methodological training materials for Zaporozhye 5 project

17 Site acceptance testing by Contractor, NRC, and NRA at NRA site

17 Site acceptance testing by Contractor, NRC, and GAN at GAN site

18 Validation report from Contractor to Government, GAN and NRA

18 Expendables from Contractor

18 Site delivery of simulator hardware with Zaporozhye 5 software load and documentation to GAN Novovoronezh (Don Region) site

18 Completion of Zaporozhye 5 project

Balakova 4 Schedule

1 Project Schedule per Section E for Balakova 4 Project

3 Data base report for Balakova 4 data

4 Preliminary Design Report from Contractor for Balakova 4 Software

6 Project review meeting for Balakova 4 Project at Contractor site

10 Acceptance test procedure Balakova 4 Project

12 Training of GAN and NRA personnel by Contractor at Contractor site

12 Project review meeting for Balakova 4 Project at Contractor site

12 Factory acceptance testing by Contractor, NRC, GAN and NRA at Contractor site

16 Site delivery of Balakova 4 simulator software load and documentation to GAN headquarters site

16 Site delivery of Balakova 4 simulator software load and documentation to NRA site

F.7 (Continued)

16 Site acceptance testing by Contractor, NRC, and GAN at GAN headquarters site

16 Site acceptance testing by Contractor, NRC, and NRA at NRA site

18 Validation report from Contractor to Government, GAN and NRA

19 Expendables from Contractor

19 Site delivery of Balakova 4 simulator software load and documentation to GAN Novovoronezh (Don Region) site

19 Completion of Balakova 4 Project

Option One - Kursk 4

Months after exercise of option

1 Project Schedule per Section E for Kursk 4 Project

3 Data base report for Kursk 4 data

4 Preliminary Design Report from Contractor for Kursk 4 Software

5 Project review meeting for Kursk 4 Project at Contractor site

7 Acceptance test procedure Kursk 4 Project

8 Training of NRA and GAN personnel by Contractor at Contractor site

10 Project review meeting for Kursk 4 Project at Contractor site

14 Factory acceptance testing for Kursk 4 Project by Contractor, NRC, GAN and NRA at Contractor site

15 Site delivery of simulator hardware with Kursk 4 software load and documentation to GAN St. Petersburg Region site

15 Site delivery of Kursk 4 simulator software load and documentation to NRA site

F.7 (Continued)

15	All methodological training materials for Kursk 4 Project
17	Site acceptance testing by Contractor, NRC, and GAN at GAN St. Petersburg Region site
17	Site acceptance testing by Contractor, NRC, and NRA at NRA site
18	Validation report from Contractor to Government, GAN and NRA
18	Expendables from Contractor
18	Site delivery of Kursk 4 simulator software load and documentation to GAN headquarters site
18	Completion of Kursk 4 project

Option Two - Rovno 1

Months after exercise of option	
1	Project Schedule per Section E for K Rovno 1 Project
3	Data base report for Rovno 1 data
4	Preliminary Design Report from Contractor for Rovno 1 Software
5	Project review meeting for Rovno 1 Project at Contractor site
7	Acceptance test procedure Rovno 1 Project
8	Training of NRA and GAN personnel by Contractor at Contractor site
10	Project review meeting for Rovno 1 Project at Contractor site
14	Factory acceptance testing for Rovno 1 Project by Contractor, NRC, GAN and NRA at Contractor site
15	Site delivery of Rovno 1 simulator software load and documentation to NRA site
15	Site delivery of Rovno 1 simulator software load and documentation to GAN headquarters site

F.7 (Continued)

15 All methodological training materials for Rovno 1 project

17 Site acceptance testing by Contractor, NRC, and NRA at NRA site

17 Site acceptance testing by Contractor, NRC, and GAN at GAN headquarters site

18 Validation report from Contractor to Government, GAN and NRA

18 Expendables from Contractor

18 Site delivery of Rovno 1 simulator software load and documentation to GAN Novovoronezh (Don Region) site

18 Completion of Rovno 1 project

{End of Clause}

SECTION G - CONTRACT ADMINISTRATION DATA

G.1 NRCAR 2052.215-71 PROJECT OFFICER AUTHORITY (JAN 1993)

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

Name: Steven Arndt

Address: U.S. Nuclear Regulatory Commission
Technical Training Center
Osborne Office Center
5700 Brainerd Road, Suite 200
Chattanooga, TN 37411-4017

Telephone Number: (423) 855-6641

(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, fills in details, or otherwise serves to accomplish the contractual statement of work.

(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 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

G.1 (Continued)

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.

(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 there to is subject to FAR 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.

G.1 (Continued)

(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.

[End of Clause]

G.2 NRCAR 2052.215-82 TRAVEL REIMBURSEMENT - ALTERNATE 1 (JAN 1993)

(a) The contractor is encouraged to use Government contract airlines, AMTRAK rail services, and discount hotel/motel properties in order to reduce the cost of travel under this contract. The contracting officer shall, upon request, provide each traveler with a letter of identification which is required in order to participate in this program. The Federal Travel Directory (FTD) identifies carriers, contract fares, schedules, payment conditions, and hotel/motel properties which offer their services and rates to Government contractor personnel traveling on official business under this contract. The FTD, which is issued monthly, may be purchased from the U.S. Government Printing Office, Washington, DC 20402.

(b) The contractor will be reimbursed for reasonable travel costs incurred directly and specifically in the performance of this contract. The cost limitations for travel costs are determined in accordance with the specific travel regulations cited in FAR 31.205-46, as are in effect on the date of the trip. 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.

(c) When the Government changes the Federal Travel Regulations, or other applicable regulations, it is the responsibility of the contractor to notify the contracting officer in accordance with the Limitations of Cost clause of this contract if the contractor will be unable to make all of the approved trips and remain within the cost and fee limitations of this contract due to the changes.

G.2 (Continued)

(End of Clause)

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

(a) Pending the establishment of final indirect rates which must be negotiated based on audit of actual costs, the contractor shall be reimbursed for allowable indirect costs as follows:

Cost Element	Rate	Base	Period
Payroll Burden(PRB)		Direct Labor(DL)	Award to Conclusion
Labor Overhead		DL+PRB	Award to Conclusion
General & Admin*		Total Cost	Award to Conclusion

* Not-to-exceed ceiling rate

(b) The contracting officer may adjust the above rates as appropriate during the term of the contract upon acceptance of any revisions proposed by the contractor except that the General & Administrative rate shall not exceed 20% for the term of the contract. It is the contractor's responsibility to notify the contracting officer in accordance with FAR 52.232-20, Limitation of Cost, or FAR 52.232-22, Limitation of Funds, as applicable, if these changes affect performance of work within the established cost or funding limitations.

[End of Clause]

G.4 **USE OF AUTOMATED CLEARING HOUSE (ACH) ELECTRONIC PAYMENT**

It is the policy of the U.S. Nuclear Regulatory Commission to pay Government vendors by the Automated Clearing House (ACH) electronic funds transfer payment system in lieu of a U.S. Treasury check. The electronic system is known as Vendor Express. Payment shall be made in accordance with FAR 52.232-28, entitled "Electronic Funds Transfer Payment Methods."

To receive payment by Vendor Express, the contractor shall complete the "Company Information" portion of Form SF 3881, entitled "Payment Information Form - ACH Vendor Payment System" found in Section J. The contractor shall take the form to the ACH Coordinator at the financial institution that maintains its company's bank account. The contractor shall discuss with the ACH Coordinator how the payment identification information (addendum record) will be passed to them once the payment is received by the financial institution. The contractor must ensure that the addendum record will not be stripped from the payment. The ACH Coordinator will fill out the "Financial Institution Information" portion of the form and return it to the Office of the Controller

G.4 (Continued)

at the following address: Nuclear Regulatory Commission, ATTN: ACH/Vendor Express, Division of Accounting and Finance, Mailstop T-9-E-2, Washington, DC 20555. Once the Office of the Controller has processed the contractor's sign-up form, the contractor will begin to receive payments electronically via Vendor Express/ACH.

If the offerors/bidders have questions concerning ACH/Vendor Express, they may call the Commercial Payments staff on (301) 415-7520.

[End of Clause]

SECTION H - SPECIAL CONTRACT REQUIREMENTS

H.1 NRCAR 2052.209-73 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.

H.1 (Continued)

(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, 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

H.1 (Continued)

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

H.1 (Continued)

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 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

H.1 (Continued)

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.

[End of Clause]

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

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

Robert Kershner - Program Manager
Ning-Wu Wang - Lead Software Engineer
Andre Zlokozov
William Beavers - Lead Instructor
Tushar Dighe - Lead Hardware Engineer
John Van Pelt - Lead Test Operator
Eric Johnston
Victor Listratov

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 or his/her authorized representative shall evaluate the request and promptly notify the contractor of his

H.2 (Continued)

or her approval or disapproval 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.

[End of Clause]

H.3 NRCAR 2052.235-72 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 and shall comply with all applicable health, safety, and fire protection regulations and requirements (including reporting requirements) of the Commission and the Department of Labor. In the event that the contractor fails to comply with these regulations or requirements, the contracting officer 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 order for resumption of work may be issued at the discretion of the contracting officer. The contractor shall make no claim for an extension of time or for compensation or damages by reason of, or in connection with, this type of work stoppage.

[End of Clause]

H.4 CONTRACTOR ACQUIRED GOVERNMENT EQUIPMENT/PROPERTY (NOV 1994)

The Contractor is authorized to acquire and/or fabricate the equipment/property listed in the Contractor's bill of material dated May 10, 1996 as deliverables required under this contract. Title to all deliverable property/material will vest in either GAN of Russia or the NRA of Ukraine, as appropriate, upon conclusion of this contract.

(b) In the event that, during contract performance, the contractor determines that the acquisition cost for the above item(s) is expected to exceed the amount(s) contained in the contractor's proposal, the contractor shall refer to the Limitation of Cost or Funds Clause when either is included in the contract.

(c) Only the equipment/property listed above, in the quantities shown, will be acquired by the contractor. The above listed equipment/property is subject to the provisions of the "Government Property" clause. [End of Clause]

H.5 RISK OF LOSS OR DAMAGE--PURCHASE (MAR 1987)

(a) The Government is relieved of all risks of loss or damage to the equipment, up to and including the day prior to the first day of a successful performance period, except for:

(1) Loss or damage caused by nuclear reaction, nuclear radiation, radioactive contamination, war, insurrection, civil strife, rebellion, weapons of war; or

(2) Negligence on the part of the Government or its agents, provided, however, that the Government shall be relieved of the liability for such risks of loss or damage due to negligence if any commercial customer of the Contractor is relieved of such liability under like circumstances.

(b) If the Government is liable for loss or damage of a machine, the Contractor shall have the option to restore the machine to its previous condition, in which event the Government shall pay the Contractor to perform such restoration at the Contractor's then-current prices, terms, and conditions. If the Contractor elects not to restore the machine, the Government may, at its own expense, restore the machine to its previous condition. If, however, the machine is lost or damaged beyond repair, the Government shall pay to the Contractor the same price for the machine as the Government would have paid had it purchased the machine on the day prior to the loss or damage under the provisions of this contract. This clause shall govern risk of loss or damage, notwithstanding any other provisions of this contract relating to title, payment, or ownership.

[End of Clause]

H.6 USE OF HARDWARE OR SOFTWARE MONITORS (MAR 1987)

The Contractor shall permit inclusion or attachment of such devices as the Government may choose to employ for the purpose of examining or measuring the activity within the computer system. Devices such as hardware monitors, which may require physical connection to the computer system, and devices such as software

H.6 (Continued)

monitors, which may require portions of the computer system's control software to be displaced, are specifically included in this category. The Contractor may not prohibit the installation of any such devices unless the particular device will cause significant or permanent damage to the computer system. The Contractor shall assist the Government in identifying and locating device connections, when requested by the Government, if the Contractor provides such service to other customers. Cost for this service, if any, is stated elsewhere in this contract.

[End of Clause]

H.7 REPLACEMENT PART AVAILABILITY (ADPE) (MAR 1987)

The Contractor guarantees that replacement parts for each piece of equipment in this contract will be available for the system's (item's) life of five years. The Contractor shall notify the Government one year before the end of the system's (item's) life as to the continuing availability of parts subsequent to this period. If parts will not be available from the Contractor, then the Government may require the Contractor to furnish data that is available to assist the Government to obtain such parts from another source.

[End of Clause]

H.8 ENGINEERING CHANGES (ADP REQUIREMENTS) (JUN 1988)

(a) After contract award, the Government may solicit, and the Contractor is encouraged to propose independently, engineering changes to the equipment, software specifications or other requirements of this contract. These changes may be proposed to save money, to improve performance, to save energy, or to satisfy increased data processing requirements. However, if proposed changes relating to improved performance are necessary to meet increased data processing requirements of the user, those requirements shall not exceed the contract requirements by more than 25 percent. If the proposed changes are acceptable to both parties, the Contractor shall submit a price change proposal to the Government for evaluation within 30 days of such acceptance. Those proposed engineering changes that are acceptable to the Government will be processed as modifications to the contract.

(b) As a minimum, the following information shall be submitted by the Contractor with each proposal:

(1) A description of the difference between the existing contract requirement and the proposed change, and the comparative advantages and disadvantages of each;

H.8 (Continued)

(2) Itemized requirements of the contract which must be changed if the proposal is adopted, and the proposed revision to the contract for each such change;

(3) An estimate of the changes in performance and cost, if any, that will result from adoption of the proposal;

(4) An evaluation of the effects the proposed change would have on collateral costs to the Government such as Government-furnished property costs, costs of related items, and costs of maintenance and operation; and

(5) A statement of the time by which the change order adopting the proposal must be issued so as to obtain the maximum benefits of the changes during the remainder of this contract, also, any effect on the contract completion time or delivery schedule shall be identified.

(c) Engineering change proposals submitted to the Contracting Officer shall be processed expeditiously. The Government shall not be liable for proposal preparation costs or any delay in acting upon any proposal submitted pursuant to this clause. The Contractor has the right to withdraw, in whole or in part, any engineering change proposal not accepted by the Government within the period specified in the engineering change proposal. The decision of the Contracting Officer as to the acceptance of any such proposal under this contract shall be final and shall not be subject to the "Disputes" clause of this contract.

(d) The Contracting Officer may accept any engineering change proposal submitted pursuant to this clause by giving the Contractor written notice thereof. This written notice may be given by issuance of a modification to this contract. The Contractor shall remain obligated to perform in accordance with the terms of the existing contract.

(e) If an engineering change proposal submitted pursuant to this clause is accepted and applied to this contract, an equitable adjustment in the contract price and in any other affected provisions of this contract shall be made in accordance with this clause and other applicable clauses of this contract. When the cost of performance of this contract is increased or decreased as a result of the change, the equitable adjustment increasing or decreasing the contract price shall be in accordance with the "Changes" clause rather than under this clause, but the resulting contract modification shall state that it is made pursuant to this clause.

(f) The Contractor is requested to identify specifically any

H.8 (Continued)

information contained in the engineering change proposal which it prefers not be disclosed to the public. The identification of information as confidential and/or proprietary is for information purposes only and shall not be binding on the Government to prevent disclosure of such information. The Contractor is advised that such information may be subject to release upon request pursuant to the Freedom of Information Act (5 U.S.C. 552).

[End of Clause]

H.9 PROHIBITION ON PAYMENT OF FOREIGN DUTIES AND TAXES

The Contractor shall not pay any foreign customs duties or other foreign import, value added, or sales tax on the government property to be delivered to the Russian government organization under this contract. The Government will not reimburse the Contractor for the incurrence of any of these costs. See Section J Attachments 11 & 12 for Article I of the Agreement between the Government of the United States of America and the Government of Ukraine Regarding Humanitarian and Technical Economic Cooperation dated May 7, 1992 and Article I of the Agreement between the Government of the United States of America and the Government of the Russian Federation Regarding Cooperation to Facilitate the Provision of Assistance dated April 4, 1992.

[End of Clause]

H.10 FOREIGN LIABILITY

Article IV of the Agreement between the Government of Ukraine and the Government of the United States of America Concerning Operational Safety Enhancements, Risk Reduction Measures and Nuclear Safety Regulation for Civilian Nuclear Facilities in Ukraine dated October 25, 1993 (Attachment 13) and Article IV of the Agreement between the Government of the United States of America and the Government of the Russian Federation Concerning Operational Safety Enhancements, Risk Reduction Measures, and Nuclear Safety Regulation for Civil Nuclear Facilities in the Russian Federation dated December 16, 1993 (Attachment 14) apply to the work under this contract.

[End of Clause]

PART II - CONTRACT CLAUSES

SECTION I - CONTRACT CLAUSES

I.1 52.252-2 CLAUSES INCORPORATED BY REFERENCE (JUN 1988)

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.

I. FEDERAL ACQUISITION REGULATION (48 CFR CHAPTER 1) CLAUSES

NUMBER	TITLE	DATE
52.202-1	DEFINITIONS	OCT 1995
52.203-3	GRATUITIES	APR 1984
52.203-5	COVENANT AGAINST CONTINGENT FEES	APR 1984
52.203-10	PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER ACTIVITY	SEP 1990
52.203-12	LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS	JAN 1990
52.204-4	PRINTING/COPYING DOUBLE-SIDED ON RECYCLED PAPER	MAY 1995
52.209-6	PROTECTING THE GOVERNMENT'S INTEREST WHEN SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR PROPOSED FOR DEBARMENT	JUL 1995
52.211-5	NEW MATERIALS	MAY 1995
52.211-7	OTHER THAN NEW MATERIAL, RESIDUAL INVENTORY, AND FORMER GOVERNMENT SURPLUS PROPERTY	MAY 1995
52.215-2	AUDIT AND RECORDS--NEGOTIATION	OCT 1995
52.215-22	PRICE REDUCTION FOR DEFECTIVE COST OR PRICING DATA	OCT 1995
52.215-24	SUBCONTRACTOR COST OR PRICING DATA	OCT 1995
52.215-27	TERMINATION OF DEFINED BENEFIT PENSION PLANS	MAR 1996
52.215-33	ORDER OF PRECEDENCE	JAN 1986
52.215-39	REVERSION OR ADJUSTMENT OF PLANS FOR POSTRETIREMENT BENEFITS OTHER THAN PENSIONS (PRB)	MAR 1996
52.215-40	NOTIFICATION OF OWNERSHIP CHANGES	FEB 1995
52.216-7	ALLOWABLE COST AND PAYMENT	JUL 1991
52.216-8	FIXED FEE	APR 1984

I.1 (Continued)

NUMBER	TITLE	DATE
52.219-8	UTILIZATION OF SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS CONCERNS	OCT 1995
52.219-9	SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED SMALL BUSINESS SUBCONTRACTING PLAN	OCT 1995
52.219-16	LIQUIDATED DAMAGES--SUBCONTRACTING PLAN	OCT 1995
52.222-3	CONVICT LABOR	APR 1984
52.222-26	EQUAL OPPORTUNITY	APR 1984
52.222-28	EQUAL OPPORTUNITY PREAWARD CLEARANCE OF SUBCONTRACTS	APR 1984
52.222-35	AFFIRMATIVE ACTION FOR SPECIAL DISABLED AND VIETNAM ERA VETERANS	APR 1984
52.222-36	AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS	APR 1984
52.222-37	EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS AND VETERANS OF THE VIETNAM ERA	JAN 1988
52.223-2	CLEAN AIR AND WATER	APR 1984
52.223-6	DRUG-FREE WORKPLACE	JUL 1990
52.225-7	BALANCE OF PAYMENTS PROGRAM	APR 1984
52.223-14	TOXIC CHEMICAL RELEASING REPORTING	OCT 1995
52.225-11	RESTRICTIONS ON CERTAIN FOREIGN PURCHASES	MAY 1992
52.227-1	AUTHORIZATION AND CONSENT	JUL 1995
52.227-2	NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT	APR 1984
52.227-3	PATENT INDEMNITY	APR 1984
52.227-14	RIGHTS IN DATA - GENERAL Alternate II (JUN 1987) Alternate III (JUN 1987) & Alternate V (JUN 1987)	JUN 1987
52.227-16	ADDITIONAL DATA REQUIREMENTS	JUN 1987
52.227-19	COMMERCIAL COMPUTER SOFTWARE - RESTRICTED RIGHTS	JUN 1987
52.228-7	INSURANCE - LIABILITY TO THIRD PERSONS	MAR 1996
52.230-2	COST ACCOUNTING STANDARDS	AUG 1992
52.230-5	ADMINISTRATION OF COST ACCOUNTING STANDARDS	FEB 1995
52.232-17	INTEREST	JAN 1991
52.232-20	LIMITATION OF COST	APR 1984
52.232-23	ASSIGNMENT OF CLAIMS	JAN 1986
52.232-25	PROMPT PAYMENT	MAR 1994
52.232-28	ELECTRONIC FUNDS TRANSFER PAYMENT METHODS	APR 1989
52.233-1	DISPUTES	OCT 1995

I.1 (Continued)

NUMBER	TITLE	DATE
52.233-3	PROTEST AFTER AWARD Alternate I (JUN 1985)	OCT 1995
52.242-1	NOTICE OF INTENT TO DISALLOW COSTS	APR 1984
52.242-3	PENALTIES FOR UNALLOWABLE COSTS	OCT 1995
52.243-2	CHANGES - COST-REIMBURSEMENT Alternate II (APR 1984)	AUG 1987
52.242-13	BANKRUPTCY	JUL 1995
52.244-2	SUBCONTRACTS (COST-REIMBURSEMENT AND LETTER CONTRACTS)	MAR 1996
52.244-5	COMPETITION IN SUBCONTRACTING	JANUARY 1996
52.244-6	SUBCONTRACTS FOR COMMERCIAL ITEMS AND COMMERCIAL COMPONENTS	OCT 1995
52.245-5	GOVERNMENT PROPERTY (COST-REIMBURSEMENT, TIME-AND-MATERIAL, OR LABOR-HOUR CONTRACTS)	JAN 1986
52.247-63	PREFERENCE FOR U.S.-FLAG AIR CARRIERS	APR 1984
52.247-64	PREFERENCE FOR PRIVATELY OWNED U.S.-FLAG COMMERCIAL VESSELS	JUL 1995
52.247-67	SUBMISSION OF COMMERCIAL TRANSPORTATION BILLS TO THE GENERAL SERVICES ADMINISTRATION FOR AUDIT	FEB 1995
52.249-6	TERMINATION (COST-REIMBURSEMENT)	MAY 1986
52.249-14	EXCUSABLE DELAYS	APR 1984
52.253-1	COMPUTER GENERATED FORMS	JAN 1991

[End of Clause]

I.2 **52.203-9 REQUIREMENT FOR CERTIFICATE OF PROCUREMENT INTEGRITY--MODIFICATION (SEP 1995)**

(a) Definitions. The definitions set forth in FAR 3.104-4 are hereby incorporated in this clause.

(b) The Contractor agrees that it will execute the certification set forth in paragraph (c) of this clause when requested by the Contracting Officer in connection with the execution of any modification of this contract.

(c) Certification. As required in paragraph (b) of this clause, the officer or employee responsible for the modification proposal shall execute the following certification. The certification in paragraph (c)(2) of this clause is not required for a modification which procures commercial items.

I.2 (Continued)

CERTIFICATE OF PROCUREMENT INTEGRITY--
MODIFICATION (NOV 1990)

(1) I, [Name of certifier] **Jerry Jen**, am the officer or employee responsible for the preparation of this modification proposal and hereby certify that, to the best of my knowledge and belief, with the exception of any information described in this certification, I have no information concerning a violation or possible violation of subsection 27(a), (b), (d), or (f) of the Office of Federal Procurement Policy Act, as amended* (41 U.S.C. 423), (hereinafter referred to as "the Act"), as implemented in the FAR, occurring during the conduct of this procurement (contract and modification number).

(2) As required by subsection 27(e)(1)(B) of the Act, I further certify that to the best of my knowledge and belief, each officer, employee, agent, representative, and consultant of [Name of Offeror] **Simulation, Systems & Services Tech. Co.** who has participated personally and substantially in the preparation or submission of this proposal has certified that he or she is familiar with, and will comply with, the requirements of subsection 27(a) of the Act, as implemented in the FAR, and will report immediately to me any information concerning a violation or possible violation of subsections 27(a), (b), (d), or (f) of the Act, as implemented in the FAR, pertaining to this procurement.

(3) Violations or possible violations: (Continue on plain bond paper if necessary and label Certificate of Procurement Integrity--Modification (Continuation Sheet), ENTER NONE IF NONE EXISTS)

None

[Signature of the officer or employee responsible for the modification proposal and date]

Jerry Jen, Vice President
[Typed name of the officer or employee responsible for the modification proposal]

* Subsections 27(a), (b), and (d) are effective on December 1, 1990. Subsection 27(f) is effective on June 1, 1991.

I.2 **(Continued)**

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER TITLE 18, UNITED STATES CODE, SECTION 1001.

(d) In making the certification in paragraph (2) of the certificate, the officer or employee of the competing Contractor responsible for the offer or bid, may rely upon a one-time certification from each individual required to submit a certification to the competing Contractor, supplemented by periodic training. These certifications shall be obtained at the earliest possible date after an individual required to certify begins employment or association with the contractor. If a contractor decides to rely on a certification executed prior to the suspension of section 27 (i.e., prior to December 1, 1989), the Contractor shall ensure that an individual who has so certified is notified that section 27 has been reinstated. These certifications shall be maintained by the Contractor for a period of 6 years from the date a certifying employee's employment with the company ends or, for an agency, representative, or consultant, 6 years from the date such individual ceases to act on behalf of the contractor.

(e) The certification required by paragraph (c) of this clause is a material representation of fact upon which reliance will be placed in executing this modification.

[End of Clause]

I.3 **OPTIONS FOR SEPARATELY PRICED ITEMS/SERVICES**

The Government may require the delivery of the items/services, identified in Section B.3 as option items/services, in accordance with Section C at the cost and fee shown in Section in B.3. The Contracting Officer may exercise the options by issuing a unilateral contract modification during the periods of time prescribed below. Refer to Section F.7 for the required delivery schedule for these option items.

SOW Section	Short Name	Option Exercise Period Beginning of Month XX to End of Month XX after the Contract Effective Date
C.1.5.1.1	Software Updates 1 site	Concurrent w/ Option 1
C.1.5.1.5	Student Station	Concurrent w/ Option 1

I.3 (Continued)

	Monitoring 1 site	
C.1.5.1.6	Training Material Development Kursk 4 Rovno 1	 Concurrent w/ Option 1 Concurrent w/ Option 2
C.1.6	Option One - Kursk 4	9 months to 12 months
C.1.7	Option Two - Rovno 1	17 months to 20 months

[End of Clause]

I.4 52.222-2 PAYMENT FOR OVERTIME PREMIUMS (JUL 1990)

(a) The use of overtime is authorized under this contract if the overtime premium cost does not exceed $0.00 or the overtime premium is paid for work--

(1) Necessary to cope with emergencies such as those resulting from accidents, natural disasters, breakdowns of production equipment, or occasional production bottlenecks of a sporadic nature;

(2) By indirect-labor employees such as those performing duties in connection with administration, protection, transportation, maintenance, standby plant protection, operation of utilities, or accounting;

(3) To perform tests, industrial processes, laboratory procedures, loading or unloading of transportation conveyances, and operations in flight or afloat that are continuous in nature and cannot reasonably be interrupted or completed otherwise; or

(4) That will result in lower overall costs to the Government.

(b) Any request for estimated overtime premiums that exceeds the amount specified above shall include all estimated overtime for contract completion and shall--

(1) Identify the work unit; e.g., department or section in which the requested overtime will be used, together with present workload, staffing, and other data of the affected unit sufficient to permit the Contracting Officer to evaluate the necessity for the overtime;

(2) Demonstrate the effect that denial of the request will have on the contract delivery or performance schedule;

I.4 (Continued)

(3) Identify the extent to which approval of overtime would affect the performance or payments in connection with other Government contracts, together with identification of each affected contract; and

(4) Provide reasons why the required work cannot be performed by using multishift operations or by employing additional personnel.

[End of Clause]

I.5 52.242-4 CERTIFICATION OF INDIRECT COSTS (OCT 1995)

(a) The Contractor shall--

(1) Certify any proposal to establish or modify billing rates or to establish final indirect cost rates;

(2) Use the format in paragraph (c) of this clause to certify; and

(3) Have the certificate signed by an individual of the Contractor's organization at a level no lower than a vice president or chief financial officer of the business segment of the Contractor that submits the proposal.

(b) Failure by the Contractor to submit a signed certificate, as described in this clause, shall result in payment of indirect costs at rates unilaterally established by the Government.

(c) The certificate of indirect costs shall read as follows:

Certificate of Indirect Costs

This is to certify that to the best of my knowledge and belief:

1. I have reviewed this indirect cost proposal;

2. All costs included in this proposal (identify proposal and date) to establish billing or final indirect costs rates for (identify period covered by rate) are allowable in accordance with the requirements of contracts to which they apply and with the cost principles of the Federal Acquisition Regulation (FAR) and its supplements applicable to those contracts;

3. This proposal does not include any costs which are unallowable under applicable cost principles of the

I.5 (Continued)

FAR or its supplements, including, but not limited to: advertising and public relations costs, contributions and donations, entertainment costs, fines and penalties, lobbying costs, defense of fraud proceedings, and goodwill; and

4. All costs included in this proposal are properly allocable to Government contracts on the basis of a beneficial or casual relationship between the expenses incurred and the contracts to which they are allocated in accordance with applicable acquisition regulations.

I declare under penalty of perjury that the foregoing is true and correct.

Firm: **Simulation, Systems and Services Technologies Company**

Signature:

Name of Certifying Official: **Jerry Jen**

Title: **Vice President**

Date of Execution: **6 June 1996**

[End of Clause]

I.6 **201-39.5202-3 PROCUREMENT AUTHORITY (OCT 1990 FIRMR)**

This acquisition is being conducted under the regulatory blanket delegation of CSA's exclusive procurement authority for FIP resources.

PART III - LIST OF DOCUMENTS, EXHIBITS AND OTHER ATTACHMENTS

SECTION J - LIST OF ATTACHMENTS

J.1 ATTACHMENTS (MAR 1987)

Attachment Number	Title
01	Billing Instructions
02	NRC Contractor Organizational Conflicts of Interest
03	NRC Handbook 3.8
04	Standard Form 1411 with Instructions
05	Contractor Spending Plan (CSP) Instructions
06	Subcontracting Plan
07	Non-exclusive License Agreement
08	List of Simulated Features
09	Methodological Support Documentation
10	USAID Expenditure Reporting Categories
11	Agreement Between the Government of the United States of America and the Government of the Russian Federation Regarding Cooperation to Facilitate the Provision of Assistance
12	Agreement between the Government of the United States of America and the Government of Ukraine Regarding Humanitarian and Technical Economic Cooperation
13	Agreement between the Government of Ukraine and the Government of the United States of America Concerning Operational Safety Enhancements, Risk Reduction Measures, and Nuclear Safety Regulation for Civilian Nuclear Facilities in Ukraine
14	Agreement between the Government of the United States of America and the Government

J.1 (Continued)

of the Russian Federation Concerning Operational Safety Enhancements, Risk Reduction Measures, and Nuclear Safety Regulation for Civil Nuclear Facilities in the Russian Federation

BILLING INSTRUCTIONS FOR COST REIMBURSEMENT TYPE CONTRACTS

General: The contractor shall prepare vouchers/invoices for reimbursement of costs in the manner and format described herein. **FAILURE TO SUBMIT VOUCHERS/INVOICES IN ACCORDANCE WITH THESE INSTRUCTIONS WILL RESULT IN REJECTION OF THE VOUCHER/INVOICE AS IMPROPER.**

Number of Copies: An original and three copies, including supporting documentation shall be submitted. A copy of all supporting documents must be attached to each copy of your voucher/invoice. Failure to submit all the required copies will result in rejection of the voucher/invoice as improper.

Designated Agency Billing Office: Vouchers/invoices shall be submitted to the following address:

U.S. Nuclear Regulatory Commission
Division of Contracts - T-7-I-2
Washington, DC 20555

HAND DELIVERY OF VOUCHERS/INVOICES IS DISCOURAGED AND WILL NOT EXPEDITE PROCESSING BY NRC. However, should you choose to deliver vouchers/invoices by hand, including delivery by any express mail services or special delivery services which use a courier or other person to deliver the voucher/invoice in person to the NRC, such vouchers/invoices must be addressed to the above Designated Agency Billing Office and will only be accepted at the following location:

U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike - Mail Room
Rockville, MD 20852

HAND-CARRIED SUBMISSIONS WILL NOT BE ACCEPTED AT OTHER THAN THE ABOVE ADDRESS.

Note that the official receipt date for hand-delivered vouchers/invoices will be the date it is received by the official agency billing office in the Division of Contracts.

Agency Payment Office: Payment will continue to be made by the office designated in the contract in Block 12 of SF 26 or Block 25 of SF 33, whichever is applicable.

Frequency: The contractor shall submit claims for reimbursement once each month, unless otherwise authorized by the Contracting Officer.

Format: Claims should be submitted in the format depicted on the attached sample form entitled "Voucher/Invoice for Purchases and Services Other than Personal" (see **Attachment 1**). The sample format is provided for guidance only. The format is not required for submission of a voucher/invoice. Alternate formats are permissible provided all requirements of the billing instructions are addressed. The instructions for preparation and itemization of the voucher/invoice are included with the sample form.

Task Ordering Contracts: If the contractor bills for more than one task order under a voucher/invoice, detailed cost information for each individual task order shall be submitted, together with a cumulative summary of all charges billed on the voucher/invoice. This includes all applicable cost elements discussed in paragraphs (a) through (n) of the attached instructions.

Billing of Cost After Expiration of Contract: If costs are incurred during the contract period and claimed after the contract has expired, the period during which these costs were incurred must be cited. To be considered a proper expiration voucher/invoice, the contractor shall clearly mark it "EXPIRATION VOUCHER" or "EXPIRATION INVOICE".

Final vouchers/invoices shall be marked "FINAL VOUCHER" or "FINAL INVOICE".

Currency: Billings may be expressed in the currency normally used by the contractor in maintaining his accounting records; payments will be made in that currency. However, the U.S. dollar equivalent for all vouchers/invoices paid under the contract may not exceed the total U.S. dollars authorized in the contract.

Supersession: These instructions supersede any previous billing instructions.

INVOICE/VOUCHER FOR PURCHASES AND SERVICES OTHER THAN PERSONAL

(SAMPLE FORMAT)

Official Agency Billing Office
U.S. Nuclear Regulatory Commission
Division of Contracts MS: T-7-I-2
Washington, DC 20555-0001
Payee's Name and Address

(a) Contract Number _____

Task Order No. (If Applicable) _____

(b) Voucher/Invoice #_____ ___ ___

(c) Date of Voucher/Invoice_____

(d) Fixed Fee _____

Individual to Contact
Regarding this Voucher
Name: _____

Tel. No.: _____

(e) This voucher represents reimbursable costs for the billing period for the billing period from _____through_____.

		Amount Billed	
		Current Period	Cumulative
(f)	Direct Costs		
	(1) Direct labor*.....	_____	_____
	(2) Fringe benefits (%, if computed as percentage).....	_____	_____
	(3) Capitalized nonexpendable equipment ($50,000 or more - see instructions)*.....	_____	_____
	(4) Non-capitalized equipment, materials, and supplies.....	_____	_____
	(5) Premium pay (NRC approved overtime).....	_____	_____
	(6) Consultants*.....	_____	_____
	(7) Travel*.....	_____	_____
	(8) Subcontracts*.....	_____	_____
	(9) Other costs*.....	_____	_____
	Total Direct Costs	_____	_____
(g)	Indirect Costs		
	(A) Overhead ____ % of _____(Indicate Base).....	_____	_____
	(B) General & Administrative Expense ____ % of Cost Elements Nos._____.....	_____	_____
	Total Direct & Indirect Costs	_____	_____
(h)	Fixed-Fee (Cite Formula): _____.....	_____	_____
)	Total Amount Billed.....	_____	_____
(j)	Adjustments.....	_____	_____
(k)	Grand Totals.....	_____	_____

* (Requires Supporting Information -- See Attached)

SAMPLE SUPPORTING INFORMATION

1) Direct Labor - $2400

Labor Category	Hours Billed	Rate	Total	Cumulative Hrs. Billed
Senior Engineer I	100	$14.00	$1400	975
Engineer	50	$10.00	$500	465
Computer Analyst	100	$5.00	$500	320
			$2400	

3) Capitalized Non-Expendable Equipment

Prototype Spectrometer - item number 1000-01 $60,000

4) Non-capitalized Equipment, Materials, and Supplies

10 Radon tubes @ $110.00 = $1100.00

6 Pairs Electrostatic gloves @ $150.00 = $900.00

$2000.00

5) Premium Pay

Walter Murphy - 10 hours @ $10.00 Per Hour = $100
(This was approved by NRC in letter dated 3/6/95).

6) Consultants' Fee

Dr. Carney - 1 hour @ $100 = $100

7) Travel

Start Date	Destination	Costs
3/1/89	Wash., DC	$200

INSTRUCTIONS FOR PREPARING COST INFORMATION FOR NRC CONTRACT VOUCHERS/INVOICES

Preparation and Itemization of the Voucher/Invoice: In order to constitute a proper invoice, the contractor shall furnish all the information set forth below. These notes are keyed to the entries on the sample voucher/invoice.

Official Agency Billing Office: Address the original and 3 copies of the voucher/invoice, together with supporting documentation attached to each copy to: U.S. Nuclear Regulatory Commission, Division of Contracts, MS: T-7-I-2, Washington, DC 20555-0001.

Vouchers/invoices delivered by hand, including delivery by express mail or special delivery services which use a courier or other person to deliver the voucher/invoice in person to the NRC, should be addressed in accordance with the foregoing and delivered to: U. S. Nuclear Regulatory Commission, One White Flint North, 11555 Rockville Pike - Mail Room, Rockville, Maryland 20852. Hand-delivered vouchers/invoices will not be accepted at other than the above address. Note, however, that the official receipt date for hand-delivered vouchers/invoices will be the date it is received by the official agency billing office in the Division of Contracts.

Payee's Name and Address. Show the name of the contractor as it appears in the contract and its correct address. When an approved assignment has been made by the contractor, or a different payee or addressee has been designated, insert the name and address of the payee. Indicate the name and telephone number of the individual responsible for answering any questions that the NRC may have regarding the invoice. The following guidance corresponds to the entries required on the sample form.

(a) Contract Number. Insert the NRC contract number.

Task Order Number, if applicable. Insert the task order number.

(b) Voucher/invoice number. The appropriate sequential number of the voucher/invoice, beginning with 001 should be designated. Contractors may also include an individual internal accounting number, if desired, in addition to the 3-digit sequential number.

(c) Date of Voucher/Invoice. Insert the date the voucher/invoice is prepared.

(d) Fixed-Fee. Insert total fixed-fee. Include this information as it applies to individual task orders as well.

(e) Billing Period. Insert the beginning and ending dates (day, month, year) of the period during which costs were incurred and for which reimbursement is claimed.

(f) Direct Costs - Insert the amount billed for the following cost elements, adjustments, suspensions, and total amounts, for both the current billing period and for the cumulative period (from contract inception to end date of this billing period).

(1) Direct Labor. This consists of salaries and wages paid (or accrued) for direct performance of the contract itemized as follows:

Labor Category	Hrs. Billed	Rate	Total	Cumulative Hrs.Billed

(2) Fringe Benefits. This represents fringe benefits applicable to direct labor and billed as a direct cost. Where a rate is used indicate the rate. Fringe benefits included in direct labor or in other indirect cost pools should not be identified here.

(3) Capitalized Non Expendable Equipment. List each item costing $50,000 or more and having a life expectancy of more than one year. List only those items of equipment for which reimbursement is requested. For each such item, list the following (as applicable): (a) the item number for the specific piece of equipment listed in the property schedule of the contract; or (b) the Contracting Officer's approval letter if the equipment is not covered by the property schedule.

(4) Non-capitalized Equipment, Materials, and Supplies. These are equipment other than that described in (3) above, plus consumable materials, supplies. List by category. List items valued at $500 or more separately. Provide the item number for each piece of equipment valued at $500 or more.

(5) Premium Pay. This enumeration in excess of the basic hourly rate. (Requires written approval of the Contracting Officer.)

(6) Consultants. The supporting information must include the name, hourly or daily rate of the consultant, and reference the NRC approval (if not specifically approved in the original contract).

(7) Travel. Total costs associated with each trip must be shown in the following format:

	Start Date		Destination		Costs
From	To		From	To	$

(8) Subcontracts. Include separate detailed breakdown of all costs paid to approved subcontractors during the billing period.

(9) Other Costs. List all other direct costs by cost element and dollar amount separately.

(g) Indirect Costs (Overhead and General and Administrative Expense). Cite the formula (rate and base) in effect in accordance with the terms of the contract, during the time the costs were incurred and for which reimbursement is claimed.

(h) Fixed Fee. If the contract provides for a fixed fee, it must be claimed as provided for by the contract. Cite the formula or method of computation. The contractor may bill for fixed fee only up to 85% of total fee.

(i) Total Amount Billed. Insert the total amounts claimed for the current and cumulative periods.

2009.570 NRC organizational conflicts of interest.

§2009.570-1 Scope of policy.

(a) It is the policy of NRC to avoid, eliminate, or neutralize contractor organizational conflicts of interest. The NRC achieves this objective by requiring all prospective contractors to submit information describing relationships, if any, with organizations or persons (including those regulated by the NRC) which may give rise to actual or potential conflicts of interest in the event of contract award.

(b) Contractor conflict of interest determinations cannot be made automatically or routinely. The application of sound judgment on virtually a case-by-case basis is necessary if the policy is to be applied to satisfy the overall public interest. It is not possible to prescribe in advance a specific method or set of criteria which would serve to identify and resolve all of the contractor conflict of interest situations which might arise. However, examples are provided in these regulations to guide application of this policy guidance. The ultimate test is as follows: Might the contractor, if awarded the contract, be placed in a position where its judgment may be biased, or where it may have an unfair competitive advantage?

(c) The conflict of interest rule contained in this subpart applies to contractors and offerors only. Individuals or firms who have other relationships with the NRC (e.g., parties to a licensing proceeding) are not covered by this regulation. This rule does not apply to the acquisition of consulting services through the personnel appointment process, NRC agreements with other Government agencies, international organizations, or state, local, or foreign Governments. Separate procedures for avoiding conflicts of interest will be employed in these agreements, as appropriate.

§2009.570-2 Definitions.

As used in §2009.570:

Affiliates means business concerns which are affiliates of each other when either directly or indirectly one concern or individual controls or has the power to control another, or when a third party controls or has the power to control both.

Contract means any contractual agreement or other arrangement with the NRC except as provided in §2009.570-1(c).

Contractor means any person, firm, unincorporated association, joint venture, co-sponsor, partnership, corporation, affiliates thereof, or their successors in interest, including their chief executives, directors, key personnel (identified in the contract), proposed consultants or subcontractors, which are a party to a contract with the NRC.

Evaluation activities means any effort involving the appraisal of a technology, process, product, or policy.

Offeror or prospective contractor means any person, firm, unincorporated association, joint venture, co-sponsor, partnership, corporation, or their affiliates or successors in interest, including their chief executives, directors, key personnel, proposed consultants, or subcontractors, submitting a bid or proposal, solicited or unsolicited, to the NRC to obtain a contract.

Organizational conflicts of interest means that a relationship exists whereby a contractor or prospective contractor has present or planned interests related to the work to be performed under an NRC contract which:

(1) May diminish its capacity to give impartial, technically sound, objective assistance and advice, or may otherwise result in a biased work product; or

(2) May result in its being given an unfair competitive advantage.

Potential conflict of interest means that a factual situation exists that suggests that an actual conflict of interest may arise from award of a proposed contract. The term potential conflict of interest is used to signify those situations that–

(1) Merit investigation before contract award to ascertain whether award would give rise to an actual conflict; or

(2) Must be reported to the contracting officer for investigation if they arise during contract performance.

Research means any scientific or technical work involving theoretical analysis, exploration, or experimentation.

Subcontractor means any subcontractor of any tier who performs work under a contract with the NRC except subcontracts for supplies and subcontracts in amounts not exceeding the small purchase threshold.

Technical consulting and management support services means internal assistance to a component of the NRC in the formulation or administration of its programs, projects, or policies which normally require that the contractor be given access to proprietary information or to information that has not been made available to the public. These services typically include assistance in the preparation of program plans, preliminary designs, specifications, or statements of work.

§2009.570-3 Criteria for recognizing contractor organizational conflicts of interest.

(a) General.

(1) Two questions will be asked in determining whether actual or potential organizational conflicts of interest exist:

(i) Are there conflicting roles which might bias an offeror's or contractor's judgment in relation to its work for the NRC?

(ii) May the offeror or contractor be given an unfair competitive advantage based on the performance of the contract?

(2) NRC's ultimate determination that organizational conflicts of interest exist will be made in light of common sense and good business judgment based upon the relevant facts. While it is difficult to identify and to prescribe in advance a specific method for avoiding all of the various situations or relationships that might involve potential organizational conflicts of interest, NRC personnel will pay particular attention to proposed contractual requirements that call for the rendering of advice, consultation or evaluation activities, or similar activities that directly lay the groundwork for the NRC's decisions on regulatory activities, future procurements, and research programs. Any work performed at an applicant or licensee site will also be closely scrutinized by the NRC staff.

(b) Situations or relationships. The following situations or relationships may give rise to organizational conflicts of interest:

(1) The offeror or contractor shall disclose information, that may give rise to organizational conflicts of interest under the following circumstances. The information may include the scope of work or specification for the requirement, being performed, the period of performance, and the name and telephone number for a point of contact at the organization knowledgeable about the commercial contract.

(i) Where the offeror or contractor provides advice and recommendations to the NRC in the same technical area where it is also providing consulting assistance to any organization regulated by the NRC.

(ii) Where the offeror or contractor provides advice to the NRC on the same or similar matter on which it is also providing assistance to any organization regulated by the NRC.

(iii) Where the offeror or contractor evaluates its own products or services, or has been substantially involved in the development or marketing of the products or services of another entity.

(iv) Where the award of a contract would result in placing the offeror or contractor in a conflicting role in which its judgment may be biased in relation to its work for the NRC, or would result in an unfair competitive advantage for the offeror or contractor.

(v) Where the offeror or contractor solicits or performs work at an applicant or licensee site while performing work in the same technical area for the NRC at the same site.

(2) The contracting officer may request specific information from an offeror or contractor or may require special contract clauses such as provided in §2009.570-5(b) in the following circumstances:

(i) Where the offeror or contractor prepares specifications that are to be used in competitive procurements of products or services covered by the specifications.

(ii) Where the offeror or contractor prepares plans for specific approaches or methodologies that are to be incorporated into competitive procurements using the approaches or methodologies.

(iii) Where the offeror or contractor is granted access to information not available to the public concerning NRC plans, policies, or programs that could form the basis for a later procurement action.

(iv) Where the offeror or contractor is granted access to proprietary information of its competitors.

(v) Where the award of a contract might result in placing the offeror or contractor in a conflicting role in which its judgment may be biased in relation to its work for the NRC or might result in an unfair competitive advantage for the offeror or contractor.

(c) Policy application guidance. The following examples are illustrative only and are not intended to identify and resolve all contractor organizational conflict of interest situations.

(1) (i) Example. The ABC Corp., in response to a Request For Proposal (RFP), proposes to undertake certain analyses of a reactor component as called for in the RFP. The ABC Corp. is one of several companies considered to be technically well qualified. In response to the inquiry in the RFP, the ABC Corp. advises that it is currently performing similar analyses for the reactor manufacturer.

(ii) Guidance. An NRC contract for that particular work normally would not be awarded to the ABC Corp. because the company would be placed in a position in which its judgment could be biased in relationship to its work for the NRC. Because there are other well-qualified companies available, there would be no reason for considering a waiver of the policy.

(2) (i) Example. The ABC Corp., in response to an RFP, proposes to perform certain analyses of a reactor component that is unique to one type of advanced reactor. As is the case with other technically qualified companies responding to the RFP, the ABC Corp. is performing various projects for several different utility clients. None of the ABC Corp. projects have any relationship to the work called for in the RFP. Based on the NRC evaluation, the ABC Corp. is considered to be the best qualified company to perform the work outlined in the RFP.

(ii) Guidance. An NRC contract normally could be awarded to the ABC Corp. because no conflict of interest exists which

could motivate bias with respect to the work. An appropriate clause would be included in the contract to preclude the ABC Corp. from subsequently contracting for work with the private sector that could create a conflict during the performance of the NRC contract. For example, ABC Corp. would be precluded from the performance of similar work for the company developing the advanced reactor mentioned in the example.

(3) (i) Example. The ABC Corp., in response to a competitive RFP, submits a proposal to assist the NRC in revising NRC's guidance documents on the respiratory protection requirements of 10 CFR Part 20. ABC Corp. is the only firm determined to be technically acceptable. ABC Corp. has performed substantial work for regulated utilities in the past and is expected to continue similar efforts in the future. The work has and will cover the writing, implementation, and administration of compliance respiratory protection programs for nuclear power plants.

(ii) Guidance. This situation would place the firm in a role where its judgment could be biased in relationship to its work for the NRC. Because the nature of the required work is vitally important in terms of the NRC's responsibilities and no reasonable alternative exists, a waiver of the policy, in accordance with §2009.570-9 may be warranted. Any waiver must be fully documented in accordance with the waiver provisions of this policy with particular attention to the establishment of protective mechanisms to guard against bias.

(4) (i) Example. The ABC Corp. submits a proposal for a new system to evaluate a specific reactor component's performance for the purpose of developing standards that are important to the NRC program. The ABC Corp. has advised the NRC that it intends to sell the new system to industry once its practicability has been demonstrated. Other companies in this business are using older systems for evaluation of the specific reactor component.

(ii) Guidance. A contract could be awarded to the ABC Corp. if the contract stipulates that no information produced under the contract will be used in the contractor's private activities unless this information has been reported to the NRC. Data on how the reactor component performs, which is reported to the NRC by contractors, will normally be disseminated by the NRC to others to preclude an unfair competitive advantage. When the NRC furnishes information about the reactor component to the contractor for the performance of contracted work, the information may not be used in the contractor's private activities unless the information is generally available to others. Further, the contract will stipulate that the contractor will inform the NRC contracting officer of all situations in which the information, developed about the performance of the reactor component under the contract, is proposed to be used.

(5) (i) Example. The ABC Corp., in response to a RFP, proposes to assemble a map showing certain seismological features

of the Appalachian fold belt. In accordance with the representation in the RFP and §2009.570-3(b)(1)(i), ABC Corp. informs the NRC that it is presently doing seismological studies for several utilities in the eastern United States, but none of the sites are within the geographic area contemplated by the NRC study.

(ii) Guidance. The contracting officer would normally conclude that award of a contract would not place ABC Corp. in a conflicting role where its judgment might be biased. Section 2052.209-73(c) Work for Others, would preclude ABC Corp. from accepting work which could create a conflict of interest during the term of the NRC contract.

(6) (i) Example. AD Division of ABC Corp., in response to a RFP, submits a proposal to assist the NRC in the safety and environmental review of applications for licenses for the construction, operation, and decommissioning of fuel cycle facilities. ABC Corp. is divided into two separate and distinct divisions, AD and BC. The BC Division performs the same or similar services for industry. The BC Division is currently providing the same or similar services required under the NRC's contract for an applicant or licensee.

(ii) Guidance. An NRC contract for that particular work would not be awarded to the ABC Corp. The AD Division could be placed in a position to pass judgment on work performed by the BC Division, which could bias its work for NRC. Further, the Conflict of Interest provisions apply to ABC Corp. and not to separate or distinct divisions within the company. If no reasonable alternative exists, a waiver of the policy could be sought in accordance with §2009.570-9.

7(i) EXAMPLE The ABC Corp. completes an analysis for NRC of steam generator tube leaks at one of a utility's six sites. Three months later, ABC Corp. is asked by this utility to perform the same analysis at another of its sites.

(ii) GUIDANCE §2052.290-73(c)(3) would prohibit the contractor from beginning this work for the utility until one year after completion of the NRC work at the first site.

8(i) EXAMPLE ABC Corp. is assisting NRC in a major on-site analysis of a utility's redesign of the common areas between its twin reactors. The contract is for two years with an estimated value of $5 million. Near the completion of the NRC work, ABC Corp. requests authority to solicit for a $100K contract with the same utility to transport spent fuel to a disposal site. ABC Corp. is performing no other work for the utility.

(ii) GUIDANCE The Contracting Officer, would allow the contractor to proceed with the solicitation because A) it is not in the same technical area as the NRC work and B) the potential for technical bias by the contractor because of financial ties to

the utility is slight due to the relative value of the two contracts.

9(i) EXAMPLE The ABC Corp. is constructing a turbine building and installing new turbines at a reactor site. The contract with the utility is for five years and has a total value of $100 million. ABC Corp. has responded to an NRC Request for Proposal requiring the contractor to participate in a major team inspection unrelated to the turbine work at the same site. The estimated value of the contract is $75K.

(ii) GUIDANCE An NRC contract would not normally be awarded to ABC Corp. since these factors create the potential for financial loyalty to the utility that may bias the technical judgment of the contractor.

(d) Other considerations.

(1) The fact that the NRC can identify and later avoid, eliminate, or neutralize any potential organizational conflicts arising from the performance of a contract is not relevant to a determination of the existence of conflicts prior to the award of a contract.

(2) It is not relevant that the contractor has the professional reputation of being able to resist temptations which arise from organizational conflicts of interest, or that a follow-on procurement is not involved, or that a contract is awarded on a competitive or a sole source basis.

§2009.570-4 Representation.

(a) The following procedures are designed to assist the NRC contracting officer in determining whether situations or relationships exist which may constitute organizational conflicts of interest with respect to a particular offeror or contractor. The procedures apply to small purchases meeting the criteria stated in the following paragraph (b) of this section.

(b) The organizational conflicts of interest representation provision at §2052.209-72 must be included in solicitations and unsolicited proposals, (including those for task orders and modifications for new work) for:

(1) Evaluation services or activities;

(2) Technical consulting and management support services;

(3) Research; and

(4) Other contractual situations where special organizational conflicts of interest provisions are noted in the solicitation and would be included in the resulting contract. This representation requirement also applies to all modifications for additional effort under the contract except those issued under the "Changes" clause. Where, however, a statement of the type required by the organizational conflicts of interest representation provisions has previously been submitted with regard to the contract being modified, only an updating of the statement is required.

(c) The offeror may, because of actual or potential organizational conflicts of interest, propose to exclude specific kinds of work contained in a RFP unless the RFP specifically prohibits the exclusion. Any such proposed exclusion by an offeror will be considered by the NRC in the evaluation of proposals. If the NRC considers the proposed excluded work to be an essential or integral part of the required work and its exclusion would be to the detriment of the competitive posture of the other offerors, the NRC shall reject the proposal as unacceptable.

(d) The offeror's failure to execute the representation required by paragraph (b) of this section with respect to an invitation for bids is considered to be a minor informality. The offeror will be permitted to correct the omission.

§2009.570-5 Contract clauses.

(a) General contract clause. All contracts and small purchases of the types set forth in §2009.570-4(b) must include the clause entitled, "Contractor Organizational Conflicts of Interest," set forth in §2052.209-73.

(b) Other special contract clauses. If it is determined from the nature of the proposed contract that an organizational conflict of interest exists, the contracting officer may determine that the conflict can be avoided, or, after obtaining a waiver in accordance with §2009.570-9, neutralized through the use of an appropriate special contract clause. If appropriate, the offeror may negotiate the terms and conditions of these clauses, including the extent and time period of any restriction. These clauses include but are not limited to:

(1) Hardware exclusion clauses which prohibit the acceptance of production contracts following a related non-production contract previously performed by the contractor;

(2) Software exclusion clauses;

(3) Clauses which require the contractor (and certain of its key personnel) to avoid certain organizational conflicts of interest; and

(4) Clauses which provide for protection of confidential data and guard against its unauthorized use.

§2009.570-6 Evaluation, findings, and contract award.

The contracting officer shall evaluate all relevant facts submitted by an offeror and other relevant information. After evaluating this information against the criteria of §2009.570-3, the contracting officer shall make a finding of whether organizational conflicts of interest exist with respect to a particular offeror. If it has been determined that real or potential conflicts of interest exist, the contracting officer shall:

(a) Disqualify the offeror from award;

(b) Avoid or eliminate such conflicts by appropriate measures; or

(c) Award the contract under the waiver provision of §2009.570-9.

§2009.570-7 Conflicts identified after award.

If potential organizational conflicts of interest are identified after award with respect to a particular contractor, and the contracting officer determines that conflicts do exist and that it would not be in the best interest of the Government to terminate the contract, as provided in the clauses required by §2009.570-5, the contracting officer shall take every reasonable action to avoid, eliminate, or, after obtaining a waiver in accordance with §2009.570-9, neutralize the effects of the identified conflict.

§2009.570-8 Subcontracts.

The contracting officer shall require offerors and contractors to submit a representation statement from all subcontractors (other than a supply subcontractor) and consultants performing services in excess of $10,000 in accordance with §2009.570-4(b). The contracting officer shall require the contractor to include contract clauses in accordance with §2009.570-5 in consultant agreements or subcontracts involving performance of work under a prime contract.

§2009.570-9 Waiver.

(a) The contracting officer determines the need to seek a waiver for specific contract awards, with the advice and concurrence of the program office director and legal counsel. Upon the recommendation of the Procurement Executive, and after consultation with legal counsel, the Executive Director for Operations may waive the policy in specific cases if he determines that it is in the best interest of the United States to do so.

(b) Waiver action is strictly limited to those situations in which:

(1) The work to be performed under contract is vital to the NRC program.

(2) The work cannot be satisfactorily performed except by a contractor whose interests give rise to a question of conflict of interest.

(3) Contractual and/or technical review and surveillance methods can be employed by the NRC to neutralize the conflict.

(c) For any waivers, the justification and approval documents must be placed in the NRC Public Document Room, 2120 L Street, NW. (Lower Level), Washington, DC.

§2009.570-10 Remedies.

In addition to other remedies permitted by law or contract for a breach of the restrictions in this subpart or for any intentional misrepresentation or intentional nondisclosure of any relevant interest required to be provided for this section, the NRC may debar the contractor from subsequent NRC contracts.

Detailed Breakdown of Costs

Through 1/26/96	R7004	U7032	R7014	U7034	U9414
	January 96 Spent	January 96 Spent	January 96 Spent	January 96 Spent	January 96 Spent
Per1	$0.00	$0.00	$8,664.00	$4,777.92	$12,507.38
Equipment	$0.00	$0.00	$0.00	$0.00	$0.00
Admin	$0.00	$0.00	$0.00	$0.00	$0.00
Total	$0.00	$0.00	$8,664.00	$4,777.92	$12,507.38
	YTD Spent	*YTD Spent*	*YTD Spent*	*YTD Spent*	*YTD Spent*
Per1	$90,749.31	$92,106.62	$28,545.53	$43,065.45	$210,388.89
Equipment	$69,970.00	$69,970.00	$32,871.00	$32,871.00	$0.00
Admin	[illegible]2,662.19	$1,304.88	$2,385.00	$2,385.00	$0.00
Total	$163,381.50	$163,381.50	$63,801.53	$78,321.45	$210,388.89

Current Billing	**$25,949.30**
Cumulative Billed	**$679,274.87**

* *The Per1 Category under R7014 will be added to the current categories in Mod. #10.*

U.S. NUCLEAR REGULATORY COMMISSION

DIRECTIVE TRANSMITTAL

TN: DT-95-12

To: NRC Management Directives Custodians

Subject: Transmittal of Directive 3.8, "Unclassified Contractor and Grantee Publications in the NUREG Series"

Purpose: Directive and Handbook 3.8 are being revised in their entirety to update information, to include editorial changes, and to add information about references. Specifically, the directive and handbook are being revised to specify that NRC must obtain prior approval from the Institute of Nuclear Power Operations (INPO) before referencing INPO documents and to explain how to reference proprietary reports.

Office and Division of Origin: Administration, Freedom of Information and Publications Service.

Contact: Juanita Beeson, 415-7166

Date Approved: June 17, 1991 (**Revised: July 9, 1995**)

Volume: 3 Information Management

Part: 1 Publications, Mail, and Information Disclosure

Directive: 3.8 Unclassified Contractor and Grantee Publications in the NUREG Series

Availability: U.S. Government Printing Office, (202) 512-2409

Unclassified Contractor and Grantee Publications in the NUREG Series

Directive 3.8

Contents

Unclassified Contractor and Grantee Publications in the NUREG Series
Directive 3.8

Policy
(3.8–01)

U.S. Nuclear Regulatory Commission policy requires that the following publications published by NRC adhere to the documentation and production requirements, standards, and practices specified in this directive and handbook: (1) unclassified NRC contractor, consultant, or grantee formal reports, books, and international agreement reports in the NUREG/CR (contractor reports), NUREG/GR (grant reports), and NUREG/IA (international agreement reports) series; (2) reports and books by contractors of the U.S. Department of Energy (DOE); and (3) publications prepared for NRC under memoranda of understanding and interagency agreements.

Objectives
(3.8–02)

- To ensure the production and dissemination of information and publications as required by the Energy Reorganization Act of 1974 and the Freedom of Information Act. (a)
- To ensure technical staff and management reviews of formal reports and books before publication. (b)
- To ensure that national security, patent rights, copyrights, proprietary rights, and rights in other sensitive unclassified information, including those specified in interagency and international agreements and memoranda of understanding, are not compromised by the release or publication of information by NRC. (c)

Objectives
(3.8–02) (continued)

- To ensure that all unclassified NRC contractor or grantee publications in the NUREG series carry the registered Government identification NUREG/CR–0000, NUREG/GR–0000, or NUREG/IA–0000, with the exception of some publications prepared by grantees, and indicate the availability of source material used in these publications. (d)

- To ensure that NRC–sponsored book manuscripts receive proper peer review from experts within and outside NRC. (e)

- To provide uniform procedures for publishing formal reports and books prepared by NRC contractors or grantees. (f)

Organizational Responsibilities and Delegations of Authority
(3.8–03)

Executive Director for Operations (EDO)
(031)

Delegates to the Deputy Executive Directors for Operation decisionmaking authority for the resolution of differences between NRC and contractors about the contents of publications, about granting contractors permission to publish NRC–sponsored information in the open literature, and about permitting contractors to issue press or other media releases concerning NRC–sponsored information.

Deputy Executive Director for Nuclear Reactor Regulation, Regional Operations and Research (DEDR)
(032)

As delegated from the EDO, makes final decisions in the following areas for the Office of Nuclear Reactor Regulation, the Office of Nuclear Regulatory Research, and regional offices:

- When an office director refuses to publish an NRC–sponsored document because of irreconcilable differences between himself or herself and the author about the contents of the document. (a)

Deputy Executive Director for Nuclear Reactor Regulation, Regional Operations and Research (DEDR)
(032) (continued)

- When an office director refuses to permit a contractor's principal investigator to publish NRC-sponsored information in the open literature. (b)
- When an office director refuses to permit a contractor to issue a press or other media release about an NRC-sponsored publication. (c)

Deputy Executive Director for Nuclear Materials Safety, Safeguards, and Operations Support (DEDS)
(033)

As delegated from the EDO, makes final decisions in the following areas for the offices reporting to the DEDS:

- When an office director refuses to publish an NRC-sponsored document because of irreconcilable differences between himself or herself and the author about the contents of the document. (a)
- When an office director refuses to permit a contractor's principal investigator to publish NRC-sponsored information in the open literature. (b)
- When an office director refuses to permit a contractor to issue a press or other media release about an NRC-sponsored publication. (c)

Office Directors
(034)

- Ensure that publications will be reviewed in draft for acceptability before final printing and distribution by determining that they are consistent with agency policy, management decisions, and that they raise no significant legal issues. (a)
- Ensure that statements of work on contracts* include a requirement that contractors comply with this directive and handbook and with Government Printing and Binding Regulations. (b)

*"Contract" in this context encompasses the "Standard Order for DOE Work" (NRC Form 173), interagency and international agreements, and grants.

Office Directors
(034) (continued)

- Sign, or delegate signature authority for, the NRC Form 426A, "Release to Publish Unclassified NRC Contractor, Consultant, or Conference Proceedings Reports" (Exhibit 1 of Handbook 3.8), and for memoranda requesting reprints of contractor publications. (c)

Director, Office of Administration (ADM)
(035)

As delegated from the DEDS, administers NRC's programs and policies for publishing unclassified contractor and grantee reports and books in the NUREG series.

Director, Division of Freedom of Information and Publications Services, (DFIPS), ADM
(036)

- Develops and administers, as delegated from the Director, ADM, NRC's program and policies for publishing unclassified contractor, consultant, and grantee formal reports, books, and international agreement reports in the NUREG/CR, NUREG/GR, and NUREG/IA series. (a)
- Applies the policy, procedures, standards, and guides for the documentation, formatting, composition, printing, and dissemination of NRC-sponsored publications in the NUREG series consistent with the mission of the agency and in accordance with the requirements of the Government Printing and Binding Regulations issued by the Joint Committee on Printing, U.S. Congress. (b)
- Develops and administers the central agency publication numbering system for identifying, producing, and retrieving unclassified NRC-sponsored publications in the NUREG series. (c)

Director, Division of Contracts (DC), ADM
(037)

Ensures that those requests for proposals, invitations for bids, and grant proposals, and the ensuing contracts and grants that require

Director, Division of Contracts (DC), ADM
(037) (continued)

publications as deliverables include provisions requiring that contractors comply with this directive and handbook and with Government Printing and Binding Regulations.

Applicability
(3.8–04)

Employees
(041)

All NRC employees shall follow the policy and guidance specified in this directive and handbook.

Other Publications
(042)

The provisions of this directive and handbook do not apply to NRC staff publications in the NUREG series, NRC docket material, or documents created by NRC boards, panels, advisory committees, or offices that report to the Commission.

Handbook
(3.8–05)

Handbook 3.8 gives detailed guidelines for preparing unclassified contractor and grantee publications in the NUREG series.

References
(3.8–06)

A Manual of Style, University of Chicago Press.

Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.).

"Copyrights," Title 17, *United States Code*.

"Cost Principles for State and Local Governments," OMB Circular A–87, Office of Management and Budget, January 1981.

Energy Reorganization Act of 1974, as amended (42 U.S.C. 5801 et seq.).

References
(3.8–06) (continued)

"Federal Grant and Cooperative Agreement Act," Pub. L. 95–224, February 3, 1978.

"Federal Regulation Requirements," Executive Order 12291, February 17, 1981 (5 U.S.C. 5601 Note).

Freedom of Information Act (5 U.S.C. 552).

Government Printing and Binding Regulations, Pub. L. 101–9, February 1990.

"Grants and Agreements With Institutions of Higher Education, Hospitals, and Other Nonprofit Organizations," OMB Circular A–110, Office of Management and Budget, July 1976.

Memorandum of Understanding Between the Department of Energy and the U.S. Nuclear Regulatory Commission, February 24, 1978.

Memorandum of Agreement Between the Institute of Nuclear Power Operations and the U.S. Nuclear Regulatory Commission, dated September 17, 1993.

NRC Management Directive 3.9, "NRC Staff and Contractor Speeches, Papers, and Journal Articles on Regulatory and Technical Subjects."

— 3.11, "Conferences and Conference Proceedings."

— 12.2, "NRC Classified Information Security Program."

— 12.6, "NRC Sensitive Unclassified Information Security Program."

NUREG–0650, Revision 1, "Publishing Documents in the NUREG Series," November 1990.

NUREG/BR–0075, Revision 2, "NRC Field Policy Manual," Field Policy Manual No. 9, dated March 22, 1993.

"Public Printing and Documents," Title 44, Chapter 3, Government Printing Office, *United States Code*.

U.S. Government Printing Office Style Manual, 1984.

Unclassified Contractor and Grantee Publications in the NUREG Series

Handbook 3.8

Contents

Contents (continued)

Part III (continued)

Part IV

Contents (continued)

Part V

Part VI

Contents (continued)

Exhibits

Part I

Introduction

This handbook specifies the procedures that the Nuclear Regulatory Commission (NRC) contractors and grantees need to follow when preparing the following publications for the NRC: (A)

- Final NUREG reports (1)
- International agreement reports (2)
- Books (3)
- Grant publications (4)

The handbook is divided into six major parts and includes a glossary and exhibits. Part II provides general information for staff consideration in preparing **statements of work**. Parts III, IV, V, and VI provide publishing guidelines specific to, respectively, **contractor reports**, **international agreement reports**, **books**, and **grantee publications**. (B)

Contractor means a private contractor, consultant, expert, another State or Federal agency working under an interagency agreement, or a Department of Energy (DOE) facility or subcontractor, such as a national laboratory, working under the DOE/NRC Memorandum of Understanding of February 24, 1978, and any subcontractors of these organizations. (C)

This directive and handbook, as well as a copy of "Publishing Documents in the NUREG Series" (NUREG–0650, Revision 1), must be included or referenced in all contracts, interagency and international agreements, and grants for which the publications previously listed are contract deliverables or grant obligations. In addition to the guidelines specific to each type of publication that appear in subsequent parts of this handbook, all statements of work must contain the applicable guidelines outlined in Part II. (D)

Part II

Preparing Publication Requirements for Statements of Work for Contracts

Specifying Publication Requirements (A)

List and describe the type of technical reports required from each project, task, or subtask, as applicable. State when, how many, and to whom the reports should be submitted and the scope of information they should contain. These reports may be unclassified, sensitive unclassified, or classified. For guidelines and requirements covering sensitive unclassified and classified publications, refer to Management Directive (MD) 12.2, "NRC Classified Information Security Program," and MD 12.6, "NRC Sensitive Unclassified Information Security Program." (1)

This directive and handbook pertain to publications that will be issued in the NUREG/CR, NUREG/IA, and NUREG/GR series. (2)

Publishing Formal Reports (B)

NUREG series reports will be printed and distributed by NRC from camera-ready copy submitted by the contractor to the Publications Branch, Mailstop T-6 E7, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. The camera-ready copy is to be prepared in accordance with the provisions of this handbook. Recommended guidelines for the organization and format of formal reports are specified in "Publishing Documents in the NUREG Series" (NUREG-0650, Revision 1). (1)

When the report contains sensitive unclassified or classified information, the contractor must comply with MD 12.2. (2)

Approved: June 17, 1991
(Revised: July 9, 1995)

Publishing Formal Reports (B) (continued)

If a draft is desired before completing a final report, specify in the statement of work (SOW) the due date for delivering the final camera-ready copy after receiving comments from NRC staff or participants (if applicable) on the draft. State that all draft material be submitted to the cognizant NRC contact. (3)

When the contractor is to submit draft material for comment before preparing the final report, state that the contractor will be asked to make changes if there are comments from NRC staff or participants. If agreement on the changes is reached, the NRC contact will authorize the contractor to prepare the final copy and submit it to the NRC contact if it is a letter report or input to a Safety Evaluation Report or an Environmental Statement, or to the Director, Division of Freedom of Information and Publications Services (DFIPS) if it is a camera-ready copy for printing and distribution. This procedure will ensure proper publication, handling, distribution and, among other things, preclude further changes that might nullify the agreement. (4)

If **special caveats** were agreed to between the contractor and the NRC contact, the caveats should accompany the NRC Form 426A (Exhibit 1) for approval when it is sent to the NRC contact. A copy of special caveats should also accompany the camera-ready copy sent to DFIPS. (5)

If **agreement on changes** to a formal technical report to be issued in the NUREG/CR series is not reached, the NRC contact may request the contractor to prepare the camera-ready copy with, in addition to the standard disclaimer required on all contractor formal reports (see Section (F), Part III of this handbook), any caveats deemed necessary to cover NRC objections. These caveats may range from "The views expressed in this report are not necessarily those of the U.S. Nuclear Regulatory Commission" to the addition of a preface setting forth the NRC opinion or footnotes at appropriate locations within the text. (6)

If **NRC objections** cannot be covered in this manner, NRC can refuse to publish the report. In the case of DOE/national laboratory reports, the DOE Operations Office Manager responsible for the laboratory should be informed by the NRC office director or regional administrator of the decision and the reasons therefor. A copy of the decision should be sent to the laboratory director. In the case of another Federal agency, a State, or a private contractor, the person who entered into the contract should similarly be informed by the

Publishing Formal Reports (B) (continued)

NRC contracting officer. The contractor is then free to publish the report without identifying NRC as the funding sponsor of the report and without the NRC disclaimer. Decisions by the office director or designee may be appealed to the appropriate Deputy Executive Director for Operations. (7)

Publishing Unclassified Information in the Open Literature and Presenting Papers (C)

Specify whether the contractor's principal investigator is permitted to publish in the **open literature** instead of submitting a final report and/or to present papers at public or association meetings during the course of the work. If this arrangement is authorized, add the following statement to the SOW: (1)

> **The principal investigator may publish the results of this work in the open literature instead of submitting a final report or may present papers at public or association meetings at interim stages of the work.**

If the NRC contact wants to review the paper or journal article before presentation or submission for publication, so state in the SOW, as follows: (2)

> **The principal investigator may publish the results of this work in the open literature instead of submitting a final report or may present papers at public or association meetings at interim stages of the work if the article or paper has been reviewed by the NRC contact in draft form and agreement has been reached on the content.**

If agreement is not reached, NRC may also require that the paper include in addition to the standard statement "Work supported by the U.S. Nuclear Regulatory Commission," any caveats deemed necessary to cover NRC objections. If NRC objections cannot be covered in this manner, NRC may refuse to authorize publication in the open literature and/or presentation of papers. (3)

In the latter case, NRC will inform the contractor of the decision, as previously stated. The contractor is then free to publish without identifying NRC as the funding sponsor of the information. Decisions by office directors or designees may be appealed to the appropriate NRC Deputy Executive Director for Operations. (4)

Publishing Unclassified Information in the Open Literature and Presenting Papers (C) (continued)

If the contractor proposes to publish in the **open literature** or present the information at meetings *in addition* to submitting the required technical reports, approval of the proposed article or presentation should be obtained from NRC. NRC shall approve the material as submitted, approve it subject to NRC-suggested revisions, or disapprove it. In any event, NRC may disapprove or delay presentation of papers on information that is subject to the Commission's approval that has not been ruled upon or that has been disapproved. (5)

If the contractor requests permission to publish in the open literature even though the contract does not explicitly provide for this type of publication, the contract can be modified to provide for such presentations. (6)

When the contractor submits journal articles for publication, each must be accompanied by the following statement: (7)

> **The submitted manuscript has been authored by a contractor of the U.S. Government under Contract* No. ____. Accordingly, the U.S. Government has a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes.**

All published papers and articles must include the following disclaimer: (8)

> **This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use or the results of such use, of any information, apparatus, product, or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights. The views expressed in this paper are not necessarily those of the U.S. Nuclear Regulatory Commission.**

*For DOE work orders, the appropriate job code number is applicable.

Publishing Unclassified Information in the Open Literature and Presenting Papers (C) (continued)

If the contractor is requested by the journal or other publisher to transfer the copyright, the contract author will respond to the journal or other publisher in writing in accord with the sample letter shown as follows: (9)

Dear (Copyright Holder's Name):

We recently received a document for signature assigning copyright and republication rights in the submitted article (title) to (name of publication). This letter is offered in lieu of the document as a means of completing the transfer of ownership. Accordingly, we hereby expressly transfer and assign our rights of ownership in the above-cited work to (name of publisher).

You are advised, however, that the above assignment and any publication or republication of the above-cited work is subject to the following Government rights:

The submitted manuscript has been authored by a contractor of the U.S. Government under Contract No. _____. Accordingly, the U.S. Government has a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes.

Sincerely,

If NRC approves open literature publication and **page charges** and travel costs are required for the presentation of papers, see MD 3.9, "NRC Staff and Contractor Speeches, Papers, and Journal Articles on Regulatory and Technical Subjects." (10)

Reports Containing Sensitive Unclassified and Classified Information (D)

Examples of the proper marking of reports designated Official Use Only, Limited Official Use, Proprietary Information, Safeguards Information, and classified (CONFIDENTIAL, SECRET, and TOP SECRET) are specified in MD 12.2.

Conference and Workshop Proceedings (E)

If NRC approves publication of compilations of papers presented at NRC-sponsored or cosponsored meetings, conferences, and symposia, see MD 3.11, "Conferences and Conference Proceedings."

Distribution of Reports to Contractors (F)

Up to 50 copies of printed unclassified NUREG/CR, NUREG/GR, and NUREG/IA reports will be bulk shipped to the contractor by NRC. (The Joint Committee on Printing's *Government Printing and Binding Regulations* permit contractors to receive free of charge up to 50 copies of reports they have produced for NRC.) If fewer than 50 copies are needed, indicate the desired quantity on NRC Form 426A (Exhibit 1). Contractors requesting single copies for specific individuals in organizations other than the contractor's organization who are not included in the distribution requested by the NRC contact may address such a request, with written justification, to the NRC contact. If the additional distribution is approved by the NRC contact, the contractor shall send address labels with the camera-ready copy to the Publications Branch, DFIPS, USNRC, Washington, DC 20555-0001, and that distribution will be made along with the standard distribution.

Coordinating Contractor Press or Other Media Releases of Information (G)

A contractor may request permission to issue a press or other media release on the work being done. That request must be made to the NRC office director or designee, who will consult with the staff of the Office of Public Affairs. The contractor must not issue a press release on nonroutine information without this prior approval. This approval may be obtained by a telephone call to the office director or designee to expedite the request. The contractor may appeal decisions not to authorize the release of information or delays in handling the request to the appropriate Deputy Executive Director for Operations.

Part III

Draft and Final NUREG Reports

Identification Information (A)

NUREG Number (1)

Each contractor report published by NRC must be identified by a unique alphanumeric designation controlled and maintained by the Division of Freedom of Information and Publications Services (DFIPS). To obtain an NRC report number, call the Publications Branch, DFIPS, at (301) 415–7008. (a)

The NRC identification numbers will have one of the following forms: (b)

- NUREG/CR–0000
- NUREG/GR–0000
- NUREG/IA–0000

CR indicates **contractor report**, GR indicates **grant report**, and IA indicates **international agreement report**. The contractor report number, if any, will be placed below the NUREG number on the title page and cover. (c)

When a report consists of more than one volume or binding, or is issued in more than one edition, an appropriate volume, number, supplement, part, addendum, or revision designation must appear immediately below the NRC report number and the contractor's report number, if any. (d)

Authors' Names (2)

Authors' names must appear on the report cover and title page, unless placing them there is impractical, as for an annual report having many contributors. Editors or compilers with subject-area expertise may also be identified as such on the cover and title page. The authors'

Identification Information (A) (continued)

Authors' Names (2) (continued)

affiliation need not be listed unless it differs from the organization creating the report.

Organizational Identification (3)

The Publications Branch, DFIPS, prepares the covers and title pages for all reports and will list information about the organization that created the report as it is provided.

Previous Reports in Series (4)

If the report being prepared is one in an ongoing series, list all previous reports in the series. Include report numbers and issuance dates. Place this list on the back of the title page. If this list cannot be placed on a single page, place the pages at the end of the front matter rather than on the back of the title page.

Report Dates (5)

The report dates are shown on the title page. These dates include the month and year the report is completed and the month and year it is published.

Report Organization and Components (B)

The organization and components of contractor reports vary, depending on their purpose and scope. Recommended format and organizational guidelines appear in "Publishing Documents in the NUREG Series" (NUREG–0650, Revision 1). (1)

Each draft and final report prepared for NRC must include an abstract of 200 words or less that appears on a separate page preceding the table of contents. The abstract also must appear on the "Bibliographic Data Sheet," NRC Form 335 (Exhibit 2). Instructions for completing NRC Form 335 appear on the back of the form. Guidelines on the special writing requirements for preparing abstracts appear in Section 5.5 of NUREG–0650, Revision 1. (2)

Pre-Publication Reviews (C)

Patent Review (1)

Patent implications must be considered before approval of reports for public release so that disclosure will not adversely affect the patent

Pre-Publication Reviews (C) (continued)

Patent Review (1) (continued)

rights of NRC or the contractor. If the work being reported is contractually managed through another Government agency (e.g., DOE national laboratories), the contractor should request that Government agency to perform the patent review. The result of the review must be reported on NRC Form 426A under item 8 (see Exhibit 1). (a)

If NRC directly administers the contract, or the contractor is unable to obtain a patent clearance from the Government agency administering the contract, the responsible NRC contracting officer must be consulted, and the responsible NRC technical contact shall consider the patent implications. If the report does not require a patent review because the report does not contain any description of novel technical developments that may be of an inventive nature, mark "N/A" on the NRC Form 426A in the space for the Patent Counsel's signature. If a possibility exists that developments of an inventive nature are disclosed, the contracting officer shall request assistance from the NRC Assistant General Counsel for Administration, Office of the General Counsel, on (301) 415–1553. (b)

Security Review (2)

If a report of sensitive unclassified or classified work is required, the NRC contact must work with the NRC Division of Security to establish the appropriate procedures and inform the contractor of these procedures through the contracting officer. The standards for marking and handling these reports are given in Management Directive (MD) 12.2, "NRC Classified Information Security Program."

Copyright Review (3)

Copyrighted material must not appear in NRC–sponsored publications without written permission from the copyright holder. See Section 3.4 of NUREG–0650, Revision 1, for information about obtaining copyright permission.

Color Printing (D)

Regulations issued by the Joint Committee on Printing (JCP) restrict the use of color in printed materials to those uses that are of demonstrable value. JCP regulations specify that "demonstrably valuable multicolor printing" includes the following categories: (1)

Color Printing (D) (continued)

- Maps and technical diagrams for which additional color is necessary for clarity. (a)
- Object identification (medical specimens, diseases, plants, flags, uniforms, etc.). (b)
- Safety programs, fire prevention, savings bonds programs, and competitive areas of personnel recruiting. (c)
- Areas wherein clearly identifiable savings in costs can be soundly predicated on multicolor use. (d)
- Printing for programs required by law, whose relative success or failure is in direct ratio to the degree of public response, and for which that response can be logically attributable to the number of colors planned and the manner in which they are proposed to be used. (e)
- Color for promotional or motivational purposes, such as programs concerning public health, safety, and consumer benefits, or to encourage utilization of Government facilities, such as programs for Social Security, Medicare, and certain areas of need for veterans. (f)

The regulations indicate that the following categories do not meet the "demonstrable value" criteria: (2)

- Printed items wherein additional color is used primarily for decorative effect. (a)
- Printed items for which additional color is used primarily in lieu of effective layout and design. (b)
- Printed items for which additional color is used excessively, that is, four colors when two or three will fulfill the need, three colors when two are adequate, two colors when one is adequate. (c)
- Printed items wherein the inclusion of multicolor does not reflect careful, competent advance planning that recognizes the contribution that the use of color is expected to make to the ultimate end-purpose. (d)

Color Printing (D) (continued)

If color printing is anticipated when the statement of work or standard order for DOE work is being prepared, contact the Publications Branch, DFIPS. Prior approval must be granted by the Director of DFIPS. If a requirement for color printing arises as the report is being prepared, submit a written justification for its use to the Director of DFIPS. (3)

Microfiche (E)

NRC contractors and DOE laboratories submitting microfiche with reports must submit a hard copy of each microfiche, include headers on each microfiche as shown in Exhibit 3, and conform to the following NRC specifications.*

- Microfiche must conform to either the 24/98 format for source documents with 14 columns and 7 rows (reduction ratio of 1 to 24) or the 48/270 format for computer output microfilm with 18 columns and 15 rows (reduction ratio of 1 to 48). (1)
- The microfiche sheet must be standard 105 mm by 148 mm. (2)
- The microfiche must be either a silver-halide master or a black or blue-black diazo placed in acid-free envelopes. (3)
- The microfiche must contain headers as shown in the sample in Exhibit 3. Specifically, the first block of the header must contain the NUREG number (include volume or revision, if applicable), the contractor identification number, and the classification (e.g., unclassified, proprietary). The second block must contain the description of the microfiche and may include the contractor's name. The third block must contain the publication date and the sheet identification. (4)
- The header information must be eye readable on a clear background. (5)
- A foldout page must be microfilmed in sections if the page is too large to be microfilmed in a double frame. No less than 25-mm overlap of original material is acceptable. (6)

*With the exception of items (3), (4), and (8), these specifications are consistent with the American National Standards Institute "Standard for Micrographics-Microfiche, ANSI/AIIM MS5-1985." Copies of this standard are available from the American National Standards Institute, ATTN: Sales Department, 11 West 42nd Street, 13th floor, New York, NY 10036 (212) 642-4900, or from the Association for Information and Image Management, ATTN: Publications Section, 1100 Wayne Avenue, Silver Spring, MD 20910 (301) 587-8202.

Microfiche (E) (continued)

- The first frame must be blank (on the first sheet only), and the second frame must contain the National Institute of Standards and Technology's (NIST's) Reference Material resolution target in Microcopy Test Charts (NBS SRM 1010A). (7)
- Jacketed microfiche is unacceptable. (8)

Disclaimers (F)

The following notice will be added by the Publications Branch, DFIPS, before the printing process on the inside front cover: (1)

> **This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product, or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.**

The branch will print the additional statement, "The views expressed in this report are not necessarily those of the U.S. Nuclear Regulatory Commission," below the standard disclaimer, if appropriate. Other qualifying statements may be added, if needed. (2)

Availability Information (G)

Reference Material (1)

Reports or other documents referenced in text, reference sections, bibliographies, and appendixes of unclassified regulatory and technical reports in the NUREG series must be available to the public either in the public domain (as in a public library, at the Government Printing Office (GPO), at the National Technical Information Service (NTIS), or at other reference or sales outlets) or in the NRC Public Document Room (PDR). This means that references should not be made to personal communications and interviews, unpublished information and information with restricted distribution (e.g., proprietary, National Security, and Official Use Only). If the unretrievable information is important and unrestricted, quote it in

Availability Information (G) (continued)

Reference Material (1) (continued)

the text or in footnotes. Provide any credit due to individuals in the text or in an acknowledgment section. Availability may be stated collectively for all entries. (a)

Although proprietary reports may not be included in a list of references, listing or identification of proprietary reports may be included in an appendix or in a separate listing following the reference section titled "Proprietary Sources of Information." (b)

In addition, reference to Institute of Nuclear Power Operations (INPO) documents may **not** be made without prior approval from INPO. Approval to reference INPO documents must be stated on the NRC Form 426A. (c)

Guidelines for developing and presenting reference material are provided in NUREG–0650, Revision 1. (d)

Reports (2)

Most final reports are sold by GPO and NTIS. A statement indicating this availability is added to each report, as appropriate, by the Publications Branch staff before the report is printed. (a)

Draft reports for which comments are requested are typically announced in the *Federal Register* as being available from the NRC. These reports are not sold at GPO or at NTIS. (b)

Forms (H)

Bibliographic Data Sheet (NRC Form 335) (1)

All published NRC reports must include an NRC Form 335 as the final right-hand page of the manuscript. Instructions for completing the NRC Form 335 appear on the back of the form. A completed NRC Form 335 must be submitted to the Technical Publications Section, DFIPS, with the camera-ready copy of the report. Exhibit 2 shows a completed NRC Form 335.

Release To Publish Unclassified NRC Contractor, Consultant, or Conference Proceedings Reports (NRC Form 426A) (2)

The NRC contact must submit a completed NRC Form 426A (see Exhibit 1) with the camera-ready copy of the report to the Technical Publications Section, DFIPS. NRC Form 426A must be signed by the staff member designated by the appropriate office director.

Printing and Reprinting (I)

The Publications Branch, DFIPS, will review the camera-ready report submitted for printing for its adherence to the standards and requirements set forth in this directive and handbook, as well as any relevant guidelines from NUREG-0650, Revision 1. Unsatisfactory manuscripts will be returned to the NRC contractor for appropriate action. (1)

Submit a memorandum requesting a **reprint** to the Director, DFIPS, or designee, for approval. Include with the request a written justification and the approval of the office director or designee for reprinting. Also provide address labels for recipients not on NRC standard distribution lists. (2)

Distribution (J)

The Publications Branch, DFIPS, will arrange distribution for all copies of unclassified formal contractor reports in accordance with instructions on NRC Form 426A (Exhibit 1). The Publications Branch will also arrange automatic distribution of these reports to NRC NUDOCS, the NRC PDR, NTIS, GPO, and the GPO Federal Depository Library Program. (1)

Sensitive unclassified and classified reports will be distributed by the NRC sponsoring office on a case-by-case basis. (2)

Part IV

International Agreement Reports

Background and Rationale (A)

NRC has cooperative nuclear safety research programs that involve either or both foreign governments and organizations and U.S. industry. These programs include monetary contributions, information exchange, and comments on program plans and results as authorized in the Energy Reorganization Act of 1974. To this end, international and U.S. industry agreements have been signed that provide for transmitting unclassified technical information from foreign participants to NRC. These procedures apply only to NRC-managed work. (1)

The interests of all NRC international nuclear safety research program participants are served best by formal dissemination of information on these programs or codes developed for or in cooperation with NRC. (2)

Identification Information (B)

Cover and Title Page (1)

The cover and title page will contain a title, a subtitle (if appropriate), the names of the authors, the performing organization, and the NRC office sponsoring the project. The cover and title page will be prepared by the Publications Branch, Division of Freedom of Information and Publications Services (DFIPS).

NRC Report Number (2)

Each report must be identified by an NRC-controlled alphanumeric number as the prime number unique to that report. The centralized document control system for unique identification is maintained by DFIPS. Numbers may be obtained by calling the Publications Branch at (301) 415-7008. (a)

Approved: June 17, 1991
(Revised: July 9, 1995)

Identification Information (B) (continued)

NRC Report Number (2) (continued)

The NRC identification number will have the form "NUREG/IA–0nn," where IA indicates "international agreement." The foreign participant's report number, if any, may be inserted below the NUREG number on the cover, if desired. (b)

When a report consists of more than one volume or binding or is issued in more than one edition, include an appropriate volume, number, supplement, part, addendum, or revision designation below the report number and the foreign participant's report number, if any. (c)

Previous Reports in Series (3)

If the report being prepared is one in an ongoing series, list all previous reports in the series. Include report numbers and issuance dates. Place this list on the back of the title page. If this list cannot be placed on a single page, place the pages at the end of the front matter rather than on the back of the title page.

Report Organization and Components (C)

The organization and components of cooperative agreement reports vary somewhat, depending on their purpose and scope. Each of these reports must include an abstract of 200 words or less that appears on a separate page before the table of contents. The abstract must also appear on the "Bibliographic Data Sheet," NRC Form 335 (Exhibit 2). Instructions for completing NRC Form 335 appear on the back of the form (Exhibit 2). Guidance on the special writing requirements for preparing abstracts appears in Section 5.5 of NUREG–0650, Revision 1.

Availability Information (D)

References and Bibliographies (1)

Reports or other documents referenced in text, reference sections, bibliographies, and appendixes of unclassified regulatory and technical reports in the NUREG series must be available to the public either in the public domain (as in a public library, at the Government Printing Office (GPO), at the National Technical Information Service (NTIS), or at other reference or sales outlets) or in the NRC Public Document Room. This means that references should not be made to personal communications, interviews, and unpublished information with restricted distribution (e.g., proprietary, National Security, Official Use Only). If the unretrievable information is important and

Availability Information (D) (continued)

References and Bibliographies (1) (continued)

unrestricted, it can be quoted in the text, in footnotes, or in appendixes. If the title of a document containing proprietary information is unclassified, it can also be quoted in the text or in a footnote. If credit is due to individuals, they can be mentioned in the text or in an acknowledgment section. Availability may be stated collectively for all entries. (a)

Although proprietary reports may not be included in a list of references, listing or identification of proprietary reports may be included in an appendix or in a separate listing following the reference section titled "Proprietary Sources of Information." (b)

In addition, reference to Institute of Nuclear Power Operations (INPO) documents may **not** be made without prior approval from INPO. Approval to reference INPO documents must be stated on the NRC Form 426A. (c)

Guidelines for developing and presenting reference material are provided in NUREG-0650, Revision 1. (d)

Reports (2)

These reports will be made available for sale by GPO and NTIS.

Disclaimer (E)

The following notice will be added by the Publications Branch, DFIPS, on the inside front cover before printing.

NOTICE

This report was prepared under an international cooperative agreement for the exchange of technical information. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product, or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

Forms (F)

Bibliographic Data Sheet (NRC Form 335) (1)

Submit a typed NRC Form 335 (Exhibit 2) with the camera-ready copy to the Technical Publications Section, DFIPS, as the final right-hand page.

Release to Publish Unclassified NRC Contractor, Consultant, or Conference Proceedings Reports (NRC Form 426A) (2)

An NRC Form 426A (Exhibit 1) must be completed and signed by the office director or designee and submitted with the camera-ready copy of the report to the Technical Publications Section, DFIPS.

Classified or Sensitive Unclassified Information (G)

The NRC contact should refer to Management Directive 12.2 or call the Division of Security for answers to questions about the status of classified or sensitive unclassified information in NUREG/IA reports.

Part V
Books

General (A)

These guidelines apply to books written by contractors and grantees that are printed by NRC. See Part VI of this handbook for guidance on publications, including books, by grantees.

Definition (B)

A book refers to a publication intended as a permanent reference or as a textbook or major critical review of a technical or regulatory topic.

Format (C)

Books are usually 6 by 9 inches in trim size, but size will be based on requirements such as ease of use and legibility for graphics, foldouts, and the like. The binding (casebound or paperback) will be chosen according to the need for durability. Additional guidance on manuscript preparations can be found in the *U.S. Government Printing Office Style Manual* and the Chicago University's *A Manual of Style*. Refer also to NRC's "Publishing Documents in the NUREG Series" (NUREG–0650, Revision 1). (1)

The contractor shall submit to the NRC project manager the typeset (photocomposed) manuscript suitable for printing. The NRC contact shall submit the manuscript to the Chief, Publications Branch, Division of Freedom of Information and Publications Services, (DFIPS), where it will be reviewed for adherence to the standards set forth and referenced in this directive and handbook. The manuscript will also be reviewed for printing acceptability by the Printing and Mail Services Branch, DFIPS. Unsatisfactory manuscripts will be reported to the NRC contact for appropriate contractual action by the NRC contracting officer or, in the case of Government agency or interagency agreement work, the publications manager of the performing organization. (2)

Approved: June 17, 1991
(Revised: July 9, 1995)

Format (C) (continued)

DFIPS will approve the design of the cover and title page containing appropriate information concerning—(3)

- Authors' names (a)
- Organizational identification (b)
- Public availability and sales (c)

All books must include a comprehensive subject index of the book's contents, unless the book is made up almost exclusively of graphical or tabular matter. See NUREG-0650, or *The Chicago Manual Style* (13th ed.) for guidelines on creating an index. (4)

NRC Document Number (D)

Each book must be identified by an NRC-controlled alphanumeric code unique to that book. The alphanumeric code will have the form NUREG/CR for books prepared by contractors and NUREG/GR for books prepared by grantees. (1)

When a book consists of more than one volume or binding, or is issued in more than one edition, include an appropriate volume, number, supplement, part, addendum, or revision designation directly below the document number. (2)

Numbers are assigned by the Publications Branch, DFIPS. The number may be obtained before the manuscript is submitted to DFIPS for printing by calling the Publications Branch at (301) 415-7166. The DFIPS staff will arrange to meet with the NRC contact for the project and, when appropriate, the author(s), to discuss the publication production requirements and the schedule for the book. (3)

Availability of Reference Materials (E)

The guidelines for availability of reference material given in Section G of Part III of this handbook also apply to books prepared by contractors and grantees that are published by NRC.

Reviews (F)

Peer (1)

Books published by NRC must undergo peer review by experts within and outside NRC. Peer review refers to a critical evaluation of the technical contents of a publication. These reviews may be conducted anonymously by reviewers from the author's own or a related field who are totally independent of the work leading to the manuscript. (a)

Reviewers should be chosen by the NRC office sponsoring the book from the potential audience for the publication and should provide an independent judgment about whether the publication successfully accomplishes the author's aims. Peer reviewers should be chosen for their expertise in the subject matter of the book. They may come from academia, the national laboratories, other Federal agencies, or from other research institutes or consulting firms. They may be identified from the membership rolls of professional societies, American National Standards Institute (ANSI) subcommittees, and the like. Do not choose more than one reviewer from the same organization. (b)

When assessing potential peer reviewers, screen for demonstrated competence and achievement in a specific discipline or research specialty. Assess competence based on the quality of research accomplished, publications in refereed journals, and other significant technical activities, achievements, and honors. Consider the judgment, perspective, and objectivity of reviewers. Consider also the personal integrity of those selected to ensure the confidentiality of information reviewed. Finally, avoid real or perceived conflicts of interest. Do not choose reviewers who are licensees or consultants to licensees, nor reviewers from intervenor groups. Likewise, do not choose reviewers who may profit financially from influencing the information reviewed. (c)

The services of reviewers from outside the agency may be acquired through consultant services contracts. The decision as to whether to reimburse peer reviewers should be made on a case-by-case basis, however. Recognize that reimbursing peer reviewers may give the appearance of a conflict of interest, suggesting to some that because NRC is paying for this service, the agency will seek only reviewers thought to be favorably disposed to the material reviewed. One way to offset this impression is to seek recommendations for peer reviewers from independent organizations, such as the American Physics

Reviews (F) (continued)

Peer (1) (continued)

Society, the American Nuclear Society, the American Society of Mechanical Engineers, or appropriate universities. Reimbursement could then be made to the organization. (d)

Copyright (2)

Copyrighted material must not be reproduced in NRC books without appropriate authority, usually written permission of the copyright holder. See Section 3.4 of NUREG-0650, Revision 1, for information about obtaining copyright permission.

Security (3)

On the basis of the knowledge of the information sources used, the author is responsible for ensuring that the manuscript does not contain classified or other access-controlled information. If uncertainty exists with respect to the security classification of a reference document or manuscript, an authorized classifier or the NRC Division of Security should be contacted for assistance. See also Management Directive 12.2, "NRC Classified Information Security Program."

Patent (4)

The patent review guidelines for draft and final formal reports specified in Section (C)(1) of Part III of this handbook also apply to books prepared by contractors and grantees.

Publishing Authorization Form (G)

A completed NRC Form 426A (Exhibit 1), signed by the office director or designee or by a DOE national laboratory authorized official if the publication is prepared for the Office of Nuclear Regulatory Research, must be submitted to DFIPS with the book manuscript.

Disclaimers (H)

The following standard U.S. Government notice will be added before printing: (1)

Disclaimers (H) (continued)

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product, or process disclosed in this document, or represents that its use by such third party would not infringe privately owned rights.

The following additional statement may be printed below the standard disclaimer, if authorized by the NRC office director or designee: (2)

This document was prepared under U.S. Nuclear Regulatory Commission (NRC) Contract No._____ . The opinions, findings, conclusions, and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the NRC.

Other qualifying statements may be added, if needed. (3)

Printing (I)

DFIPS will submit book manuscripts to GPO for printing. The printing cycle requires from 6 to 8 weeks.

Distribution and Sales (J)

The DFIPS staff will arrange distribution in accordance with distribution guidance provided by the NRC project manager on NRC Form 426A (Exhibit 1). (1)

Free distribution should be limited to those who contributed materially to the book or to those for whom the book's subject matter bears directly on their work at or for NRC. (2)

DFIPS will arrange to make the book available for sale through GPO. DFIPS also will arrange to have it made available at the NRC PDR and for the GPO Federal Depository Library Program. (3)

Part VI

Grant Publications

Background and Rationale (A)

The Nuclear Regulatory Commission funds grants for educational and nonprofit institutions, State and local governments, and professional societies for the expansion, exchange, and transfer of knowledge and ideas pursuant to the Atomic Energy Act of 1954, as amended, Sections 31.a and 141.b.

Publication of Results (B)

The grant will specify the publication requirements of the award. Grant results may be published by NRC, by the grantee, or in the open literature.

Publication by NRC (1)

This publication option must be governed by the guidelines specified in Part III of this handbook for reports or in Part V of this handbook for books, as appropriate. See "Identification Information," Section (C) of this part.

Publication by a Grantee (2)

When the grant specifies that the grantee is to publish the results of his or her work, the grantee must grant to the Government a royalty-free, nonexclusive, irrevocable license to reproduce, translate, publish, use, and dispose of all copyrightable material first produced or composed in the grantee's performance under the grant.

Publication by a Grantee in the Open Literature (3)

When the grantee submits journal articles for publication, each article must be accompanied by the following statement: (a)

Publication of Results (B) (continued)

Publication by a Grantee in the Open Literature (3) (continued)

The submitted manuscript has been authored by a grantee of the U.S. Government under Grant No._____. Accordingly, the U.S. Government has a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes.

All open literature publications prepared under this grant must contain the following statement: (b)

This paper was prepared with the support of the U.S. Nuclear Regulatory Commission (NRC) under Grant No._____. The opinions, findings, conclusions, and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the NRC.

If the grantee is requested by the journal or other publisher to transfer the copyright, the grantee author will respond to the journal or other publisher in writing in accord with the sample letter shown as follows: (c)

Dear (Publisher's Name):

We recently received a document for signature assigning copyright and republication rights in the submitted article (title) to (name of publication). This letter is offered in lieu of the document as a means of completing the transfer of ownership. Accordingly, we hereby expressly transfer and assign our rights of ownership in the above-cited work to (name of publisher).

You are advised, however, that the above assignment and any publication or republication of the above-cited work is subject to the following Government rights:

The submitted manuscript has been authored by a grantee of the U.S. Government under Grant No. _____. Accordingly, the U.S. Government has a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or allow others to do so, for U.S. Government purposes.

Sincerely,

Approved: June 17, 1991
(Revised: July 9, 1995)

Publication of Results (B) (continued)

Reprints of Open Literature Publications (4)

When any article resulting from work under the grant is published in a scientific, technical, or professional journal, two reprints of the publication must be sent to the cognizant NRC program officer, clearly labeled with the grant number and other appropriate identifying information.

Identification Information (C)

Each report or book published by NRC that results from a grant must be identified by an alphanumeric number, "NUREG/GR-000," where "GR" indicates "grant report." (1)

When the publication consists of more than one volume, number, supplement, part, or binding, or is issued in more than one edition, an appropriate volume, supplement, part, or revision designation must appear below the NUREG/GR number. (2)

Numbers may be obtained from the Publications Branch at (301) 415-7008. (3)

Pre-Publication Reviews (D)

The U.S. Congress characterizes the relationship between a Federal agency and a grant recipient as one in which "the recipient can expect to run the project without agency collaboration, participation, or intervention as long as it is run in accordance with the terms of the instrument."

Glossary*

Book. A publication intended as a permanent reference or textbook or as a major critical review of a technical or regulatory topic. It may be *casebound* (hardback) or paperbound.

Camera-Ready Copy. Pages ready for printing by the offset printing process. This is a colloquial term used even though the printing process may not involve the so-called copy camera (see also *reproducible masters*).

Casebound. Term denoting a book with a hard cover.

Compose. To arrange letters, in type or film, for printing. Usually synonymous with *typesetting*.

Composition. The process of setting type by hot-metal casting, phototypesetting, or electronic character generating devices (e.g., computers) for the purpose of producing *camera-ready copy*, negatives, a plate, or an image to be used in the production of *printing* or microform.

Contractor Report. Record of work done (a report) prepared in accordance with the provisions of a contract or under or pursuant to an interagency agreement.

Copyright. A form of protection provided by the laws of the United States (Title 17, U.S. Code), to the authors of "original works of authorship," including literary, dramatic, musical, artistic, and certain other intellectual works. This protection is available to both published and unpublished works. Generally, copyrighted material may not be reproduced without the permission of the author or the publisher.

Disseminate. To announce the publication of reports and make them available for free distribution, sale, or copying.

*Words in *italics* in definitions are also defined in the glossary.

Glossary (continued)

Distribution. Reports dispensed to specific organizations and individuals to ensure their participation in the regulatory process and support of research and technological investigations. Such distribution may be accomplished by the use of standard distribution lists established and maintained by the Division of Freedom of Information and Publications Services at the request of the originating office or region.

Documentation. Classification and associated markings required for classified or sensitive unclassified documents, the NRC report number unique to the report, title (and subtitle, if any), author or correspondent (if any), organization identification and contract number (or job code number), date, and availability.

Edition. All copies of a book printed from the same type. Edition also refers to format, such as *paperback*, *casebound*, or to the text, as revised, expanded, and so on. If extensive revisions have been made to the text and the book is reprinted, the revised version is the new edition.

Grant. A legal instrument which defines the relationship between the Government and a recipient for the transfer of money, property, services, or anything of value to the recipient for the accomplishment of a public purpose of support or stimulation authorized by law. A grant presumes a limited amount of involvement by the agency in the performance by the recipient.

Grant Report. A record of work done prepared in accordance with the provisions of the *grant*.

Index. An alphabetical list of all major topics discussed in a *book*. It cites the page numbers where each topic can be found. The index is the last section of a book.

International Agreement. Cooperative nuclear safety research programs that involve either or both foreign governments and organizations and U.S. industry. Such involvement, authorized under 42 U.S.C. 5801, includes monetary contributions, information exchanges, and comments on program plans and results.

International Agreement Report. A record of work done prepared in accordance with the provisions of an *international agreement*.

Glossary (continued)

Manuscript. A handwritten, typewritten, or *composed* version of a document, as distinguished from a printed copy.

NRC Project Manager. The NRC staff member responsible for the work performed by consultants or contractors and their subcontractors, or for work performed under or pursuant to an interagency agreement.

Paperback. A *book* with a flexible paper cover.

Peer Review. A critical evaluation of the technical contents of a publication. These reviews are conducted by reviewers from the author's own or a related field who are totally independent of the work leading to the *manuscript*. Reviewers should be chosen from the potential audience for the publication and should provide an independent judgment about whether the publication successfully accomplishes the author's aims.

Photocomposition. *Typesetting* performed when photosensitive paper or film is exposed to light in the form of letters and characters. Photocomposition is to be distinguished from hot-metal and typewriter *composition*.

Printing. As defined by the Joint Committee on Printing, includes and applies to the process of *composition*, platemaking, presswork, collating, and microform; the equipment used in such processes; or the end product produced by such processes and equipment.

Proprietary Information. Trade secrets; privileged or confidential research, development, commercial, or financial information exempt from mandatory disclosure under 10 CFR Part 2 (Sections 2.740 and 2.790) and under 10 CFR Part 9 (Section 9.17); and other information submitted in confidence to the NRC by a foreign source and determined to be unclassified by the NRC.

Public Domain. Materials for which a *copyright* never existed, such as U.S. Government publications, or for which a copyright has expired.

Publicly Available Documents. Information (reports and references) that is available in the NRC Public Document Room (PDR) for public inspection and copying or available in the *public domain*.

Approved: June 17, 1991
(Revised: July 9, 1995)

Glossary (continued)

Reproducible Masters. *Camera–ready copy* that includes (1) originals of line drawings (or prints that can be copied); (2) glossy prints of black and white photographs; (3) original *typeset* or printed text, tables, cover, title page, contents, and abstract; or (4) other forms of the materials that a printer can reproduce.

Trim Size. The final size of the whole page, margins included.

Typesetting. The placement of type on a page (letters, numbers, and other characters) in conformance with specific style and layout instructions.

Unique Identification. NRC identification (NUREG number) used on a report and its attachments, revisions, and supplements that is not used on any other publication.

Exhibit 1
NRC Form 426A, "Release to Publish Unclassified NRC Contractor, Consultant, or Conference Proceedings Reports"

NRC FORM 426A (3-89)
NRCM 1102, 3202

U.S. NUCLEAR REGULATORY COMMISSION

RELEASE TO PUBLISH UNCLASSIFIED NRC CONTRACTOR, CONSULTANT, OR CONFERENCE PROCEEDINGS REPORTS

(Please Type or Print)

1. REPORT NUMBER (If any)
NUREG/CR-5627
BNL-NUREG-52257

2. TITLE AND SUBTITLE
Alternate Modal Combination Methods in Response Spectrum Analysis

3. FIN OR GRANT NUMBER
A-3955

4. AUTHORS
P. Bezler and others

5. CONTRACTOR | MAILING ADDRESS | TELEPHONE NUMBER
Brookhaven National Laboratory
Department of Nuclear Energy
Building 129
Upton, NY 11973
566-2447

6. TYPE OF DOCUMENT
X A. TECHNICAL REPORT
X FORMAL ☐ LETTER REPORT
B. CONFERENCE PAPER
(1) TITLE OF CONFERENCE PAPER:
(2) DATE(S) OF CONFERENCE:
(3) LOCATION OF CONFERENCE:
C. OTHER

7. DISTRIBUTION
RA
50 copies: Judy Liu, Technical Information Division, Bldg. 477B, Brookhaven National Laboratory, Upton, NY 11973
10 copies: Nilesh Chokshi, RES, NLS-217

8. CERTIFICATION (ANSWER ALL QUESTIONS)

YES	NO	
X		A. REFERENCE AVAILABILITY — Is all material referenced in this report available to the public either through a public library, the Government Printing Office, the National Technical Information Service, or the NRC Public Document Room? If no, list the specific availability of a referenced document with the reference listing below.
		SPECIFIC AVAILABILITY
	X	B. COPYRIGHTED MATERIAL — Does this report contain copyrighted material? If yes, attach a letter of release from the source that owns the copyright.
	X	C. COMPUTER CODES — Does this report contain a computer code? If yes, it must comply with the standards in NRC Manual Chapter 0804, "Planning and Control of Automatic Data Processing (ADP) Resources."
	X	D. PATENT CLEARANCE — Does this report require patent clearance? If yes, the NRC Patent Counsel must signify clearance by signing below.
		NRC PATENT COUNSEL (Type or Print Name) | SIGNATURE | DATE
	X	E. INFORMATION REQUESTS — Does this report contain any questionnaire, survey, or data collection requests?
	X	F. LICENSING REQUIREMENTS — Does this report impose requirements on licensees?

9. AUTHORIZATION

A. DOE LAB AUTHORIZING OFFICIAL (If applicable) (Type or print name)
R.A. Bari
SIGNATURE: R A Bari
DATE: 9/25/90

B. NRC RESPONSIBLE STAFF MEMBER (Type or print name)
L. Murphy
SIGNATURE: Cynthia J. Murphy
OFFICE/DIV: 442-3860
TELEPHONE: NLS217A
MAIL STOP:
DATE: 10/10/90

NRC FORM 426A (3-89)

Exhibit 2
NRC Form 335, "Bibliographic Data Sheet"

NRC Form 335 (2-89) — U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)
NUREG/CR-5603
EGG-2607

2. TITLE AND SUBTITLE
Pressure-Dependent Fragilities for Piping Components:
Pilot Study on Davis-Besse Nuclear Power Station

3. DATE REPORT PUBLISHED
MONTH: October — YEAR: 1990

4. FIN OR GRANT NUMBER
B5699

5. AUTHOR(S)
D.A. Wesley, T.R. Kipp, D.K. Nakaki, H. Hadidi-Tamjed

6. TYPE OF REPORT
Technical

7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION – NAME AND ADDRESS (If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)
ABB Impell Corporation
27401 Los Altos, Suite 480
Mission Viejo, CA 92691

Under contract to:
Idaho National Engineering Laboratory
EG&G Idaho, Inc.
Idaho Falls, ID 83415

9. SPONSORING ORGANIZATION – NAME AND ADDRESS (If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)
Division of Safety Issue Resolution
Office of Nuclear Regulatory Research
U.S. Regulatory Commission
Washington, D.C. 20555

10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)
The capacities of four, low-pressure fluid systems to withstand pressures and temperatures above the design levels were established for the Davis-Besse Nuclear Power Station. The results will be used in evaluating the probability of plant damage from Interfacing System Loss of Coolant Accidents (ISLOCA) as part of the probabilistic risk assessment of the Davis-Besse nuclear power station undertaken by EG&G Idaho, Inc. Included in this evaluation are tie tanks, heat exchangers, filters, pumps, valves, and flanged connections for each system. The probabilities of failure, as a function of internal pressure, are evaluated as well as the variabilities associated with them. Leak rates or leak areas are estimated for the controlling modes of failure. The pressure capacities for the pipes and vessels are evaluated using limit-state analyses for the various failure modes considered. The capacities are dependent on several factors, including the material properties, modeling assumptions, and the postulated failure criteria. The failure modes for gasketed-flange connections, valves, and pumps do not lend themselves to evaluation by conventional structural mechanics techniques and evaluation must rely primarily on the results from ongoing gasket research test programs and available vendor information and test data.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)
pressure-dependent fragilities
piping components
Interfacing System Loss of Coolant Accidents (ISLOCA)
probabilistic risk assessment
Davis-Besse Nuclear Power Station

13. AVAILABILITY STATEMENT
Unlimited

14. SECURITY CLASSIFICATION
(This Page) Unclassified
(This Report) Unclassified

15. NUMBER OF PAGES

16. PRICE

Exhibit 2 (continued)

DO NOT PRINT THESE INSTRUCTIONS AS A PAGE IN THE NUREG REPORT

INSTRUCTIONS

NRC FORM 335, BIBLIOGRAPHIC DATA SHEET, IS BASED ON GUIDELINES FOR FORMAT AND PRODUCTION OF SCIENTIFIC AND TECHNICAL REPORTS, ANSI Z39.18–1987 AVAILABLE FROM AMERICAN NATIONAL STANDARDS INSTITUTE, 1430 BROADWAY, NEW YORK, NY 10018. EACH SEPARATELY BOUND REPORT–FOR EXAMPLE, EACH VOLUME IN A MULTIVOLUME SET–SHALL HAVE ITS UNIQUE BIBLIOGRAPHIC DATA SHEET.

1. **REPORT NUMBER.** Each individually bound report must carry a unique alphanumeric designation (NUREG) assigned by the Regulatory Publications Branch, Division of Freedom of Information and Publications Services, in accordance with American National Standard ANSI Z39.23–1983, Standard Technical Report Number (STRN). Use uppercase letters, Arabic numerals, slashes, and hyphens only, as in the following examples: NUREG-0100, NUREG/CP-0010, NUREG/CR-0100, and NUREG/BR-0010. For reports in a series add Vol., Supp., Rev., and Addendum, when necessary. Add contractor cross-reference identification number (if any) below NUREG-series number, e.g., PNL-XXXX, SANDXX-XXXX, SAI-XXXX.

2. **TITLE AND SUBTITLE.** Title should indicate clearly and briefly the subject (coverage) of the report; including any subtitle to the main title. When a report is prepared in more than one volume, repeat the primary title, add volume number and include subtitle for the specific volume. Use upper and lower case letters, but capitalize computer code names. Do not use acronyms and initialisms in titles; may be added in parenthesis.

3. **DATE REPORT PUBLISHED.** Each report must carry a date indicating month and year published.

4. **FIN OR GRANT NUMBER.** Insert the FIN or grant number under which report was prepared.

5. **AUTHOR(S).** Give name(s) in conventional order (e.g., John R. Doe, J. Robert Doe). List author's affiliation if it is different from the performing organization.

6. **TYPE OF REPORT.** State draft, final, preliminary, topical, technical, regulatory, annual, quarterly, etc.

7. **PERIOD COVERED.** Add inclusive dates.

8. **PERFORMING ORGANIZATION NAME AND MAILING ADDRESS.** Give name, street, city, state, and ZIP code. List no more than two levels of an organizational hierarchy. Display the name of the organization exactly as follows: Division, Office, Organization or Government agency, and address.

9. **SPONSORING ORGANIZATION.** If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.

10. **SUPPLEMENTARY NOTES.** Enter information not included elsewhere but useful, such as: Prepared in cooperation with ... Presented at conference of ... To be published ... Docket No. ... When a report is revised, indicate whether the new report supersedes or supplements the older report.

11. **ABSTRACT.** Include a brief (200 words or less) factual summary of the most significant information contained in the report. If the report contains a significant bibliography or literature survey or multiple volumes, mention it here. Abstract is to be prepared by author or project manager.

12. **KEY WORDS/DESCRIPTORS.** Select from the Energy Data Base Subject Thesaurus, DOE/TIC-7008 R-5, the proper authorized terms that identify the major concept of the research and are sufficiently specific and precise to be used as index entries for cataloging.

13. **AVAILABILITY STATEMENT.** Denote public releasability, for example "unlimited", or limitation for reasons other than security.

14. **SECURITY CLASSIFICATION.** Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., unclassified).

15. **NUMBER OF PAGES.** Leave blank. (Added by NTIS)

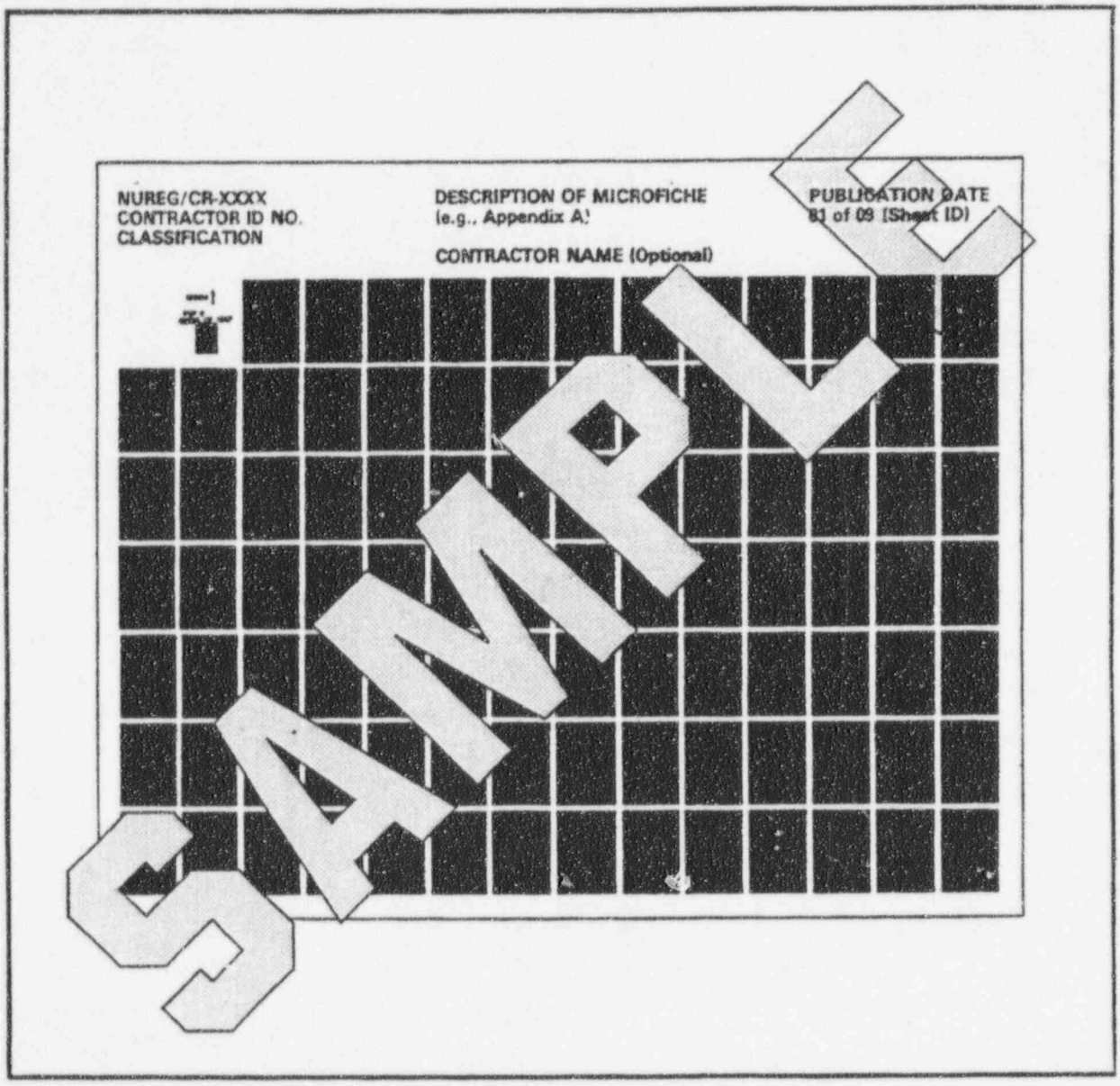
16. **PRICE.** Leave blank. (Added by NTIS)

U.S. GOVERNMENT PRINTING OFFICE: 1988 0–544-624

Approved: June 17, 1991
(Revised: July 9, 1995)

Exhibit 3

Microfiche Sheet Sample



CONTRACT PRICING PROPOSAL COVER SHEET

1. SOLICITATION/CONTRACT/MODIFICATION NO.

FORM APPROVED OMB NO. 9000-0013

NOTE: This form is used in contract actions if submission of cost or pricing data is required. *(See FAR 15.804-6(a))*

2. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*

3A. NAME AND TITLE OF OFFEROR'S POINT OF CONTACT

3B. TELEPHONE NO.

4. TYPE OF CONTRACT ACTION *(Check)*

- ☐ A. NEW CONTRACT
- ☐ B. CHANGE ORDER
- ☐ C. PRICE REVISION/ REDETERMINATION
- ☐ D. LETTER CONTRACT
- ☐ E. UNPRICED ORDER
- ☐ F. OTHER *(Specify)*

5. TYPE OF CONTRACT *(Check)*

☐ FFP ☐ CPFF ☐ CPIF ☐ CPAF
☐ FPI ☐ OTHER *(Specify)*

6. PROPOSED COST *(A+B=C)*

A. COST	B. PROFIT/FEE	C. TOTAL
$	$	$

7. PLACE(S) AND PERIOD(S) OF PERFORMANCE

8. List and reference the identification, quantity and total price proposed for each contract line item. A line item cost breakdown supporting this recap is required unless otherwise specified by the Contracting Officer. *(Continue on reverse, and then on plain paper, if necessary. Use same headings.)*

A. LINE ITEM NO.	B. IDENTIFICATION	C. QUANTITY	D. TOTAL PRICE	E. REF

9. PROVIDE NAME, ADDRESS, AND TELEPHONE NUMBER FOR THE FOLLOWING *(If available)*

A. CONTRACT ADMINISTRATION OFFICE

B. AUDIT OFFICE

10. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS WORK? *(If "Yes," identify)*

☐ YES ☐ NO

11A. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT? *(If "Yes," complete Item 11B)*

☐ YES ☐ NO

11B. TYPE OF FINANCING *(√ one)*

☐ ADVANCE PAYMENTS ☐ PROGRESS PAYMENTS
☐ GUARANTEED LOANS

12. HAVE YOU BEEN AWARDED ANY CONTRACTS OR SUBCONTRACTS FOR THE SAME OR SIMILAR ITEMS WITHIN THE PAST 3 YEARS? *(If "Yes," identify item(s), customer(s) and contract number(s))*

☐ YES ☐ NO

13. IS THIS PROPOSAL CONSISTENT WITH YOUR ESTABLISHED ESTIMATING AND ACCOUNTING PRACTICES AND PROCEDURES AND FAR PART 31 COST PRINCIPLES? *(If "No," explain)*

☐ YES ☐ NO

14. COST ACCOUNTING STANDARDS BOARD (CASB) DATA *(Public Law 91-379 as amended and FAR PART 30)*

A. WILL THIS CONTRACT ACTION BE SUBJECT TO CASB REGULATIONS? *(If "No," explain in proposal)*

☐ YES ☐ NO

B. HAVE YOU SUBMITTED A CASB DISCLOSURE STATEMENT *(CASB DS-1 or 2)*? *(If "Yes," specify in proposal the office to which submitted and if determined to be adequate)*

☐ YES ☐ NO

C. HAVE YOU BEEN NOTIFIED THAT YOU ARE OR MAY BE IN NONCOMPLIANCE WITH YOUR DISCLOSURE STATEMENT OR COST ACCOUNTING STANDARDS? *(If "Yes," explain in proposal)*

☐ YES ☐ NO

D. IS ANY ASPECT OF THIS PROPOSAL INCONSISTENT WITH YOUR DISCLOSED PRACTICES OR APPLICABLE COST ACCOUNTING STANDARDS? *(If "Yes," explain in proposal)*

☐ YES ☐ NO

This proposal is submitted in response to the RFP, contract, modification, etc. in Item 1 and reflects our best estimates and/or actual costs as of this date and conforms with the instructions in FAR 15.804-6(b) (2), Table 15-2. By submitting this proposal, the offeror, if selected for negotiation, grants the contracting officer or an authorized representative the right to examine, at any time before award, those books, records, documents and other types of factual information, regardless of form or whether such supporting information is specifically referenced or included in the proposal as the basis for pricing, that will permit an adequate evaluation of the proposed price.

15. NAME AND TITLE *(Type)*

16. NAME OF FIRM

17. SIGNATURE

18. DATE OF SUBMISSION

NSN 7540-01-142-9845
U.S. GOVERNMENT PRINTING OFFICE 1990 - 262-081

1411-102

STANDARD FORM 1411 (REV. 7-87)
Prescribed by GSA
FAR (48 CFR) 53.215-2(c)

STANDARD FORM 1411 WITH INSTRUCTIONS

1. SF 1411 provides a vehicle for the offeror to submit to the Government a pricing proposal of estimated and/or incurred costs by contract line item with supporting information, adequately cross-referenced, suitable for detailed analysis. A cost-element breakdown using the applicable format prescribed in 7A, B or C below, shall be attached for each proposed line item and must reflect any specific requirements established by the Contracting Officer. Supporting breakdowns must be furnished for each cost element, consistent with offeror's cost accounting system.

When more than one contract line item is proposed, summary total amounts covering all line items must be furnished for each cost element. If agreement has been reached with Government representatives on use of forward pricing rates/factors, identify the agreement, include a copy, and describe its nature. Depending on offeror's system, breakdowns shall be provided for the following basic elements of cost, as applicable.

Materials - Provide a consolidated priced summary of individual material quantities included in the various tasks, orders, or contract line items being proposed and the basis for pricing (vendor quotes, invoice prices, etc.).

Subcontracted Items - Include parts, components, assemblies, and services that are to be produced or performed by others in accordance with offeror's design, specifications, or direction and that are applicable only to the prime contract. For each subcontract over $500,000, the support should provide a listing by source, item quantity, price, type of subcontract, degree of competition, and basis for establishing source and reasonableness of price, as well as the results of review and evaluation of subcontract proposals when required by FAR 15.806.

Standard Commercial Items - Consists of items that offeror normally fabricates, in whole or in part, and that are generally stocked in inventory. Provide an appropriate explanation of the basis for pricing. If price is based on cost, provide a cost breakdown; if priced at other than cost, provide justification for exemption from submission of cost or pricing data, as required by FAR 15.804-3(e).

Interorganizational Transfer (at other than cost) - Explain pricing method used. (See FAR 31.205-26.)

Raw Material - Consists of material in a form or state that requires further processing. Provide priced quantities of items required for the proposal.

Interorganizational Transfer (at cost) - Include separate breakdown of cost by element.

Direct Labor - Provide a time-phased (e.g., monthly, quarterly, etc.) breakdown of labor hours, rates, and cost by appropriate category, and furnish bases for estimates.

Indirect Costs - Indicate how offeror has computed and applied offeror's indirect costs, including cost breakdowns, and showing trends and budgetary data, to provide a basis for evaluating the reasonableness of proposed rates. Indicate the rates used and provide an appropriate explanation.

Other Costs - List all other costs not otherwise included in the categories described above (e.g., special tooling, travel, computer and consultant services, preservation, packaging and packing, spoilage and rework, and Federal excise tax on finished articles) and provide bases for pricing.

Royalties - if more than $250, provide the following information on separate page for each separate royalty or license fee: name and address of licensor; date of license agreement; patent numbers, patent application serial numbers, or other basis on which the royalty is payable; brief description (including any part or model numbers of each contract item or component on which the royalty is payable); percentage or dollar rate of royalty per unit; unit price of contract item; number of units; and total dollar amount of royalties. In addition, if specifically requested by the Contracting Officer, provide a copy of the current license agreement, and identification of applicable claims of specific patents. (See FAR 27.204 and 31.205-37.)

Facilities Capital Cost of Money - When the offeror elects to cla' facilities capital cost of money as an allowable cost, the offeror mus. submit Form CASB-CMF and show the calculation of the proposed amount (see FAR 31-205-10).

2. As part of the specific information required, the offeror must submit with offeror's proposal, and clearly identify as such, cost or pricing data (that is, data that are verifiable and factual and otherwise as defined in FAR 15.801). In addition, submit with offeror's proposal any information reasonably required to explain offeror's estimating process, including:

   a. The judgmental factors applied and the mathematical or other methods used in the estimate, including those used in projecting from known data; and

   b. The nature and amount of any contingencies included in the proposed price.

3. There is a clear distinction between submitting cost or pricing data and merely making available books, records, and other documents without identification. The requirement for submission of cost or pricing data is met when all accurate cost or pricing data reasonably available to the offeror have been submitted, either actually or by specific identification, to the Contracting Officer or an authorized representative. As later information comes into the offeror's possession. it should be promptly submitted to the Contracting Officer. requirement for submission of cost or pricing data continues to the ti... of final agreement on price.

4. In submitting offeror's proposal, offeror must include an index, appropriately referenced, of all the cost or pricing data and information accompanying or identified in the proposal. In addition, any future additions and/or revisions, up to the date of agreement on price, must be annotated on a supplemental index.

5. By submitting offeror's proposal, the offeror, if selected for negotiation, grants, the Contracting Officer or an authorized representative the right to examine those books, records, documents, and other supporting data that will permit adequate evaluation of the proposed price. This right may be exercised at any time before award.

6. As soon as practicable after final agreement on price, but before the award resulting from the proposal, the offeror shall, under the conditions stated in FAR 15.804-4, submit a Certificate of Current Cost or Pricing Data.

7. Headings for Submission of Line-Item Summaries:

A. New Contracts (including Letter contracts).

Cost Elements (1)	Proposed Contract Estimate-Total Cost (2)	Proposed Contract Estimate-Unit Cost (3)	Reference (4)

Under Column (1) - Enter appropriate cost elements.

Under Column (2) - Enter those necessary and reasonable costs that in offeror's judgment will properly be incurred in efficient contract performance. When any of the costs in this column have already been incurred (e.g., under a letter contract or unpriced order), describe them on an attached supporting schedule. When preproduction or startup costs are significant, or when specifically requested to do so by the Contracting Officer, provide a full identification and explanation of them.

Under Column (3) - Optional, unless required by the Contracting Officer.

Under Column (4) - Identify the attachment in which the information supporting the specific cost element may be found. Attach separate pages as necessary.

B. Change Orders (modifications).

Cost Elements (1)	Estimated Cost of All Work Deleted (2)	Cost of Deleted Work Already Performed (3)	Net Cost to Be Deleted (4)	Cost of Work Added (5)	Net Cost of Change (6)	Reference (7)

Under Column (1) - Enter appropriate cost elements.

Under Column (2) - Include (i) current estimates of what the cost would have been to complete deleted work not yet performed, and (ii) the cost of deleted work already performed.

Under Column (3) - Include the incurred cost of deleted work already performed, actually computed if possible, or estimated in the Contractor's Accounting records. Attach a detailed inventory of work, materials, parts, components, and hardware already purchased, manufactured, or performed and deleted by the change, indicating the cost and proposed disposition of each line item. Also, if offeror desires to retain these items or any portion of them, indicate the amount offered for them.

Under Column (4) - Enter the net cost to be deleted which is the estimated cost of all deleted work less the cost of deleted work already performed. Column (2) less Column (3) = Column (4).

Under Column (5) - Enter the offeror's estimate for cost of work added by the change. When nonrecurring costs are significant, or when specifically requested to do so by the Contracting Officer, provide full identification and explanation of them.

Under Column (6) - Enter the net cost of change which is the cost of work added, less the net cost to be deleted. When this results is negative, place the amount in parentheses. Column (4) less Column (5) = Column (6).

Under Column (7) - Identify the attachment in which the information supporting the specific cost element may be found. Attach separate pages as necessary.

C. Price Revision/Redetermination

Cutoff Date (1)	Number of Units Completed (2)	Number of Units To Be Completed (3)	Contract Amount (4)	Redetermination Proposal Amount (5)	Difference (6)

Cost Elements (7)	Incurred Cost-Preproduction (8)	Incurred Cost Completed Units (9)	Incurred Cost-Work In Process (10)	Total Incurred Cost (11)	Estimated Cost To Complete (12)	Estimated Total Cost (13)	Reference (14)

Under Column (1) - Enter the cutoff date required by the contract, if applicable.

Under Column (2) - Enter the number of units completed during the period for which experienced costs of production are being submitted.

Under Column (3) - Enter the number of units remaining to be completed under the contract.

Under Column (4) - Enter the cumulative contract amount.

Under Column (5) - Enter the offeror's redetermination proposal amount.

Under Column (6) - Enter the difference between the contract amount and the redetermination proposal amount. When this result is negative, place the amount in parenthesis. Column (4) less Column (5) = Column (6).

Under Column (7) - Enter appropriate cost elements. When residual inventory exists, the final costs established under fixed-price-incentive and fixed-price-redeterminable arrangements should be net of the fair market value of such inventory. In support of subcontract costs, submit a listing of all subcontracts subject to repricing action, annotated as to their status.

Under Column (8) - Enter all costs incurred under the contract before starting production and other nonrecurring costs (usually referred to as startup costs) from offeror's books and records as of the cutoff date. These include such costs as preproduction engineering, special plant rearrangement, training program, and any identifiable nonrecurring costs such as initial rework, spoilage, pilot runs, etc. In the event the amounts are not segregated in or otherwise available from offeror's records, enter in this column offeror's best estimates. Explain the basis for each estimate and how the costs are charged on offeror's accounting records (e.g., included in production costs as direct

engineering labor, charged to manufacturing overhead, etc.). Also how the costs would be allocated to the units at their various states of contract completion.

Under Columns (9) and (10) - Enter in Column (9) the production costs from offeror's books and records (exclusive of preproduction costs reported in Column (8) of the units completed as of the cutoff date. Enter in Column (10) the costs of work in process as determined from offeror's records or inventories at the cutoff date. When the amounts for work in process are not available in Contractor's records but reliable estimates for them can be made, enter the estimated amounts in Column (10) and enter in Column (9) the differences between the total incurred costs (exclusive of preproduction costs) as of the cutoff date and these estimates. Explain the basis for the estimates, including identification of any provision for experienced or anticipated allowances, such as shrinkage, rework, design changes, etc. Furnish experienced unit or lot costs (or labor hours) from inception of contract to the cutoff date, improvement curves, and any other available production cost history pertaining to the item(s) to which offeror's proposal relates.

Under Column (11) - Enter total incurred costs (Total of Columns (8), (9), and (10)).

Under Column (12) - Enter those necessary and reasonable costs that in Contractor's judgment will properly be incurred in completing the remaining work to be performed under the contract with respect to the item(s) to which Contractor's proposal relates.

Under Column (13) - Enter total estimated cost (Total of Columns (11) and (12)).

Under Column (14) - Identify the attachment in which the information supporting the specific cost element may be found. Attach separate pages as necessary.

CONTRACTOR SPENDING PLAN - INSTRUCTIONS

The Contractor Spending Plan (CSP) is an important tool for projecting and tracking contract costs and progress each task under the contract.

Applicability

The Nuclear Regulatory Commission (NRC) requires that the CSP be completed for cost reimbursement contracts when the award amount is expected to exceed $100,000 and the period of performance is expected to exceed 6 months. For task order type contracts, a CSP is required when an individual cost reimbursement task order is expected to exceed the above thresholds. When a contract or task order modification increases the contract or task order amount of a cost reimbursement contract or task order to over $100,000 and the period of performance from the effective date of the modification to the contract or task order expiration exceeds 6 months, a CSP is required for all contract work to be performed after the effective date of the modification.

Submission

1. A CSP is required:

   a. as part of the cost proposal for a cost reimbursement contract or individual task order, or modification to a contract or task order which meets the above thresholds;

   b. as part of the Best and Final Offer (if requested) as a result of negotiations;

2. Updated CSP information is required on a monthly basis or as approved by the CO as part of the "Financial Status Report" (Ref: Section F.3, "Financial Status Report").

Format

The attached CSP sample format may be duplicated and used by the Contractor, or modified to permit more accurate reporting or to meet other needs of the contractor. For instance, the sample format provides spaces to report projected costs for 12 months, but the contractor may wish to alter the sample format for shorter or longer contract/task order periods. The contractor may also wish to alter the sample format for ease of typing or automated production. So long as complete information is provided on actual and projected costs or accomplishments, changes to the format to improve relevance to the circumstances are encouraged.

It is up to the discretion of the offeror to determine the appropriate level of cost detail to be presented based on the complexity of the effort. This plan reflects only the minimum requirements for submission of cost details which will be considered for completeness, reasonableness, and as a measure of effective management of the effort. The Contracting Officer reserves the right to request additional cost information, if deemed necessary.

CONTRACTOR BIDDING PROPOSAL

(to be completed as a part of the Offeror's Cost Proposal for each cost reimbursement contract or individual task order or for any contract or task order modification which exceeds $100,000 and has a performance period exceeding 6 months)

Solicitation No. _____ Performance Period: from ___/___/___ to ___/___/___
Contract No. _____

Task Order No. _____
Modification No. _____
Offeror/Contractor Name: _____

Total Estimated Costs (including fixed fee, if any) of the Proposed Contract/Task Order/Modification (to a contract or task order) at the time of proposal submission. Does not include options. $_____

Provide cost details by month for the total contract/task order/or task order modification

Cost Elements	1st Month	2nd Month	3rd Month	4th Month	5th Month	6th Month
Direct Costs	$_____	$_____	$_____	$_____	$_____	$_____
Indirect Costs	$_____	$_____	$_____	$_____	$_____	$_____
Total Estimated Costs including fixed fee if any	$_____	$_____	$_____	$_____	$_____	$_____
Project Completion	_____%	_____%	_____%	_____%	_____%	_____%

Cost Elements	7th Month	8th Month	9th Month	10th Month	11th Month	12th Month
Direct Costs	$_____	$_____	$_____	$_____	$_____	$_____
Indirect Costs	$_____	$_____	$_____	$_____	$_____	$_____
Total Estimated Costs including fixed fee if any	$_____	$_____	$_____	$_____	$_____	$_____
Project Completion	_____%	_____%	_____%	_____%	_____%	_____%

SUBCONTRACTING PLAN

FOR

UTILIZATION OF SMALL BUSINESS (SB),
SMALL DISADVANTAGED BUSINESS (SDB) AND
SMALL WOMAN-OWNED BUSINESS CONCERNS

SUBMITTED BY:

S3 Technologies
Simulation, Systems & Services
Technologies Company
8930 Stanford Blvd
Columbia, MD 21045-4713

Analytical Simulators for Russia and Ukraine
Request for Proposal #RS-AED-96-265

Approved By: Holloway D. Umholtz Date: REVISED 5/13/96

Holloway D. Umholtz,
Manager, Purchasing

S3 TECHNOLOGIES COMPANY

S3 Technologies
Simulation, Systems & Services
Technologies Company
8930 Stanford Blvd.
Columbia, MD 21045-4713

Subcontracting Plan - RFP

1. Goals (Percentages of total planned subcontracting dollars):

   a. Small Business (SB) - 3%

   b. Small Disadvantaged Business (SDB) - 0%

   c. Small Woman-Owned - 0%

2. Total Dollars:

   a. Planned to be subcontracted - $1,335,909

   b. Planned to be subcontracted to SB - $43,359

3. Principal Types of Supplies and Services to be Subcontracted and Those Planned for Subcontracting to SB and SDB:

ITEM	SB
Computers	
Computer Peripherals	X
Labor	
Software	

4. The above goals and planned procurement actions were developed based on preliminary design concept and bill of materials, previous experience in procuring similar items, and quotes received from planned subcontractors.

5. Sources for subcontracting were identified by review of S3 Technologies lists and SBA-PASS.

6. Indirect materials and Overhead items are not included in the goals.

7. Holloway Umholtz, Manager of Purchasing will administer this subcontracting plan. Her duties are:

   a. Assure SB and SDB are provided an equitable opportunity to compete for S3 Technologies subcontracts.

(1) Supervise or conduct employee training and motivation regarding utilization of SB and SDB.

(2) Maintain source lists, guides, and other data (i.e., vendor size certifications) that identify SB and SDB concerns.

(3) Contact appropriate organizations (i.e., SBA-PASS) to identify additional SB and SDB as required.

(4) Arrange corporate participation in trade associations, business development organizations, and conferences and trade fairs to locate SB and SDB sources.

(5) Counsel and discuss subcontracting opportunities with potential SB and SDB firms, and arrange appropriate S3 Technologies assistance (i.e., technical, financial, management, etc.) to these firms as required and practicable.

(6) Assure that S3 Technologies solicitation terms and conditions (i.e., format, wording, response time, specifications, quantities, delivery schedules, terms of payment, etc.) are sufficiently simple and attainable to attract maximum SB and SDB response.

(7) Review each planned procurement (subcontract or purchase order) of $10,000 or more to assure solicitation from SB and SDB, and as a minimum, all reasonable efforts are made to:

(a) Identify and solicit at least one SB or SDB source for each item or service previously procured from a LB "single source."

(b) Solicit at least three SB and one SDB for each procurement where adequate competition is known to exist.

(c) Assure that when SB and SDB source lists are excessively long, reasonable efforts are made to give all these firms an opportunity to compete over a period of time.

(d) Give each newly identified SB and SDB source an opportunity to compete at the earliest possible date.

b. Review each subcontract of $500,000 or more planned for award to a LB to assure that the solicitation includes the FAR 52.219-9 clause, or equivalent.

c. Review, approve, and monitor LB subcontractor subcontracting plans when required.

d. Perform (semi-annual) internal audit of S3 Technologies compliance with all current SB and SDB programs requirements, and (semi-annual) review of progress toward attaining goals.

8. Efforts S3 Technologies will make to assure that SB and SDB concerns have an equitable opportunity to compete for subcontracts are outlined in paragraph 7 above and demonstrated by the reports and records outline in paragraphs 10 and 11 below.

9. S3 Technologies includes the FAR 52.219-8 "Utilization of SB and SDB Concerns" clause in all subcontracts that offer further subcontracting opportunities, and will require all subcontractors (except Small Business concerns) who receive subcontracts in excess of $500,000 to adopt a plan similar to this plan.

10. S3 Technologies will:

a. Cooperate in any studies or surveys as may be required.

b. Submit periodic reports in order to allow the customer to determine compliance with this plan.

c. Submit SF 294 and SF 295 per the instructions on the forms.

d. Ensure that its subcontractors agree to submit SF 294 and SF 295 when applicable.

11. S3 Technologies will maintain the following records:

a. Source lists, guides and other data that identify SB and SDB concerns.

b. Organizations contacted to locate SB and SDB concerns.

c. Records on each subcontract solicitation resulting in an award of more that $100,000 indicating:

(1) Whether SB concerns were solicited and if not, why not.

(2) Whether SDB concerns were solicited and if not, why not.

(3) If applicable, the reason award was not made to a SB concern.

d. Records of outreach efforts and contacts with trade associations, business development organizations, and conferences and trade fairs to locate SB and SDB sources.

e. On a contract basis, records to support award data submitted to the customer, including the name, address and business size of each subcontractor.

This subcontracting plan reflects S3 Technologies continuous commitment to identify and assist SB/SDB concerns, and afford these firms equitable opportunity to compete for S3 Technologies subcontracts. The goals set forth in this plan are based on data developed during proposal preparation and will vary proportionate to negotiated changes in scope of effort prior to award, and solicited subcontractors continued ability to satisfactorily perform after date of award of prime contract. Should the level of effort be changed before or after award, the goals will automatically increase or decrease proportionately.

Attachment 1
to Contract NRC-26-96-265

NON-EXCLUSIVE LICENSE AGREEMENT

This License Agreement is entered into by and between **Simulation, Systems & Services Technologies Company**, 8930 Stanford Boulevard, Columbia, Maryland 21045 U.S.A. (hereinafter "S3 Technologies") and **United States Nuclear Regulatory Commission**, (hereinafter "Licensee") as of the date of execution by both parties on the signature page hereof.

1.0 DEFINITIONS. The following definitions shall apply to this Agreement:

1.1 "Reference Contract" shall mean Contract between Licensee and S3 Technologies for work relating to the Designated Equipment.

1.2 "Designated Business Purpose" shall mean Licensee's and Sublicensee's use, operation, calibration, certification, modification, maintenance and repair of the Designated Equipment.

1.3 "Licensed Software" shall mean the computer software programs listed in Schedule A to this Agreement, all copies thereof, all programs, modules and subroutines related thereto, and all Proprietary Information incorporated therein.

1.4 "Support Materials" shall mean: (i) all end-user documentation, reports, manuals, data, drawings, notes or other materials in any medium listed in Schedule A of this Agreement which complement, support, accompany or explain the use of the Licensed Software by Licensee in its capacity as an end-user of the Licensed Software; and (ii) each copy (including copies merged into other materials), translation, update or modification of all or any part thereof, in any medium, delivered to Licensee by S3 Technologies.

1.5 "Proprietary Information" shall mean the Licensed Software (including both source code and executable code versions as applicable) and the Support Materials. Proprietary Information shall also mean, to the extent that such disclosure takes place, any other information and/or data which is disclosed in writing or other tangible form by S3 Technologies to Licensee (or, if orally disclosed, is reduced to or summarized in a writing or other tangible form within sixty (60) days after such oral disclosure) and is designated by S3 Technologies in such writing or other tangible form as proprietary or confidential.

1.6 "Designated Equipment" shall mean such Equipment as is listed on Schedule B of this Agreement.

2.0 LICENSE GRANT.

2.1 *Generally*. In consideration of the payments made and to be made to S3 Technologies under the Reference Contract, and subject to the terms and conditions of this Agreement, S3 Technologies hereby grants to Licensee and Licensee hereby accepts from S3 Technologies a non-exclusive, non-transferable license, except with the right to sublicense the rights granted hereunder to the proper party for each piece of Designated Equipment to: (i) use the Licensed Software on the Designated Equipment; and (ii) use and copy the Support Materials. In both instances, the use and/or copying rights granted hereunder shall be exercised solely by Licensee's employees and solely for the purpose of conducting the Designated Business Purpose.

2.2 *Term of License*. The license granted hereunder shall be perpetual unless terminated in accordance with Section 7 hereof.

2.3 *Nature of Rights Granted*. Licensee understands and specifically agrees that S3 Technologies retains title to the Licensed Software, the Support Materials, and any Proprietary Information disclosed to Licensee, and that Licensee possesses only the specific license rights granted hereunder.

3.0 LIMITATIONS ON USE AND COPYING.

3.1 *Use*. Licensee shall not reverse engineer, reverse compile or disassemble the Licensed Software.

3.2 *Copying*. Licensee may make and maintain two (2) backup/archival copies of the Licensed Software. Licensee may also make copies of the Support Materials to the extent required to accomplish the Designated Business Purpose. All copies of the Licensed Software and Support Materials will be stored in secure conditions at the site of the Designated Equipment. Licensee shall maintain a record of all such copies, which record may be inspected by S3 Technologies at any time upon five (5) days written notice.

3.3 *Legends*. All copies of the Licensed Software and Support Materials shall include the legends used by S3 Technologies, whether relating to trademarks, trade secrets, copyrights or otherwise, in the same form and location as the original legend or in any other reasonable form or location specified by S3 Technologies from time to time.

4.0 CONFIDENTIALITY.

4.1 *Generally.* Licensee agrees to keep confidential all Proprietary Information furnished to Licensee under the Reference Contract. Licensee shall maintain the Proprietary Information under secure conditions and shall confine knowledge and use of the Proprietary Information solely to its employees who require such knowledge and use in the ordinary course and scope of their employment by Licensee. Licensee shall not disclose such Proprietary Information to any third party in any form except as otherwise provided by this Agreement. Licensee shall incorporate and ensure such restrictions within its sublicense to the respective sublicensee.

4.2 *Limitations on Nondisclosure.* Licensee shall not be liable for the disclosure of Proprietary Information where Licensee can demonstrate, with documentary evidence, including affidavits, that the Proprietary Information which were disclosed:

(a) are or have become generally available to the public through no wrongful act or omission of Licensee; or

(b) were already in Licensee's possession or known to Licensee prior to the effective date of this Agreement and were not acquired, directly or indirectly, from S3 Technologies or others under an obligation of confidentiality; or

(c) were independently made available to Licensee by a third party provided that such third party did not acquire such Proprietary Information directly or indirectly from S3 Technologies.

4.3 *Exceptions to Section 4.2 Limitations.* No item of Proprietary Information shall be deemed to be generally available to the public or to be already in the possession of Licensee merely because certain component parts or features of the Proprietary Information, or combinations of such component parts or features, are generally available to the public or were already in the possession of Licensee.

4.4 *Third Party Contractors.* Where Licensee enters into a contract with a third party for services, maintenance, operation or modification of the Designated Equipment or the Licensed Software, Licensee may, upon S3 Technologies' prior written consent, which shall not be unreasonably withheld, disclose Proprietary Information to the third party to the extent necessary to permit the third party to perform its obligations; provided, however, that the third party shall have entered into an agreement which protects S3 Technologies against unauthorized use or disclosure of Proprietary Information. For a period of five (5) years following the effective date of this Agreement, S3 Technologies may

reasonably withhold such consent when the third party is in direct competition with S3 Technologies as a simulator vendor or as a subcontractor to a simulator vendor.

4.5 *Other Disclosures.* Licensed Software and/or Support Materials may also be disclosed pursuant to requirements of a governmental agency or operation of Law. In such a case, Licensee shall provide, prior to disclosure, written notification to S3 Technologies and afford S3 Technologies timely opportunity to limit unnecessary disclosure.

4.6 *Relationship to Reference Contract.* To the extent that the Reference Contract contains provisions governing Licensee's use of S3 Technologies' Proprietary Information, the provisions found in the Reference Contract shall prevail over those provisions found in Sections 4.1 - 4.5 hereof.

5.0 LICENSED SOFTWARE MODIFICATIONS. Licensee shall generally be entitled to modify the Licensed Software, or to engage the services of third parties to modify the Licensed Software in accordance with Section 4.4, so long as Licensee is then in compliance with the material provisions of this Agreement.

6.0 NO LIABILITY FOR THIRD-PARTY ACTS AND OMISSIONS. Except as may be expressly agreed to in writing by S3 Technologies, S3 Technologies shall not have any liabilities of any kind to Licensee or others with regard to:

(a) Licensed Software that has been modified by any person or entity other than S3 Technologies or its subcontractor Lakrom;

(b) non-conformities in the Licensed Software caused by defects, problems, or failure of hardware or Licensed Software not provided by S3 Technologies or its subcontractor Lakrom;

(c) non-conformities in the Licensed Software caused by the acts or omissions of Licensee or any other person or entity except S3 Technologies or its subcontractor Lakrom.

7.0 TERMINATION AND SURVIVAL.

7.1 *Generally.* This Agreement shall become effective upon its execution by S3 Technologies and Licensee, and shall terminate upon the occurrence of any one or more of the following events:

(a) upon the termination of the Reference Contract if such termination is due to a breach by Licensee;

(b) five (5) days after S3 Technologies gives Licensee written notice of Licensee's breach of any of the provisions of this Agreement relating to confidentiality or permissible disclosures unless Licensee has the cured the breach within such five (5) day period;

(c) thirty (30) days after either party gives the other written notice of the other's material breach of any provision of this Agreement, unless the breaching party has cured the breach within the thirty (30) day period; or

(d) upon ten (10) days written notice by either party to the other if the other party becomes insolvent, executes an assignment for the benefit of creditors, or becomes subject to bankruptcy or receivership proceedings; or

(e) at any time upon the written mutual agreement of Licensee and S3 Technologies.

(f) ten (10) years from the execution date of this Agreement. In this case the provisions of paragraph 7.2 below shall not be applicable to the Licensee.

7.2 *Procedure Upon Termination*. Licensee shall, upon termination of this Agreement, immediately discontinue further use of the Licensed Software, Support Materials and any other Proprietary Information. Within one (1) month after termination of this Agreement, Licensee shall furnish to S3 Technologies a completed "Certificate of Return or Destruction of Proprietary Information" (the form of which shall be supplied by S3 Technologies), certifying that the original and all copies, including translations, updates and modifications, of the Proprietary Information received from S3 Technologies or made in connection with the license granted herein have been returned to S3 Technologies or destroyed. The media on which Licensed Software is provided shall remain the property of S3 Technologies and Licensee agrees to return such media to S3 Technologies promptly upon termination of this Agreement.

7.3 *Survival*. All obligations concerning use, confidentiality and nondisclosure shall survive the termination of this Agreement.

7.4 *Remedies*. Any remedies provided to S3 Technologies hereunder are in addition to, and not in lieu of, any other remedies available at law or in equity.

7.5 *Injunctive Relief.* Licensee acknowledges that the violation by Licensee of its covenants in this Agreement relating to the nondisclosure of, or use limitations governing, the Licensed Software, the Support Materials and the Proprietary Information would result in damage to S3 Technologies that could not be completely remedied by the award of monetary damages. Accordingly, Licensee agrees that any such violation shall entitle S3 Technologies to obtain an injunction or decree of specific performance against Licensee.

8.0 REFERENCE CONTRACT PROVISIONS. Responsibilities and obligations for shipment, risk of loss during shipment, Licensed Software installation, Licensed Software support and maintenance, and data entry and conversion are allocated as provided in the Reference Contract, as are warranties and limitations of warranty relating to Licensed Software performance, Licensed Software ownership and Licensed Software non-infringement.

9.0 APPLICABLE LAW. This Agreement shall be governed by such laws as have been selected in the Reference Contract.

10.0 SEVERABILITY. If for any reason any provision of this Agreement shall be held by a court of competent jurisdiction to be legally invalid or unenforceable, the validity and enforceability of the remainder of this Agreement shall not be affected and such provision shall be deemed modified to the minimum extent necessary to make such provision consistent with applicable law and, in its modified form, such provision shall then be enforceable and enforced.

11.0 NON-ASSIGNABILITY. Licensee may not assign, sublicense, or otherwise transfer this Agreement or any rights granted herein without the prior written consent of S3 Technologies.

12.0 AMENDMENTS. Any amendments to this Agreement (including any Schedules and/or Exhibits thereto) must be contained in a writing signed by Licensee and S3 Technologies.

ACCEPTED AND AGREED TO:

Simulation, Systems & Services Technologies Company (S3 Technologies)

By: _____

Name: Jerry Jen

Title: Vice President

Date: 6 June 1996

US Nuclear Regulatory Commission (Licensee)

By: _____

Name: Mary H. Mace

Title: Contracting Officer

Date: June 12, 1996

SCHEDULE A

List of Licensed Software and Support Materials

1. Licensed Software includes: (in object code only)

   FLOWNETS
   RETACT
   XIS
   STK Core
   S^3

2. Support Materials includes: User Guides

SCHEDULE B

Designated Equipment

1. Designated Equipment shall be:

Simulation Computer (SGI Challenge L R4400)
Instructor Station (SGI Indigo R4400)
Student/User Station (DELL Pentium 586 DX-75MHz)

Attachment 8

List of Simulated Failures

1. Failures in the systems affecting reactivity

   1.1 Uncontrolled removal of the control rods group.
   1.2 Starting-up of RCP belonging to previously inactive loop.
   1.3 Control rod ejection (variable).
   1.4 Drop in boric acid concentration in a coolant due to failures in boron shim system (Variable)
   1.5 Drop of control rods (variable).
   1.6 Control rods locking in the intermediate position upon automatic protection actuation.
   1.7 False actuation of automatic protection.
   1.8 False actuation of unit power reduction automatics.

2. Coolant flow deviations

   2.1 Jamming of RCP rotor.
   2.2 Trip of RCPs (variable inertia) (redundant components).
   2.3 Trip of one of the four operating RCPs under conditions of accompanying failure SG relief valve in disconnected loop.

3. Failure in secondary circuit heat removal system.

   3.1 Turbine generator trip.
   3.2 Trip of turbine driven feedwater pumps (redundant).
   3.3 Loss of water level in one SG (variable).
   3.4 Complete loss of feedwater delivery (variable in time).
   3.5 Level control system failure in one SG with accompanying SG level variations (variable).
   3.6 Spurious closure of main steam isolation valve at SG.
   3.7 Failure of one by-pass valve in open position under automatic protection actuation (variable).
   3.8 Loss of vacuum (variable).

4. Failure with loss of sealing in the secondary circuit

   4.1 SG steam pipes rupture inside containment (redundant and variable).
   4.2 SG steam pipes rupture beyond containment (redundant and variable).
   4.3 SG steam pipes rupture after check valve (redundant and variable).
   4.4 SG steam header rupture (variable).
   4.5 Unforeseen closure of SG relief valve.
   4.6 Unforeseen steam dump valve actuation.
   4.7 Unforeseen by-pass valve actuation.
   4.8 SG feed water pipe rupture inside containment.
   4.9 SG feed water pipe rupture before intercept valve.
   4.10 Feedwater pipe rupture after high pressure heater.
   4.11 Failure of steam dump valve to close.
   4.12 Emergency feed water pipe rupture.

5. Failures with loss of sealing in the primary circuit

5.1 Main circulation pipeline rupture at the reactor inlet.
5.2 Main circulation pipeline rupture at the reactor outlet.
5.3 Rupture of piping connecting ECCS with reactor.
5.4 Rupture of piping connecting ECCS tank with reactor.
5.5 Rupture of piping connecting pressurizer with main recirculation loop.
5.6 Rupture of piping (variable).
5.7 Failure of pressurizer safety/relief valve to be seated properly after actuation.
5.8 SG heat transfer tube rupture.
5.9 Rupture of primary circuit header in SG.

6. Failures in primary circuit pressure control system

6.1 Failure to close "fine" injection valve.
6.2 Failure to close "heavy" injection valves.

7. Failures in the primary circuit auxiliary systems

7.1 Trip of makeup water pump and failure to start stand-by pump.
7.2 Closure of pneumatic valve on primary circuit blow-down line.
7.3 Failure in RCP component cooling circuit.
7.4 Termination of locking water delivery to RCP 1.
7.5 Blocking of pneumatically driven intercept valve at the primary circuit blow-down line.
7.6 Failure in RCP oil/lubrication system.
7.7 Failure in make-up water pump oil/lubrication system.
7.8 Loss of service water for non-essential consumers.
7.9 Controlled leakage system failure.
7.10 Leakage from cooling pond.
7.11 Coolant leakage in to TK80W01 and into component cooling circuit.
7.12 Spurious pneumatic valve closure at the primary circuit makeup line.
7.13 Spurious pneumatic valve closure at the RCP sealing water discharge line.
7.14 Component cooling circuit leakage into the controlled leakage/drainage system.
7.15 Spurious pneumatic intercept valve closure at the line delivering sealing water to RCP.

8. Failures in safety systems

8.1 Unavailability of safety train(s) (redundant).
8.2 False closure of intercept/isolation valve under full power operation of the unit.
8.3 Loss of containment integrity (variable).
8.4 Leakage from the emergency boron solution tank.

9. Failures in secondary circuit system.

9.1 Failure in automatic system for stand-by/redundant condensate pump

actuation.
9.2 Trip of condensate pump(s) (1 stage) (redundant).
9.3 Trip of condensate pump(s) (2 stage) (redundant).
9.4 Condensate pump (1 stage) pressure piping ruptures.
9.5 Condensate pump (2 stage) pressure piping ruptures.
9.6 Loss of sealing in low pressure heater #3 piping.
9.7 Loss of sealing in low pressure heater #4 piping.
9.8 Loss of sealing in low pressure heater #5 piping.
9.9 Failure in level controller of low pressure heater #2.
9.10 Failure in level control system in deaerators.
9.11 Deaerators pressure control failure in the process of steam delivery from auxiliary header.
9.12 Failure in the condensate level control system in low pressure heaters #2, 3, 4, 5.
9.13 Disconnection of the two groups of high pressure heaters.
9.14 Heat transfer tube rupture in high pressure heater.
9.15 Train out of one group of high pressure heaters.
9.16 Loss of sealing in condenser vessel or in condenser piping.
9.17 Trip of circulating pump(s) (redundant).
9.18 Failure in moisture reheater drain system.
9.19 Loss of sealing in reheater piping.
9.20 Failure in the reheaters heating steam system.
9.21 Rupture of auxiliary steam header.
9.22 Failure in condensate drain system of turbine driven feedwater pump.

10. Failures in Electrical Generator Systems

10.1 Oil level drop in damper tank of the generator shaft sealing system.
10.2 Hydrogen leakage into stator winding cooling system.
10.3 Failure in the stator winding cooling system.

10.4 Failure in the generator shaft sealing system.
10.5 Failure in the generator gas cooling system.

11. Failures in the Systems Delivering Electricity to the Grid

11.1 Asynchronous operation of generator.
11.2 Internal damages of generator.
11.3 Frequency variations in generator system.
11.4 Failure in excitation system.

12. Failures in Power Supply System

12.1 Disconnection of one 6 KW bus.
12.2 Disconnection of auxiliary transformer(s) (redundant).

13. Common Failures

13.1 Controllers:
-automatic control failure

-inadvertent movement of controller to "more" or "less" position.
-change in controller setpoint.

13.2 Technological protection and interlocking:
-failure to actuate at a setpoint value
-false actuation

13.3 Data/instrument channels:
-failure in instrument channel
-unreliable data

13.4 Pumps:
-pump trip
-interlocking failure during pump operation
-false start up of a pump
-rotor jamming
-splitting of electrical motor and pump coupling
-failure in a circuit for automatic start of stand-by pump.

13.5 Control and isolating valves:
-blocking at any position
-failure to display data on valve position
-drive failure
-control circuit failure

13.6 Pneumatically driven valves:
-spurious closure due to drive failure (for properly closed valve)
-spurious opening due to drive failure (for properly open valve)

13.7 Check valves:
-failure to open with direct flow
-failure to close with reverse flow
-blocking in intermediate position

13.8 Electrical circuit breakers:
-failure to switch on/off.

13.9 Safety/Relief Valves:
-spurious opening (due to malfunction of control)
-failure upon actuation
-failure to open upon reaching the setpoint of actuation

13.10 Reactor data/instrument channels:
-failure of out-of-core neutron detector
-failure of in-core instrument channel
-failure of in-core thermocouple.

Attachment 9

Methodological Support Documentation

1 Materials needed to present simulation courses

The contractor will provide in english and russian course material needed to present training on the simulator. This should include, but not be limited to:

1. Draft Course Manuals
2. Instructor Lesson Plans
3. Instructor Guides
4. Simulator Scenarios
5. Plant Procedures
   a. Normal Operating Procedures
   b. Off Normal Operating Procedures
   c. Alarm Response Procedures
   d. Technical Specifications
   e. Emergency Operating Procedures

2 Draft Student Materials

The course manual provided should contain the following information:

a. Course Outline
b. Table of Contents
c. Course Purpose
d. Course Objectives
e. Simulator Layout Drawings
f. Basic System Drawings of Major Systems
g. Text containing information on the basis of the steps used in the Emergency Operating Procedures.
h. Graphs and Tables associated with the Emergency Operating Procedures
i. A listing of the procedures available in the simulator control room.

3 Instructor Training Material

3.1 Classroom Lesson Plans

The classroom lesson plans should provide the instructor with enough information to ensure subject material is adequately covered. The lesson plan should be in an outline format and should contain the following categories:

1. Special Instructions for the instructor, if any.
2. List of training aids to be used, ie. transparencies, tapes, slides, film, etc.
3. List of handouts to be given to the students if any.

4. List of reference documents used to develop the lesson plan, ie. course manual, EOP's, technical specifications, FSAR's, etc.
5. List of course objectives. This will what the training staff expects the students to learn from this session.
6. Presentation section. This is the primary information to be covered during the session and it should include notes placed in the body of the lesson plan to inform the instructor when to use certain training aids.
7. Review section. The instructor should review the main topics and the course objectives, and address any additional student questions

Displays used in the lecture should be the same as the figures used in the student manual, unless the students are given a copy of the display as a handout.

3.2 Simulator Instructor Guides

The simulator instructor guides should give a daily agenda for the instructor to follow during the simulator training. It should closely follow the course outline, but will include guidance for the instructor on what should be done for each training session, both in the classroom and the simulator. The instructor guides are an aid to the instructor for maintaining course schedule but it should be permissible for the instructor to deviate from an instructor guide, based on student need and time requirements.

The instructor guides should be in an outline format and should basically be as follows:

Training session name or number.
Classroom agenda:
This will inform the instructor of the subjects to covered during this session and should include the name or number of the lesson plan to be used for instruction.

Simulator agenda:
This will inform the instructor of the task to be performed during the simulator session and should include the name or number of any lesson plans or scenarios to be used during this session. It should also include any special instructions for the instructor if any, ie. "Review EHC Panel before performing any exercises during this session".

3.3 Simulator Scenarios

The simulator scenarios will be fairly detailed and should include the following information for the instructor:

a. Simulator initial conditions.

b. Instructions to be given to the students
c. A list of remote functions and malfunctions expected to used during the exercise.
d. A time chart giving information on when a particular function is to be used and what the instructor should expect to see in the way of plant response, student actions, and a listing of the procedures the instructor should expect the students to use during the exercise.
e. Guidance for the instructor on when to terminate the exercise, ie "Terminate the exercise when the students stabilize the reactor water level at normal level".
f. Guidance for the instructor for reviewing the exercise upon completion.

The simulator instructor guides are intended to be an aid to the instructor and can be deviated from on the student needs and time requirements.

4. Simulator Instructional Methodology Support Documentation

The Contractor shall submit instructional support documentation, that will include lesson plans, simulator scenarios, and presentation material, to assist the GAN and NRA in developing a training system for the use of the simulator in his training program.

Expenditure Reporting Categories

Contractor Personnel:	
US Contractors	PER1
Russian/Ukrainian Contractors	PER2
US Interpreters	PER3
Travel:	
Russian/Ukrainian Personnel	TVL1
NRC Personnel	TVL2
Training	TRNG
Equipment	EQPT
Other costs:	
Document Translation	DOCT
Admin Project Support	ADMN

Definitions for Expenditure Reporting Categories

Contractor Personnel:

US Contractors - Refers to personnel costs in contracts with US national laboratories or other US companies, includes contractor travel.

Russian/Ukrainian Contractors - Costs for services provided in-country.

US Interpreters - Costs for interpreter services contracted for in the US, including travel.

Travel:

Russian/Ukrainian Personnel - All costs associated with international and US domestic travel. Costs include the traditional costs associated with travel: transportation, per diem, lodging, local transportation, etc. This category does not include the travel for Russian/Ukrainian contractors.

NRC Personnel - All costs associated with international and domestic travel. Costs include the traditional costs associated with travel: transportation, per diem, lodging, local transportation, etc.

Training:

Training materials and associated equipment, such as books and computers.

Equipment:

Technical equipment that is not associated with training or general administrative support. For example, equipment and computers for safety analysis would be included in this category.

Other costs:

Document Translation - for NUREGS and other documents to support the project.

Administrative Project Support - Any administrative equipment, such as computers and printers, programs, software, which the Russians and Ukrainians need for participation in the project. Includes provision for administrative support personnel.

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AGREEMENT BETWEEN
THE GOVERNMENT OF THE UNITED STATES OF AMERICA
AND
THE GOVERNMENT OF THE RUSSIAN FEDERATION
REGARDING COOPERATION TO FACILITATE
THE PROVISION OF ASSISTANCE

The Government of the United States of America and the Government of the Russian Federation (hereinafter referred to as the "Parties"):

Being guided by a mutual desire to cooperate in facilitating the provision of humanitarian and technical assistance in support of market economic and democratic reform to benefit the people of the Russian Federation;

Recognising that the Government of the Russian Federation appreciates the humanitarian and technical assistance and notes the important positive role that non-governmental organisations of the United States of America can play in providing such assistance;

Recognising that full cooperation between the Parties will be aimed at the effective use of such assistance;

Have agreed as follows:

ARTICLE I
TAXES AND OTHER CHARGES

(a) Commodities, supplies or other property provided or

utilized in connection with United States assistance programs may be imported into, exported from, or used in the Russian Federation free from any tariffs, dues, customs duties, import taxes, and other similar taxes or charges imposed by the Russian Federation, or any subdivision thereof.

(b) Any United States Government or United States private organisation that has responsibility for implementing United States assistance programs, and any personnel of such private organisation who are not nationals of or ordinarily resident in the Russian Federation and that are present in the Russian Federation in connection with such programs, shall be exempt from (1) any income, social security or other taxes imposed by the Russian Federation, or any subdivision thereof, regarding income received in connection with the implementation of United States assistance programs, and (2) the payment of any tariffs, dues, customs duties, import taxes, and other similar taxes or charges upon personal or household goods imported into, exported from, or used in the Russian Federation for the personal use of such personnel or members of their families.

(c) The access and movement of aircraft and vessels operated by or for the Government of the United States of America in connection with United States assistance programs in the Russian Federation shall be free of landing fees, navigation charges, port charges, tolls and similar charges by the Russian Federation, or any subdivision thereof.

ARTICLE II
STATUS OF PERSONNEL

Personnel of the United States Government present in the Russian Federation in connection with United States assistance programs shall be accorded status equivalent to that accorded administrative and technical staff personnel under the Vienna Convention on Diplomatic Relations of April 18, 1961. Nothing in this Agreement shall be construed to derogate from the privileges and immunities to which personnel are otherwise entitled.

ARTICLE III
INSPECTION AND AUDIT

Upon reasonable request, representatives of the Government of the United States of America may examine the utilization of any commodities, supplies, other property, or services provided under United States assistance programs at sites of their location or use and may inspect or audit any and all records or other documentation in connection with the assistance during the period in which the United States provides assistance to the Russian Federation and for three years thereafter.

ARTICLE IV
USE OF ASSISTANCE

Any commodities, supplies, or other property provided under United States assistance programs will be used for agreed upon purposes. If use of any commodities, supplies or other property occurs for purposes other than those agreed upon under such programs, which could reasonably have been prevented by appropriate action of the Government of the Russian Federation, the Government of the Russian Federation upon request shall refund in United States dollars to the Government of the United States of America the amount originally disbursed for such commodities, supplies, or other property. The Government of the United States of America may, in its discretion, make available the amount refunded to finance other costs of the assistance activity involved.

ARTICLE V
OTHER AGREEMENTS

The Parties recognize that further arrangements or agreements may be necessary or desirable with respect to particular United States assistance activities. In case of any inconsistency between this Agreement and any such further written agreement, the provisions of such further written agreements shall prevail.

ARTICLE VI
ENTRY INTO FORCE, AMENDMENTS AND DURATION

(a) This Agreement shall enter into force upon signature by both Parties. This Agreement may be amended, which amendment shall enter into force upon signature by both Parties.

(b) This Agreement shall remain in force for 90 days after the receipt by either Party of written notification of the intention of the other to terminate it. In such event, the provisions of this Agreement shall continue to apply with respect to assistance furnished before the date of termination of this Agreement.

DONE at Moscow, this 4 day of April, 1992.

FOR THE GOVERNMENT OF
THE UNITED STATES OF AMERICA

FOR THE GOVERNMENT
THE RUSSIAN FEDERATION

A-4112

AGREEMENT BETWEEN
THE GOVERNMENT OF THE UNITED STATES OF AMERICA AND
THE GOVERNMENT OF UKRAINE
REGARDING HUMANITARIAN AND TECHNICAL ECONOMIC COOPERATION

The Government of the United States of America and the Government of Ukraine,

Recognizing their mutual interest in cooperation for the purpose of providing when needed humanitarian and technical economic assistance for the benefit of both countries, and

Recognizing the need to conclude further agreements of a practical and implementational nature to help ensure the effectiveness of this cooperation,

Have in this spirit agreed as follows:

ARTICLE I

TAXES AND OTHER CHARGES

(a) Commodities, supplies or other property provided or utilized in connection with United States assistance programs may be imported into, exported from, or used in Ukraine free from any tariffs, dues, customs duties, import taxes, and other similar taxes or charges imposed by Ukraine, or any subdivision thereof.

(b) Any United States Government or United States private organization that has legal responsibility for implementing United States assistance programs, and any personnel of such private organization who are not nationals of or ordinarily resident in Ukraine and that are present in Ukraine in connection with such programs, shall be exempt from (1) any income, social security or other taxes imposed by Ukraine, or any subdivision thereof, regarding income received in connection with the implementation of United States assistance programs, and (2) the payment of any tariffs, dues, customs duties, import taxes, and other similar taxes or charges upon personal or household goods imported into, exported from, or used in Ukraine for the personal use of such personnel or members of their families.

(c) The access and movement of aircraft and vessels operated by or for the Government of the United States of America in connection with United States assistance programs in

Ukraine shall be free of landing fees, navigation charges, port charges, tolls and similar charges by Ukraine, or any subdivision thereof.

ARTICLE II

STATUS OF PERSONNEL

Civilian and military personnel of the United States Government present in Ukraine in connection with United States assistance programs shall be accorded status equivalent to that accorded administrative and technical staff personnel under the Vienna Convention on Diplomatic Relations of April 18, 1961. Nothing in this Agreement shall be construed to derogate from the privileges and immunities to which such personnel are otherwise entitled.

ARTICLE III

INSPECTION AND AUDIT

Upon reasonable request, representatives of the Government of the United States of America may examine the utilization of any commodities, supplies, other property, or services provided under United States assistance programs at sites of their location or use; and may inspect or audit any records or other documentation in connection with the assistance wherever such records or documentation are located during the period in which the United States provides assistance to Ukraine and for three years thereafter.

ARTICLE IV

USE OF ASSISTANCE

Any commodities, supplies, or other property provided under United States assistance programs will be used solely for the purposes agreed upon between the Governments of the United States of America and Ukraine. If use of any commodities, supplies or other property occurs for purposes other than those agreed upon under such programs, which could reasonably have been prevented by appropriate action of the Government of Ukraine, the Government of Ukraine upon request shall refund in United States dollars to the Government of the United States of America the amount disbursed for such commodities, supplies, or other property. The Government of the United States of America may, in its discretion, make available the amount refunded to finance other costs of the assistance activity involved.

ARTICLE V

OTHER AGREEMENTS

The Government of the United States of America and the Government of Ukraine recognize that further arrangements or agreements may be necessary or desirable with respect to particular United States assistance activities. In case of any inconsistency between this Agreement and any such further written agreements, the provisions of such further written agreements shall prevail.

ARTICLE VI

ENTRY INTO FORCE

This Agreement shall enter into force upon signature by both parties.

DONE at Washington, this seventh day of May, 1992, in duplicate, in the English and Ukrainian languages, both texts being equally authentic.

FOR THE GOVERNMENT OF
THE UNITED STATES OF AMERICA:

James A. Baker III

FOR THE GOVERNMENT OF
UKRAINE:

L. Kravchuk

AGREEMENT BETWEEN THE GOVERNMENT OF UKRAINE AND THE GOVERNMENT OF THE UNITED STATES OF AMERICA CONCERNING OPERATIONAL SAFETY ENHANCEMENTS, RISK REDUCTION MEASURES AND NUCLEAR SAFETY REGULATION FOR CIVILIAN NUCLEAR FACILITIES IN UKRAINE

The Government of Ukraine and the Government of the United States of America, hereinafter referred to as the Parties;

Desiring to support the implementation of the Multilateral Nuclear Safety Initiative announced at the May 23, 1992, Lisbon meeting for the coordination of assistance to the States that were formerly a part of the Soviet Union;

Intending to build upon the framework for cooperation set forth in the Agreement between the Government of Ukraine and the United States of America Regarding Humanitarian and Technical Economic Cooperation of May 7, 1992 (the "Cooperation Agreement");

Have agreed as follows:

ARTICLE I

1. The Parties shall cooperate in order to assist Ukraine in achieving the following objectives:

(a) providing further operational safety enhancements by expediting development of emergency operating procedures, performance based training, and administrative and operational controls for VVER-440, VVER-1000 and RBMK civilian nuclear power reactors in Ukraine;

(b) reducing the risks associated with the operation of VVER-440, VVER-1000 and RBMK civilian nuclear power reactors in Ukraine; and

(c) developing consistent and effective safety standards and procedures for use by regulatory authorities in Ukraine responsible for the safety of civilian nuclear facilities.

2. Any assistance provided under this Agreement by the United States of America shall be used only for agreed upon purposes.

3. Cooperation may include, but is not limited to:

(a) improving nuclear plant equipment servicing and maintenance practices;

(b) improving diagnostic methods and hardware, and training for technical support personnel, including a full-scope simulator for operators;

(c) implementing safety analysis methodologies;

(d) improving confinement performance in case of severe accidents;

(e) developing methods to prevent uncontrolled hydrogen explosions in confinements;

(f) installing dedicated emergency diesels and feedwater pumps in protected areas;

(g) performing technical and fire safety assessments;

(h) improving basic fire prevention, detection, and response capabilities;

(i) designing reactor trip mechanisms for high risk failure modes;

(j) training in regulatory methods and procedures, inspection techniques and evaluation, regulatory law, and the use of radioactivity monitoring equipment; and

(k) improving regulatory effectiveness by developing appropriate regulatory standards, requirements, procedures and equipment.

ARTICLE II

1. The Parties shall coordinate and review implementation of this Agreement through the Joint Coordinating Committee for Civilian Nuclear Reactor Safety (the "JCCCNRS"), reporting to

the Joint Committee on Cooperation in the Peaceful Uses of Atomic Energy (the "JCC"), established under the Agreement Between the United States of America and the Union of Soviet Socialist Republics on Scientific and Technical Cooperation in the Field of the Peaceful Uses of Atomic Energy of June 1, 1990 (the "Peaceful Uses Agreement") and the Memorandum of Cooperation in the Field of Civilian Nuclear Reactor Safety Between the United States of America and the Union of Soviet Socialist Republics of April 26, 1988 (the "CNRS-MOC").

2. If the Peaceful Uses Agreement or the CNRS-MOC expires or otherwise terminates before the expiration or termination of this Agreement, the JCCCNRS and JCC shall remain in effect during the period this Agreement is in force for the purposes set forth in Paragraph 1 of this Article.

ARTICLE III

1. Articles I ("Taxes and Other Charges"), II ("Status of Personnel"), III ("Inspection and Audit"), and IV ("Use of Assistance") of the Cooperation Agreement, Article III (relating to the JCCCNRS) of the CNRS-MOC, and Article 6 (relating to the JCC) of the Peaceful Uses Agreement shall apply to any assistance provided by the United States under this Agreement.

2. The Parties may enter into implementing agreements to accomplish the objectives set forth in Article I of this Agreement.

3. In case of any inconsistency between this Agreement and any implementing agreement, the provisions of this Agreement shall prevail.

ARTICLE IV

1. The Government of Ukraine shall, in respect of legal proceedings and claims, other than contractual claims, hold harmless and bring no legal proceedings against the Government of the United States of America and its personnel, or against contractors and contractors' personnel of the Government of the United States of America, for damage to property owned by Ukraine, or death or injury to any personnel of Ukraine, arising out of activities pursuant to this Agreement.

2. Claims by third parties, arising out of the acts or omissions of the Government of the United States of America or its personnel, or of contractors or contractors' personnel of the Government of the United States of America, done in the performance of official duty, or arising out of any act, omission or occurrence for which the United States of America is otherwise legally responsible under the law of Ukraine, shall be the responsibility of the Government of Ukraine.

3. The provisions of this Article shall not prevent the Parties from providing compensation in accordance with their national laws.

4. Nothing in this Article shall be interpreted to prevent legal proceedings or claims against nationals of Ukraine or permanent residents of Ukraine in connection with activities within the framework of this Agreement.

ARTICLE V

Assistance of the Government of the United States of America, in accordance with this agreement, shall be provided in accordance with the national laws and regulations of each Party, and shall be subject to the availability of appropriated funds and the mutual agreement of the Parties.

ARTICLE VI

This Agreement shall enter into force upon signature and shall remain in force for a period of five (5) years. This Agreement may be terminated prior to its expiration by either Party upon six (6) months written notice to the other Party of its intention to do so. In either event, the provisions of Articles II, III and IV of this Agreement shall continue to apply with respect to assistance furnished before the date of expiration or termination of this Agreement, unless otherwise agreed by the Parties in writing.

DONE at Kiev, this 25th day of October , 1993, in duplicate, each in the Ukrainian and English languages, both texts being equally authentic.

FOR THE GOVERNMENT OF UKRAINE:

FOR THE GOVERNMENT OF THE UNITED STATES OF AMERICA:

Warren Christopher

DEPARTMENT OF STATE
WASHINGTON

October 25, 1993

Excellency:

I have the honor to refer to the Agreement signed today between the Government of the United States of America and the Government of Ukraine Concerning Operational Safety Enhancements, Risk Reduction Measures and Nuclear Safety Regulation for Civilian Nuclear Facilities in Ukraine (the "Agreement"). In this connection, the Government of the United States of America wishes to propose to the Government of Ukraine the following understandings:

The term "contractors" includes all persons and organizations engaged in carrying out contracts entered into by the Government of the United States of America pursuant to the Agreement, including sub-contractors, consultants, suppliers and sub-suppliers of equipment and services at any tier.

Article IV(1) is a waiver of claims for direct, indirect and consequential damages and applies to claims brought by the Government of Ukraine; it does not apply to third-party claims. The term "contractual claims" contained in Article IV(1) refers only to claims brought in order to enforce

His Excellency
Anatoliy M. Zlenko,
Minister of Foreign Affairs of Ukraine,
Kiev.

contracts to which the Government of Ukraine or Ukrainian nationals are party. The term "contractual claims" does not refer to claims for property damage, including consequential damages, nor for death or personal injury, nor to claims relating to contracts between the Government of the United States of America and other persons for the implementation of the Agreement.

The term "official duty" contained in Article IV(2) encompasses all activities undertaken pursuant to the Agreement by employees of the Government of the United States of America, or by its contractors and their employees.

The "responsibility of the Government of Ukraine" referred to in Article IV(2) includes the obligation to provide for the adequate defense of, to indemnify and to hold harmless the Government of the United States and its employees, as well as its contractors and their employees, in connection with any claim brought against any of them in any court or other forum in any country in connection with activities undertaken pursuant to the Agreement.

Obligations undertaken by Ukraine pursuant to Article IV relating to civilian nuclear power reactors that Ukraine owns at the time the Agreement enters into force shall remain in effect regardless of any subsequent transfer of ownership of those reactors, and pursuant to Article VI, shall remain in effect notwithstanding the termination or expiration of the Agreement.

If the Government of Ukraine agrees to the aforementioned proposal, this note and your note to that effect shall constitute an understanding between our governments, and shall form an integral part of the Agreement.

Accept, Excellency, the renewed assurances of my highest consideration.

Warren Christopher

A7714

AGREEMENT BETWEEN
THE GOVERNMENT OF THE UNITED STATES OF AMERICA
AND
THE GOVERNMENT OF THE RUSSIAN FEDERATION
CONCERNING OPERATIONAL SAFETY ENHANCEMENTS, RISK REDUCTION MEASURES AND NUCLEAR SAFETY REGULATION FOR CIVIL NUCLEAR FACILITIES IN THE RUSSIAN FEDERATION

The Government of the United States of America and the Government of the Russian Federation, hereinafter referred to as the "Parties":

Desiring to support the implementation of the Multilateral Nuclear Safety Initiative announced at the May 23, 1992, Lisbon meeting for the coordination of assistance to the states that were formerly a part of the Union of Soviet Socialist Republics;

Taking into account the Agreement between the Government of the United States of America and the Government of the Russian Federation Regarding Cooperation to Facilitate the Provision of Assistance of April 4, 1992, hereinafter referred to as the Assistance Agreement;

Have agreed as follows:

Article I

1. The Parties shall cooperate to facilitate the achievement of the following objectives:

(a) providing further operational safety enhancements by expediting development of emergency operating procedures, performance based training, as well as administrative and operational controls for VVER-440, VVER-1000 and RBMK nuclear power reactors in the Russian Federation;

(b) reducing the risks associated with the operation of VVER-440, VVER-1000 and RBMK nuclear power reactors in the Russian Federation; and

(c) consistently and effectively improving nuclear and radiation safety standards and regulations for use in the Russian Federation.

2. Cooperation may include, but is not limited to:

(a) improving equipment servicing and maintenance for nuclear power plants with VVER-440, VVER-1000 and RBMK nuclear power reactors;

(b) improving the equipment of management and control systems, diagnostic methods and hardware and training for technical personnel;

(c) implementing safety analysis methodologies;

(d) improving the characteristics of confinements in case of severe accidents;

(e) developing methods to prevent uncontrolled hydrogen explosions in confinements;

(f) installing dedicated emergency diesels and feedwater pumps in protected areas;

(g) performing technical and fire safety assessments;

(h) improving basic fire prevention, detection, and response capabilities;

(i) designing reactor scram mechanisms for high-risk failure modes;

(j) training in regulatory methods and procedures, inspection techniques and analysis, regulatory laws, and the use of radioactivity monitoring equipment; and

(k) improving regulatory effectiveness by developing appropriate regulatory standards, requirements and procedures, as well as by procuring equipment.

3. Any assistance provided under this Agreement shall be subject to the provisions of the Assistance Agreement, unless provided otherwise in this Agreement. Both Parties shall take all necessary measures under the laws and regulations of their respective countries to implement their obligations under this Agreement.

Article II

1. The Parties shall coordinate and review implementation of this Agreement through the Joint Coordinating Committee for Civilian Nuclear Reactor Safety (the "JCCCNRS"), reporting to the Joint Committee on Cooperation in the Peaceful Uses of Atomic Energy (the "JCC"), established under the Agreement between the United States of America and the Union of Soviet Socialist Republics on Technical Cooperation in the Field of the Peaceful Uses of Atomic Energy of June 1, 1990 (the "Peaceful Uses Agreement") and the Memorandum of Cooperation in the Field of Civilian Nuclear Reactor Safety between the United States of America and the Union of Soviet Socialist Republics of April 26, 1988 (the "CNRS-MOC").

2. If the Peaceful Uses Agreement or the CNRS-MOC expires or otherwise terminates before the expiration or termination of this Agreement, the JCCCNRS and JCC shall remain in effect during the period this Agreement is in force for the purposes set forth in paragraph 1 of this Article.

Article III

1. The Parties may enter into implementing agreements as appropriate to accomplish the objectives set forth in Article I of this Agreement.

2. In case of any inconsistency between this Agreement and any implementing agreement, the provisions of this Agreement shall prevail.

Article IV

1. With the exception of claims for damage or injury against individuals arising from their premeditated actions, the Government of the Russian Federation shall bring no claims or other legal proceedings arising from activities undertaken pursuant to this Agreement against the Government of the United States of America and its personnel or its contractors, subcontractors, consultants, suppliers or subsuppliers of equipment or services at any tier and their personnel, for indirect, direct or consequential damage to property owned by the Russian Federation. This paragraph shall not apply to legal actions brought by the Government of the Russian Federation to enforce the provisions of contracts to which it or a Russian national is a party.

2. With the exception of claims for damage or injury against individuals arising from their premeditated actions, the Government of the Russian Federation shall provide for the adequate defense of, indemnify, and shall bring no claims against, the Government of the United States of America and its personnel and its contractors, subcontractors, consultants, suppliers or subsuppliers of equipment or services at any tier and their personnel in connection with third-party claims in any court or forum arising from activities undertaken pursuant to this Agreement for injury or damage occurring within or outside the territory of the Russian Federation that results from a nuclear incident occurring within the territory of the Russian Federation. Nothing in this paragraph shall be construed as acknowledging the jurisdiction of any court or forum over third-party claims to which this paragraph applies, nor shall it be construed as waiving the sovereign immunity of either Party with respect to third-party claims that may be brought against it.

3. The Parties may, as necessary, conduct consultations regarding claims and legal proceedings concerning this Article.

4. The provisions of this Article shall not prevent the Parties from providing compensation in accordance with their national laws.

5. Nothing in this article shall be interpreted to prevent legal proceedings or claims against nationals of the Russian Federation or permanent residents of the Russian Federation.

6. The Government of the United States of America shall strive to ensure delivery of equipment and services of high quality and their performance in accordance with mutually acceptable specifications. The Government of the Russian Federation shall accept final delivery after determining conformity with mutually acceptable specifications.

7. The obligations undertaken by the Government of the Russian Federation pursuant to this Article relating to nuclear power reactors it owns at the time this Agreement enters into force shall remain in effect regardless of any subsequent transfer of ownership of those reactors, and, pursuant to Article VI, shall remain in effect notwithstanding the termination or expiration of this Agreement.

Article V

Assistance of the Government of the United States of America in accordance with this Agreement shall be provided subject to the availability of appropriated funds and the mutual agreement of the Parties.

Article VI

1. This Agreement shall enter into force upon signature and shall remain in force for a period of five years. This Agreement may be terminated prior to its expiration by either Party upon six months written notice to the other Party of its intention to do so. In either event, the provisions of this Agreement shall continue to apply with respect to assistance furnished before the date of expiration or termination, unless the Parties otherwise agree in writing.

2. This Agreement may be extended for additional five-year terms by written agreement of the Parties.

DONE at Moscow, this sixteenth day of December, 1993, in duplicate, in the English and Russian languages, each text being equally authentic.

FOR THE GOVERNMENT OF THE UNITED STATES OF AMERICA:

FOR THE GOVERNMENT OF THE RUSSIAN FEDERATION: