POLICY ISSUE
(INFORMATION)

April 5, 2001 SECY-01-0059

FOR: The Commissioners

FROM: William D. Travers /RA/
Executive Director for Operations

SUBJECT: STATUS OF USNRC RESEARCH CONDUCTED BY THE RUSSIAN RESEARCH CENTER (KURCHATOV INSTITUTE) AND THE RUSSIAN ACADEMY OF SCIENCES

PURPOSE:

To inform the Commission of progress made in 2000 on research sponsored by the U.S. Nuclear Regulatory Commission (USNRC) at the Russian Research Center (RRC) (the Kurchatov Institute) and the Institute of Nuclear Safety of the Russian Academy of Sciences (IBRAE/RAS). Also, to inform the Commission of the staff's plan to continue these arrangements in 2001 provided that research results continue to be of value to the USNRC and that measurable progress is being made. We will inform the Commission annually of these programs.

SUMMARY:

For the past several years, the RRC and the RAS have performed research work for the USNRC under bilateral agreements. This work is funded by the Office of Nuclear Regulatory Research and has involved research in code development and assessment, hydrogen combustion experiments, evaluation of high-burnup fuel test data, in-vessel debris coolability experiments, evaluation of reactor pressure vessel surveillance capsule data, uncertainty analysis methods, and development of concrete containment failure criteria.

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The results of this work have led to code improvements, expanded data bases and confirmatory research information. This work has also helped the Russians become familiar with USNRC analytical tools, safety issues, and Western approaches to safety. It is our intent to continue these programs in 2001 at a level comparable to that in 2000. The proposed Implementing Agreements for the 2001 work are attached to this paper.

BACKGROUND:

In SECY-91-375, "Proposed Arrangement with the I.V. Kurchatov Institute for Atomic Energy of the U.S.S.R. on Severe Accident Experiments," SECY-92-015, SECY-93-350, SECY-95-021, SECY-96-036, SECY-97-050, SECY-98-049, SECY-99-078, and SECY-00-0072, "Status of NRC Research Conducted by the Russian Research Center (I.V. Kurchatov Institute) and the Institute of Nuclear Safety of the Russian Academy of Sciences," the staff provided descriptions of research programs being conducted in Russia for the USNRC and recommended to the Commission that continued research cooperation between the USNRC and the RRC and the RAS was in the best interest of the USNRC. The Commission endorsed the staff recommendation.

The work currently being performed for the USNRC by the RRC is described in the Implementing Agreement on Severe Accident Research between the USNRC and RRC. A copy of Addendum 4 to this Implementing Agreement describing the work in 2000 was enclosed with SECY-00-0072. The work covered by the addendum consisted of :

- Measuring mechanical properties of cladding from high-burnup fuel and evaluating those results for applicability to the analysis of safety transients

- Developing and demonstrating a 3-D reactor transient physics code

The FY 2000 cost to the USNRC for this work specified in the addendum was $150K in accordance with the Agreement.

The work being performed for the USNRC by RAS is described in the Implementing Agreement on the Development and Application of Nuclear Safety Analysis Codes between the USNRC and the Institute of Nuclear Safety (IBRAE) of the RAS. A copy of Addendum 5 to this Implementing Agreement describing the work in 2000 was also enclosed with SECY-00-0072. The 2000 work covered by the addendum consisted of:

- Probabilistic risk assessment contributors to uncertainty

The FY 2000 cost to the USNRC for this work was $80K in accordance with the Agreement.

An additional task was added to Addendum 5 (under Article II.B.2 of the addendum) in early FY 2001 to assess the latest version of the MELCOR code (Version 1.8.5) which was released in December 2000. The FY 2001 cost to the USNRC for this work is $100K of which $75K has already been paid.

DISCUSSION:

Discussed below is a summary of the work performed in 2000 under Addenda 4 and 5 of the Implementing Agreements, and our plans for continuing work in 2001. The Implementing Agreement with the RRC expired on February 23, 2001, and the Implementing Agreement with the RAS expired on December 31, 2000. The proposed Implementing Agreements to continue this work at the RRC and RAS for a 5-year period are attached to this paper.

WORK AT THE RUSSIAN RESEARCH CENTER

Work Completed in 2000

- High-Burnup Fuel

During 2000, the high-burnup fuel work consisted of performing axial tensile tests on irradiated and unirradiated Alloy E110 fuel rod cladding and reassessing and summarizing earlier Russian data on that alloy that were not generated in this program. The temperature range was expanded in 2000 to cover conditions of loss-of-coolant accidents (high temperatures) as well as reactivity accidents (low temperatures), which were the focus of earlier work. These are the two accident types that are postulated for safety analysis around the world to ensure that plausible events do not degrade into core melt accidents. A report on Mechanical Properties of Unirradiated and Irradiated Zr-1%Nb Cladding covering the low temperature regime was submitted and is currently in publication as a NUREG/IA report. Mechanical properties from this program will be incorporated in USNRC's FRAPTRAN fuel rod computer code, which is being used to resolve high-burnup issues associated with reactivity accidents and loss-of-coolant accidents. These mechanical properties will let the staff make estimates of the behavior of the newer niobium-bearing alloys (M5 and ZIRLO) that are in use in the U.S. for which mechanical properties data are not yet available (or not available to the USNRC). While there may be some differences in the mechanical properties of niobium-bearing alloys manufactured by different vendors, the general effects of adding niobium should be apparent. Insights from the Russian data have also been used directly by USNRC in reviewing licensing submittals for the newer alloys and in assessing regulatory criteria.

- 3-D Reactor Physics

Comparisons of the Russian BARS code and USNRC’s PARCS code have been very useful because they are state-of-the art detailed codes that are needed for the analysis of reactivity accidents in light of substantially reduced acceptance criteria for high-burnup fuel. These two codes have completely different developmental origins, and their comparison provides insights and confidence in their analytic capabilities. During 2000, sensitivity analyses were carried out on important parameters for the TMI-1 rod-ejection benchmark calculations that had been previously performed. A report on this work (NSI RRC KI 90-12/1-1-01) has been issued. Analysis of boron-dilution events, another type of reactivity accident, was begun. The PARCS code will be used by USNRC for confirmatory plant transient analysis once high-burnup criteria are established for the reactivity accidents.

Work Planned for 2001

Attachment 1 to this paper describes the work planned in 2001 at the RRC. This work is summarized below:

- High-Burnup Fuel

Continue assessment of earlier Russian data for conditions of loss-of-coolant accidents. Perform ring-compression tests and axial tensile tests of oxidized specimens of irradiated and unirradiated E110 cladding to determine the zero-ductility conditions for analysis of loss-of-coolant accidents. Transfer all Russian special modeling that was incorporated in USNRC 's FRAP-T6 fuel rod transient code and MATPRO materials property library to USNRC's new FRAPTRAN code and updated MATPRO library.

- 3-D Reactor Physics

Additional calculations will be made of a TMI-1 rod-ejection accident to compare beginning-of-cycle and end-of-cycle behavior, and to compare central-rod and peripheral-rod behavior. Sensitivity studies will be initiated on boron-dilution accidents to examine major uncertainties. Modifications will be made to the BARS code for calculating partial cores of mixed-oxide fuel (MOX) to benchmark the results to those using the USNRC PARCS codes. The cost to the USNRC for the 2001 work described above is $150K.

WORK AT THE RUSSIAN ACADEMY OF SCIENCES

Work Completed in 2000

- Probabilistic Risk Assessment – Contributors to Uncertainty

The RAS effort during FY 2000 was focused on assessing the change in acceptance criteria for loss of coolant accidents (LOCA) as the break size is reduced from the large break LOCA to smaller breaks. A draft report was received and is undergoing review. This work is being used by the staff in its evaluation of the feasibility of risk-informing 10 CFR 50 (Option 3)

Work Planned for 2001

Attachment II to this paper describes the work planned in 2001 at the RAS. This work is summarized below:

- Assessment of MELCOR Version 1.8.5

RAS will assess MELCOR Version 1.8.5 using application to a VVER-1000 plant as a test case. Feedback on models and user characteristics will be provided to USNRC. It should be noted that this work was started in December 2000, upon release of the code, under Addendum 5. The cost to the USNRC for this work is $100K, of which $75K has already been paid as discussed in the background section of this paper.

- Risk Communication

RAS plans to explore approaches to improve risk communication. The objective of the work is to assess approaches in various countries and industries with respect to the risks to the public, how these risks are managed and communicated. FY 2001 USNRC funding of $50K will help to support this activity.

CONCLUSION:

Given the progress to date on the ongoing programs, the expectation that the 2001 work described above can be successfully carried out, and the relatively small funding involved, we believe that it is in the best interest of the USNRC to continue our agreements with the RRC and RAS. The benefits from the research conducted by the RRC and the RAS are discussed in Attachment III. As noted in the Discussion Section, the Implementing Agreement with the RRC expired on February 23, 2001, and the Implementing Agreement with the RAS expired on December 31, 2000. Accordingly, new Implementing Agreements with the RRC and RAS for a period of 5 years have been prepared and are attached. I intend to forward these to the RRC and RAS for signature.

RESOURCES:

The cost to the USNRC in FY 2001 of the research summarized above would be $150K for the RRC and $150K for the RAS of which $75K has already been paid due to the early start of this work under Article II.B.2 of Addendum 5. These costs do not include the cost of travel, which will be paid for by the RRC and RAS. Funds for this research work are in the FY 2001 Office of Nuclear Regulatory Research budget.

COORDINATION:

This paper has been coordinated with the Office of International Programs, which has no objection, the Office of the Chief Financial Officer, which has no resource objection, and the Office of the General Counsel, which has no legal objection.

I will continue to keep the Commission informed of progress on the USNRC sponsored research at the RRC and the RAS.

/RA by William F. Kane Acting For/

William D. Travers
Executive Director
for Operations

Attachments:
I. Implementing Agreement Between the U.S. NRC and the Russian Research Center
II. Implementing Agreement Between the U.S. NRC and The Institute of Nuclear Safety of the Russian Academy of Sciences
III. Benefits from Research Conducted by the Russian Research Center and Russian Academy of Sciences

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IMPLEMENTING AGREEMENT
BETWEEN
THE UNITED STATES NUCLEAR REGULATORY COMMISSION (USNRC)
AND
THE RUSSIAN RESEARCH CENTER (RRC)
FORMERLY THE I.V. KURCHATOV INSTITUTE FOR ATOMIC ENERGY (KI)
ON FUEL BEHAVIOR RESEARCH

Considering that the United States Nuclear Regulatory Commission (USNRC) and Russian Research Center, formerly the I.V. Kurchatov Institute for Atomic Energy (RRC-KI):

A. Have been cooperating in the area of civilian nuclear reactor safety as part of a 5-year 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 signed on December 16, 1993, hereinafter "Agreement";

B. Have been conducting joint cooperative nuclear safety activities through the Joint Coordinating Committee for Civilian Nuclear Reactor Safety (JCCCNRS) (pursuant to the Memorandum of Cooperation in the Field of Civilian Nuclear Reactor Safety of April 26, 1988, and the Agreement between the United States of America and the Union of Soviet Socialist Republics on Scientific and Technical Cooperation in the Field of Peaceful Uses of Atomic Energy of June 1, 1990; hereinafter Peaceful Uses Agreement). The JCCCNRS has been acknowledged as the implementing committee for the above Agreement;

C. Have a mutual interest in cooperation in the field of nuclear safety research, with the objective of improving the safety of reactors on an international basis;

D. Have, as a mutual objective, reciprocity in the exchange of technical information in the field of reactor safety research;

The USNRC and the RRC have adopted the following terms and conditions as an implementing agreement.

ARTICLE I – PROGRAM COOPERATION

The USNRC and the RRC, in accordance with the provisions of this Implementing Agreement and subject to applicable laws and regulations in force in the respective Countries, will join together in nuclear safety programs related to the behavior of reactor fuel, especially the behavior of reactor fuel with high burnup.

ARTICLE II – FORMS OF COOPERATION

Cooperation between the parties may take the following forms:

A. The exchange of information in the form of experimental results, technical reports, code validation data, correspondence, newsletters, visits, joint meetings, and such other means as the parties agree.

B. The temporary assignment of personnel of one party or of its contractors to laboratories or facilities owned by the other party; each assignment to be considered on a case-by-case basis and to be the subject of a separate attachment-of-staff arrangement between the parties.

C. The execution of joint programs and projects, including those involving a division of activities between the parties; each joint program and project may be considered on a case-by-case basis and may be the subject of a separate arrangement between the parties.

D. The use by one party of facilities that are owned by the other party; such use of facilities may be the subject of separate arrangements between the parties and may be subject to commercial terms and conditions.

E. If either party wishes to visit, assign personnel, or use the facilities owned or operated by entities other than the parties to this Implementing Agreement, the parties recognize that the approval of such entities will in general be required with respect to the terms upon which such visit, assignment, or use will be made.

F. Any other form agreed between the parties.

ARTICLE III – SCOPE OF COOPERATION

The objectives of this Implementing Agreement are to (a) obtain experimental data on the behavior of Zr-1%Nb fuel rod cladding under postulated accident conditions, (b) advance the development of fuel rod codes that are used to analyze fuel behavior under accident conditions, and (c) explore and modify plant transient codes for analyzing postulated accidents in light-water reactors containing high-burnup fuel.

A. <u>USNRC Scope of Responsibility</u>

Subject to Article VI, the USNRC will provide and coordinate the provision of the following specified goods and services related to the study of fuel behavior.

1. Codes

    a. The USNRC will transmit to the RRC the following fuel behavior computer codes and associated documentation developed by the USNRC: FRAPCON-3, FRAP-T6, FRAPTRAN, MATPRO. These computer codes will include the latest versions for PC and workstation applications.

b. The USNRC will also accommodate reasonable requests from RRC regarding installation and use of these codes on PCs and workstations.

c. The USNRC will provide input data for U.S. plant designs and other parameters that may become part of analytical activities that are undertaken.

2. Meetings, Visits, and Exchange of Personnel

Subject to Article V.J of this Implementing Agreement, the USNRC will:

a. Permit Russian personnel sponsored by RRC to attend, as appropriate, technical program review meetings and technical progress meetings related to this Implementing Agreement.

b. Facilitate visits of RRC-sponsored personnel to laboratories at which USNRC-sponsored work related to this Implementing Agreement is being conducted.

c. Permit the assignment of RRC-sponsored personnel to participate in USNRC nuclear safety programs related to this Implementing Agreement and to have ready access to relevant documentation associated with severe accident codes and concrete containment performance.

3. The USNRC will direct and coordinate with the RRC the above activities to assure timely and effective completion of the above tasks.

4. During the course of this cooperation, the USNRC and RRC will develop specific tasks such as those listed above. These tasks, once developed, will be included as technical appendices to this agreement.

B. <u>RRC-KI Scope of Responsibility</u>

1. Experimental Investigations

Perform experimental tests and measurements on irradiated and unirradiated fuel rod cladding in laboratories, hot cells, and test reactors. These investigations are to be performed on Russian cladding alloys that are similar to alloys being used in the U.S. and are therefore of mutual interest.

2. Code Development and Applications

Modify USNRC fuel rod computer codes, which have been developed for Zircaloy cladding, such that they are applicable to Russian cladding alloys. Provide models, materials properties, and correlations in forms that are compatible with USNRC codes and materials properties libraries. Perform studies with Russian plant transient codes in comparison with U.S. plant transient codes for the purpose of validation and further development.

3. Additional Work

Subject to availability of funds and agreement between USNRC and RRC, additional work related to fuel behavior research or 3-D reactor physics may be added under this Agreement, subject to USNRC receipt and approval of a work plan.

4. Quarterly Technical and Financial Progress Reports

The RRC will prepare a quarterly summary letter report on each of the above tasks. Each report should include: the title of the project, a Financial Identification Number (FIN) to be provided by the USNRC, the period of performance, and the reporting period. This report should contain two sections as indicated below.

4.1 Project Status Section

This section should include the following:

a. A listing of the efforts completed during the period and milestones reached or, if missed, an explanation why.

b. Any problems or delays encountered or anticipated and recommendations for resolution.

c. A summary of progress to date (this may be expressed in terms of percentage completion for the project).

d. Planned accomplishments for the next reporting period.

e. Preliminary or interim results, conclusions, trends, or other items of information that the RRC believes are of timely interest to the USNRC.

f. Problems or delays experienced by the RRC in the conduct of this effort and the proposed resolutions

4.2 Financial Status Section

Provide the total amount of funds expended (cost) during the reporting period for each task identifying the major items of expense and the total cumulative expenditure for the year to date.

5. Audit and Record Requirements

The RRC shall maintain complete accounting records of all funds provided to it by the USNRC under this Implementing Agreement in accordance with accounting principles generally accepted in the Russian Federation. These accounting records shall be maintained for a period of no less than 3 years after the expiration of this Implementing Agreement. The USNRC, or other authorized U.S. Government officials shall have full access to the accounting records for the purposes of financial audit during the period of

this Implementing Agreement and, after its expiration, for a period of no less than 3 years.

6. Meetings, Visits and Exchange of Personnel

   In accordance with Article V.J. of this Implementing Agreement, the RRC will:

   a. Permit USNRC personnel or contractors sponsored by USNRC to attend, as appropriate, technical program review meetings and technical progress meetings concerning RRC work related to this Implementing Agreement.

   b. Facilitate visits of USNRC personnel or contractors sponsored by USNRC to laboratories at which RRC-sponsored work related to this Implementing Agreement is being conducted.

   c. Permit the assignment of USNRC personnel or its contractors sponsored by USNRC to participate in the RRC nuclear safety program related to this Implementing Agreement and to have ready access to relevant nuclear reactor safety documentation, codes and results.

   d. Attend USNRC's annual Water Reactor Safety Meeting and Cooperative Severe Accident Research Meetings to present results of research work as requested. In general, this will involve annually two trips to the U.S.

ARTICLE IV – FINANCIAL CONSIDERATIONS

The ability of the parties to carry out their obligations is subject to the appropriation of funds by the appropriate governmental authorities and to laws and regulations applicable to the parties. Subject to the availability of funds, the USNRC will provide the RRC the sum of $150,000 in Fiscal Year 2001. The first payment of $75,000 will be made upon approval of a work plan called a Description of Work. RRC will complete a Description of Work acceptable to both parties within 60 days after entry into force of this Implementing Agreement. A second payment of $75,000 will be made in July 2001. Payment will be made upon receipt of RRC invoices, subject to U.S. Government rules and regulations.

If other technical appendices are developed during the course of this cooperation, the resulting financial considerations will be included in those appendices.

ARTICLE V – ADMINISTRATION OF THE IMPLEMENTING AGREEMENT

A. The USNRC and the RRC will each designate one representative to coordinate and determine the detailed implementation of this Implementing Agreement. This designated representative will be referred to as an Administrator of the Implementing Agreement. The Administrators may, at their discretion, delegate this responsibility to the appropriate individuals with respect to a given issue.

B. This Implementing Agreement states restrictions concerning dissemination of proprietary or other confidential or privileged information. Other information that my be restricted includes matters related to organization, budget, personnel, or management.

C. Each party to this Implementing Agreement will have access to all reports written by its partner's technical personnel assigned to the respective activities that derive from participation in this Implementing Agreement.

D. Subject to Article VG. and VH., USNRC-supplied codes and analytical techniques and any improvements, modifications or updates to such codes or techniques will not be disseminated to other parties outside the Russian Federation without the consent of the USNRC.

E. Except for dissemination to USNRC and its principal contractors in accordance with this Implementing Agreement, RRC-supplied codes and analytical techniques and any improvements, modifications or updates to such codes and techniques will not be disseminated to other parties outside the U.S. without the consent of the RRC.

F. The application or use of any codes exchanged or transferred between the parties under this Implementing Agreement shall be the responsibility of the receiving party, and the transmitting party does not warrant the suitability of such codes for any particular use or application.

G. The USNRC computer codes disseminated under this Implementing Agreement are to be considered privileged information unless otherwise noted, are protected as such by the USNRC, and shall be treated likewise by RRC. They are in particular, subject to all the provisions of Article VI including the requirements for an agreement of confidentiality prior to dissemination, with the exception that they need not be marked with the restrictive designation. The codes are subject to this protection in both object and source forms and as recorded in any media.

H. The USNRC computer codes and other related analytical techniques that are provided to the RRC under this Implementing Agreement and any improvements, modifications or updates to such codes or techniques are for the purpose of this Implementing Agreement and shall not be used by RRC or other parties within the Russian Federation for commercial purposes; that is, for financial or other benefits not concerned with the study of reactor safety.

   Among the code uses that will be permitted under this Implementing Agreement are those related to research in the reactor safety area and analyses performed by the members or their contractors that can assist regulators and plant personnel in assessing the safety of the plant, analyzing operating events, and training of operators. Specific examples of permitted analyses include: design basis accidents (e.g., loss-of-coolant accidents), anticipated transients, accident management and emergency operating procedures, mid-loop operation, analysis to support PRA success criteria, power upgrades and reload.

   Prohibited uses of the code include: (1) analyses to develop a new reactor design, and (2) analyses to support power upgrades and reload in the U.S. unless performed by a U.S. subsidiary.

I. The USNRC codes and other related analytical techniques shall not be advertised directly or by implication to obtain contracts related to the construction, servicing, or refueling of nuclear facilities, nor shall advertising imply that the USNRC has endorsed any analysis or techniques.

J. It is understood that the USNRC makes no warranties whatsoever for the ability or suitability of any USNRC code or other analytical technique to perform in any particular manner for any particular purpose, or to accomplish any particular task. It is further understood that the USNRC accepts no liability for damages of any type that may result from the use of the USNRC codes or other analytical techniques provided under this Implementing Agreement.

K. Travel costs, living expenses, and salaries will be borne by the parties who incurred them unless specified otherwise.

ARTICLE VI – EXCHANGE AND USE OF INFORMATION AND INTELLECTUAL PROPERTY

A. General

The Parties support the widest possible dissemination of information provided or exchanged under this Implementing Agreement, subject both to the need to protect proprietary or other confidential or privileged information as may be exchanged hereunder, and to the provisions of the Intellectual Property Addendum, which is an integral part of this Implementing Agreement.

B. Definitions (As used in this Implementing Agreement)

1. The term "information" means nuclear energy-related regulatory, safety, safeguards, waste management, scientific, or technical data, including information on results or methods of assessment, research, and any other knowledge intended to be provided or exchanged under this Implementing Agreement.

2. The term "proprietary information" means information made available under this Implementing Agreement which contains trade secrets or other privileged or confidential commercial information (such that the person having the information may derive an economic benefit from it or may have a competitive advantage over those who do not have it), and may only include information which:

   a. has been held in confidence by its owner;

   b. is of a type which is customarily held in confidence by its owner;

   c. has not been transmitted by the owner to other entities (including the receiving party) except on the basis that it be held in confidence;

   d. is not otherwise available to the receiving party from another source without restriction on its further dissemination; and

   e. is not already in the possession of the receiving party.

3. The term "other confidential or privileged information" means information, other than "proprietary information," which is protected from public disclosure under the laws and regulations of the country of the party providing the information and which has been transmitted and received in confidence.

C. Marking Procedures for Documentary Proprietary Information

A party receiving documentary proprietary information pursuant to this Implementing Agreement shall respect the privileged nature thereof, provided such proprietary information is clearly marked with the following (or substantially similar) restrictive legend:

> "This document contains proprietary information furnished in confidence under an Implementing Agreement dated _____ between the United States Nuclear Regulatory Commission and the Russian Research Center and shall not be disseminated outside these organizations, their consultants, contractors, and licensees, and concerned departments and agencies of the Government of the United States and the Government of the Russian Federation without the prior approval of (name of transmitting party). This notice shall be marked on any reproduction hereof, in whole or in part. These limitations shall automatically terminate when this information is disclosed by the owner without restriction."

This restrictive legend shall be respected by the receiving party and proprietary information bearing this legend shall not be used for commercial purposes, made public, or disseminated in any manner unspecified by or contrary to the terms of this Implementing Agreement without the consent of the transmitting party.

D. Dissemination of Documentary Proprietary Information

1. In general, proprietary information received under this Implementing Agreement may be freely disseminated by the receiving Party without prior consent to persons within or employed by the receiving Party, and to concerned Government departments and Government agencies in the country of the receiving Party.

2. In addition, proprietary information may be disseminated without prior consent to contractors or consultants of the receiving Party located within the geographical limits of that Party's nation, for use only within the scope of work of their contracts with the receiving Party in work relating to the subject matter of this Implementing Agreement; provided that any such dissemination of proprietary information shall be on an as-needed, case-by-case basis, shall be pursuant to an agreement of confidentiality, and shall be marked with a restrictive legend substantially similar to that appearing in Article VI. C. above.

3. With the prior written consent of the party furnishing proprietary information under this Implementing Agreement, the receiving Party may disseminate such proprietary information more widely than otherwise permitted in subsections 1. and 2. The parties shall cooperate in developing procedures for requesting and obtaining approval for such wider dissemination, and each party will grant such approval to the extent permitted by its national policies, regulations, and laws.

E. Marking Procedures for Other Confidential or Privileged Information of a Documentary Nature

A party receiving under this Implementing Agreement other confidential or privileged information shall respect its confidential nature, provided such information is clearly marked so as to indicate its confidential or privileged nature and is accompanied by a statement indicating

1. that the information is protected from public disclosure by the Government of the transmitting party; and

2. that the information is transmitted under the condition that it be maintained in confidence.

F. Dissemination of Other Confidential or Privileged Information of a Documentary Nature

Other confidential or privileged information may be disseminated in the same manner as that set forth in paragraph D., Dissemination of Documentary Proprietary Information.

G. Non-Documentary Proprietary or Other Confidential or Privileged Information

Non-documentary proprietary or other confidential or privileged information provided in seminars and other meetings arranged under this Implementing Agreement, or information arising from the attachments of staff, use of facilities, or joint projects, shall be treated by the parties according to the principles specified for documentary information in this Implementing Agreement; provided, however, that the party communicating such proprietary or other confidential or privileged information has placed the recipient on notice as to the character of the information communicated.

H. Consultation

If, for any reason, one of the parties becomes aware that it will be, or may reasonably be expected to become, unable to meet the nondissemination provisions of this Implementing Agreement, it shall immediately inform the other party. The parties shall thereafter consult to define an appropriate course of action.

I. Other

Nothing contained in this Implementing Agreement shall preclude a party from using or disseminating information received without restriction by a party from sources outside of this Implementing Agreement.

ARTICLE VII – FINAL PROVISIONS

A. This Implementing Agreement shall be effective from the date of signature by the USNRC and the RRC and shall be effective for a period of 5 years. It may be extended for a further period of time by written agreement of the parties.

B. Either party may withdraw from the present Implementing Agreement after providing the other party written notice at least 180 days prior to its intended date of withdrawal.

C. All costs arising from implementation of this Implementing Agreement will be borne by the party that incurs them except when specifically agreed to otherwise by both parties.

D. The parties to this Implementing Agreement reserve the right to modify or extend the activities described in Article III within the intended scope of this Implementing Agreement upon written concurrence of its Administrators.

E. Any dispute between the parties concerning the interpretation or application of this Implementing Agreement will be settled by mutual agreement of the parties.

DONE at Rockville, Maryland on _____, 2001 , and at Moscow, Russia on _____, 2001 .

FOR THE UNITED STATES NUCLEAR REGULATORY COMMISSION:

BY: _____
William D. Travers
TITLE: Executive Director for Operations

FOR THE INSTITUTE OF NUCLEAR SAFETY OF THE RUSSIAN ACADEMY OF SCIENCES:

BY: _____
Vladimir Asmolov
TITLE: Director, Nuclear Safety Institute/RRC

INTELLECTUAL PROPERTY ADDENDUM

Pursuant to Article VI of this Implementing Agreement:

The parties shall ensure adequate and effective protection of intellectual property created or furnished under this Implementing Agreement and relevant implementing arrangements. The parties agree to notify one another in a timely fashion of any inventions or copyrighted works arising under this Implementing Agreement and to seek protection for such intellectual property in a timely fashion. Rights to such intellectual property shall be allocated as provided in this Addendum.

I. SCOPE

A. This Addendum is applicable to all cooperative activities undertaken pursuant to this Implementing Agreement, except as otherwise specifically agreed by the parties or their designees.

B. For purposes of this Implementing Agreement, "intellectual property" shall have the meaning found in Article 2 of the Convention Establishing the World Intellectual Property Organization, done at Stockholm, July 14, 1967; viz., " ‘intellectual property’ shall include the rights relating to:

- literary, artistic and scientific works,
- performances of artists, phonograms, and broadcasts,
- inventions in all fields of human endeavor,
- scientific discoveries,
- industrial designs,
- trademarks, service marks, and commercial names and designations,
- protection against unfair competition,

and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields."

C. This Addendum addresses the allocation of rights, interests, and royalties between the parties. Each party shall ensure that the other party can obtain rights to intellectual property allocated in accordance with the Addendum by obtaining those rights from its own participants through contracts or other legal means, if necessary. This Addendum does not otherwise alter or prejudice the allocation between a party and its nationals, which shall be determined by that party's laws and practices.

D. Disputes concerning intellectual property arising under this Implementing Agreement should be resolved through discussions between the concerned participating institutions or, if necessary, the parties or their designees. Upon mutual agreement of the parties, a dispute shall be submitted to an arbitral tribunal for binding arbitration in accordance with the

applicable rules of international law. Unless the parties or their designees agree otherwise in writing, the arbitration rules of the United Nations Commission on International Trade Law (UNCITRAL) shall govern.

E. Termination or expiration of this Implementing Agreement shall not affect rights or obligations under this Addendum.

II. ALLOCATION OF RIGHTS

A. Each party shall be entitled to a non-exclusive, irrevocable, royalty-free license in all countries to translate, reproduce, and publicly distribute scientific and technical journal articles, reports, and books directly arising from cooperation under this Implementing Agreement. All publicly distributed copies of copyrighted work prepared under this provision shall indicate the names of the authors of the work unless an author explicitly declines to be named.

B. Rights to all forms of intellectual property, other than those rights described in Section II(A) above, shall be allocated as follows:

1. Visiting researchers, for example, scientists visiting primarily in furtherance of their education, shall receive intellectual property rights under the policies of the host institution. In addition, each visiting researcher named as an inventor shall be entitled to national treatment with regard to awards, bonuses, benefits, or any other rewards, in accordance with the policies of the host institution.

2. (a) For intellectual property created during joint research, for example, when the parties, participating institutions, or participating personnel have agreed in advance on the scope of work, each party shall be entitled to obtain all rights and interests in its own country. The party in whose country the invention was made shall have first option to acquire all rights and interests in third countries. If research is not designated as "joint research", rights to intellectual property arising from the research will be allocated in accordance with paragraph II.B.1. In addition, each person named as an inventor shall be entitled to national treatment with regard to awards, bonuses, benefits, or any other rewards, in accordance with the policies of the host institution.

   (b) Notwithstanding paragraph II.B.2.(a), if a type of intellectual property is available under the laws of one party but not the other party, the party whose laws provide for this type of protection shall be entitled to all rights and interests worldwide. Persons named as inventors of the property shall nonetheless be entitled to royalties as provided in paragraph II.B.2.(a).

IMPLEMENTING AGREEMENT
BETWEEN
THE UNITED STATES NUCLEAR REGULATORY COMMISSION (USNRC)
AND
THE INSTITUTE OF NUCLEAR SAFETY (IBRAE)
OF THE
RUSSIAN ACADEMY OF SCIENCES (RAS)
ON THE DEVELOPMENT AND APPLICATION OF NUCLEAR SAFETY ANALYSIS CODES
AND PROBABILISTIC RISK ASSESSMENT TECHNIQUES

Considering that the United States Nuclear Regulatory Commission (USNRC) and Institute of Nuclear Safety of the Russian Academy of Sciences (IBRAE/RAS):

A. Have been cooperating in the area of civilian nuclear reactor safety as part of a 5-year 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 signed on December 16, 1993, hereinafter "Agreement";

B. Have been conducting joint cooperative nuclear safety activities through the Joint Coordinating Committee for Civilian Nuclear Reactor Safety (JCCCNRS) (pursuant to the Memorandum of Cooperation in the Field of Civilian Nuclear Reactor Safety of April 26, 1988, and the Agreement between the United States of America and the Union of Soviet Socialist Republics on Scientific and Technical Cooperation in the Field of Peaceful Uses of Atomic Energy of June 1, 1990; hereinafter Peaceful Uses Agreement). The JCCCNRS has been acknowledged as the implementing committee for the above Agreement;

D. Have a mutual interest in cooperation in the field of nuclear safety research, with the objective of improving the safety of reactors on an international basis;

E. Have, as a mutual objective, reciprocity in the exchange of technical information in the field of reactor safety research;

The USNRC and the IBRAE/RAS have adopted the following terms and conditions as an implementing agreement.

ARTICLE I – PROGRAM COOPERATION

The USNRC and the IBRAE/RAS, in accordance with the provisions of this Implementing Agreement and subject to applicable laws and regulations in force in the respective Countries, will join together in nuclear safety programs related to the development and application of nuclear safety analysis codes (i.e., CONTAIN, SCDAP/RELAP, CORCON, HMS, VANESA, MELCOR) probabilistic risk assessment techniques to RBMK, VVER-type and U.S. LWR reactors.

ARTICLE II – FORMS OF COOPERATION

Cooperation between the parties may take the following forms:

A. The exchange of information in the form of technical reports, code validation data, correspondence, newsletters, visits, joint meetings, and such other means as the parties agree.

B. The temporary assignment of personnel of one party or of its contractors to laboratories or facilities owned by the other party; each assignment to be considered on a case-by-case basis and to be the subject of a separate attachment-of-staff arrangement between the parties.

C. The execution of joint programs and projects, including those involving a division of activities between the parties; each joint program and project may be considered on a case-by-case basis and may be the subject of a separate arrangement between the parties.

D. The use by one party of facilities that are owned by the other party; such use of facilities may be the subject of separate arrangements between the parties and may be subject to commercial terms and conditions.

E. If either party wishes to visit, assign personnel, or use the facilities owned or operated by entities other than the parties to this Implementing Agreement, the parties recognize that the approval of such entities will in general be required with respect to the terms upon which such visit, assignment, or use will be made.

F. Any other form agreed between the parties.

ARTICLE III – SCOPE OF COOPERATION

The objective of this Implementing Agreement is to develop and assess improved models to selected USNRC severe accident codes and to develop, apply or assess probabilistic risk assessment techniques to improve safety and public confidence. In particular, this agreement will include assessment of models for the MELCOR, SCDAP/RELAP and SAPHIRE codes and development of risk communication techniques.

A. <u>USNRC Scope of Responsibility</u>

Subject to Article VI, the USNRC will provide and coordinate the provision of the following specified goods and services related to the MELCOR, SCDAP/RELAP and SAPHIRE codes.

1. Codes

    a. The USNRC will transmit to the IBRAE/RAS the MELCOR, SCDAP/RELAP and SAPHIRE nuclear safety analysis codes and associated documentation developed by the USNRC. These computer codes will include the latest versions applicable to computer workstation applications.

b. The USNRC will also accommodate reasonable requests from IBRAE/RAS regarding the installation and use of these codes in computer work stations as indicated below.

2. Meetings, Visits, and Exchange of Personnel

Subject to Article V.J of this Implementing Agreement, the USNRC will:

a. Permit Russian personnel sponsored by IBRAE/RAS to attend, as appropriate, technical program review meetings and technical progress meetings related to this Implementing Agreement.

b. Facilitate visits of IBRAE/RAS-sponsored personnel to laboratories at which USNRC-sponsored work related to this Implementing Agreement is being conducted.

c. Permit the assignment of IBRAE/RAS-sponsored personnel to participate in USNRC nuclear safety programs related to this Implementing Agreement and to have ready access to relevant documentation associated with severe accident and probabilistic risk assessment codes.

3. The USNRC will direct and coordinate with the IBRAE/RAS the above activities to assure timely and effective completion of the above tasks.

4. During the course of this cooperation, the USNRC and IBRAE/RAS will develop specific tasks such as those listed above, involving nuclear safety analysis codes. These tasks, once developed, will be included as technical appendices to this agreement.

B. <u>IBRAE Scope of Responsibility</u>

The IBRAE/RAS, in coordination with the USNRC, will provide the following specified goods and services related to code assessment and probabilistic risk assessment.

1. Model Development for USNRC Severe Accident Codes

Assess the latest version of the MELCOR code in the following areas:

– user attributes for level 2 risk assessment
– adequacy of models for level 2 risk assessment

2. Risk Communication

– Explore ways to improve risk communication by considering the approaches used in various countries and industries to manage and communicate to the public and governmental organizations.

3. Additional Work

Subject to availability of funds and agreement between USNRC and IBRAE/RAS, additional work related to code consolidation, code development or risk assessment may be added under this Agreement, subject to USNRC receipt and approval of a work plan.

4. Quarterly Technical and Financial Progress Reports

The IBRAE/RAS will prepare a quarterly summary letter report on each of the above tasks. Each report should include: the title of the project, a Financial Identification Number (FIN) to be provided by the USNRC, the period of performance, and the reporting period. This report should contain two sections as indicated below.

4.1 Project Status Section

This section should include the following:

a. A listing of the efforts completed during the period and milestones reached or, if missed, an explanation why.

b. Any problems or delays encountered or anticipated and recommendations for resolution.

c. A summary of progress to date (this may be expressed in terms of percentage completion for the project).

d. Planned accomplishments for the next reporting period.

e. Preliminary or interim results, conclusions, trends, or other items of information that the IBRAE/RAS believes are of timely interest to the USNRC.

f. Problems or delays experienced by the IBRAE/RAS in the conduct of this effort and the proposed resolutions

4.2 Financial Status Section

Provide the total amount of funds expended (cost) during the reporting period for each task identifying the major items of expense and the total cumulative expenditure for the year to date.

5. Audit and Record Requirements

The IBRAE/RAS shall maintain complete accounting records of all funds provided to it by the USNRC under this Implementing Agreement in accordance with accounting principles generally accepted in the Russian Federation. These accounting records shall be maintained for a period of no less than 3 years after the expiration of this Implementing Agreement. The USNRC, or other authorized U.S. Government officials shall have full access to the accounting records for the purposes of financial audit during

the period of this Implementing Agreement and, after its expiration, for a period of no less than 3 years.

6. Meetings, Visits and Exchange of Personnel

   In accordance with Article V.J. of this Implementing Agreement, the IBRAE/RAS will:

   a. permit USNRC personnel or contractors sponsored by USNRC to attend, as appropriate, technical program review meetings and technical progress meetings concerning IBRAE/RAS work related to this Implementing Agreement.

   b. Facilitate visits of USNRC personnel or contractors sponsored by USNRC to laboratories at which IBRAE/RAS-sponsored work related to this Implementing Agreement is being conducted.

   c. Permit the assignment of USNRC personnel or its contractors sponsored by USNRC to participate in the IBRAE/RAS nuclear safety program related to this Implementing Agreement and to have ready access to relevant nuclear reactor safety documentation, codes and results.

ARTICLE IV – FINANCIAL CONSIDERATIONS

The ability of the parties to carry out their obligations is subject to the appropriation of funds by the appropriate governmental authority and to laws and regulations applicable to the parties. Subject to the availability of funds, the USNRC will provide the IBRAE/RAS the sum of $75K in Fiscal Year 2001.

A payment of $75K will be made upon approval of the work plan. IBRAE/RAS will complete a work plan acceptable to both parties within 60 days after entry into force of this Implementing Agreement. Payment will be made upon receipt of IBRAE/RAS invoices, subject to U.S. government rules and regulations.

If other technical appendices are developed during the course of this cooperation, the resulting financial considerations will be included in these appendices.

ARTICLE V – ADMINISTRATION OF THE IMPLEMENTING AGREEMENT

A. The USNRC and the IBRAE/RAS will each designate one representative to coordinate and determine the detailed implementation of this Implementing Agreement. This designated representative will be referred to as an Administrator of the Implementing Agreement. The Administrators may, at their discretion, delegate this responsibility to the appropriate individuals with respect to a given issue.

B. This Implementing Agreement states restrictions concerning dissemination of proprietary or other confidential or privileged information. Other information that my be restricted includes matters related to organization, budget, personnel, or management.

C. Each party to this Implementing Agreement will have access to all reports written by its partner's technical personnel assigned to the respective activities that derive from participation in this Implementing Agreement.

D. USNRC-supplied codes and analytical techniques and any improvements, modifications or updates to such codes or techniques will not be disseminated to other parties outside the Russian Federation without the consent of the USNRC.

E. Except for dissemination to USNRC and its principal contractors in accordance with this Implementing Agreement, IBRAE/RAS-supplied codes and analytical techniques and any improvements, modifications or updates to such codes and techniques will not be disseminated to other parties outside the U.S. without the consent of the IBRAE/RAS.

F. The application or use of any codes exchanged or transferred between the parties under this Implementing Agreement shall be the responsibility of the receiving party, and the transmitting party does not warrant the suitability of such codes for any particular use or application.

G. The USNRC computer codes disseminated under this Implementing Agreement are to be considered privileged information unless otherwise noted, are protected as such by the USNRC, and shall be treated likewise by IBRAE/RAS. They are in particular, subject to all the provisions of Article VI including the requirements for an agreement of confidentiality prior to dissemination, with the exception that they need not be marked with the restrictive designation. The codes are subject to this protection in both object and source forms and as recorded in any media.

H. The USNRC computer codes and other related analytical techniques that are provided to the IBRAE/RAS under this Implementing Agreement and any improvements, modifications or updates to such codes or techniques are for the purpose of this Implementing Agreement and shall not be used by IBRAE/RAS or other parties within the Russian Federation for commercial purposes; that is, for financial or other benefits not concerned with the study of reactor safety.

   Among the code uses that will be permitted under this Implementing Agreement are those related to research in the reactor safety area and analyses performed by the members or their contractors that can assist regulators and plant personnel in assessing the safety of the plant, analyzing operating events, and training of operators. Specific examples of permitted analyses include: design basis accidents (e.g., loss-of-coolant accidents), anticipated transients, accident management and emergency operating procedures, mid-loop operation, analysis to support PRA success criteria, power upgrades and reload.

   Prohibited uses of the code include: (1) analyses to develop a new reactor design, and (2) analyses to support power upgrades and reload in the U.S. unless performed by a U.S. subsidiary.

I. The USNRC codes and other related analytical techniques shall not be advertised directly or by implication to obtain contracts related to the construction, servicing, or refueling of nuclear facilities, nor shall advertising imply that the USNRC has endorsed any analysis or techniques.

J. It is understood that the USNRC makes no warranties whatsoever for the ability or suitability of any USNRC code or other analytical technique to perform in any particular manner for any particular purpose, or to accomplish any particular task. It is further understood that the USNRC accepts no liability for damages of any type that may result from the use of the USNRC codes or other analytical techniques provided under this Implementing Agreement.

K. Travel costs, living expenses, and salaries will be borne by the parties who incurred them unless specified otherwise.

ARTICLE VI – EXCHANGE AND USE OF INFORMATION AND INTELLECTUAL PROPERTY

A. General

The Parties support the widest possible dissemination of information provided or exchanged under this Implementing Agreement, subject both to the need to protect proprietary or other confidential or privileged information as may be exchanged hereunder, and to the provisions of the Intellectual Property Addendum, which is an integral part of this Implementing Agreement.

B. Definitions (As used in this Implementing Agreement)

1. The term "information" means nuclear energy-related regulatory, safety, safeguards, waste management, scientific, or technical data, including information on results or methods of assessment, research, and any other knowledge intended to be provided or exchanged under this Implementing Agreement.

2. The term "proprietary information" means information made available under this Implementing Agreement which contains trade secrets or other privileged or confidential commercial information (such that the person having the information may derive an economic benefit from it or may have a competitive advantage over those who do not have it), and may only include information which:

   a. has been held in confidence by its owner;

   b. is of a type which is customarily held in confidence by its owner;

   c. has not been transmitted by the owner to other entities (including the receiving party) except on the basis that it be held in confidence;

   d. is not otherwise available to the receiving party from another source without restriction on its further dissemination; and

   e. is not already in the possession of the receiving party.

3. The term "other confidential or privileged information" means information, other than "proprietary information," which is protected from public disclosure under the laws and

regulations of the country of the party providing the information and which has been transmitted and received in confidence.

C. Marking Procedures for Documentary Proprietary Information

A party receiving documentary proprietary information pursuant to this Implementing Agreement shall respect the privileged nature thereof, provided such proprietary information is clearly marked with the following (or substantially similar) restrictive legend:

> "This document contains proprietary information furnished in confidence under an Implementing Agreement dated _____ between the United States Nuclear Regulatory Commission and the Institute of Nuclear Safety of the Russian Academy of Sciences and shall not be disseminated outside these organizations, their consultants, contractors, and licensees, and concerned departments and agencies of the Government of the United States and the Government of the Russian Federation without the prior approval of (name of transmitting party). This notice shall be marked on any reproduction hereof, in whole or in part. These limitations shall automatically terminate when this information is disclosed by the owner without restriction."

This restrictive legend shall be respected by the receiving party and proprietary information bearing this legend shall not be used for commercial purposes, made public, or disseminated in any manner unspecified by or contrary to the terms of this Implementing Agreement without the consent of the transmitting party.

D. Dissemination of Documentary Proprietary Information

1. In general, proprietary information received under this Implementing Agreement may be freely disseminated by the receiving Party without prior consent to persons within or employed by the receiving Party, and to concerned Government departments and Government agencies in the country of the receiving Party.

2. In addition, proprietary information may be disseminated without prior consent to contractors or consultants of the receiving Party located within the geographical limits of that Party's nation, for use only within the scope of work of their contracts with the receiving Party in work relating to the subject matter of this Implementing Agreement; provided that any such dissemination of proprietary information shall be on an as-needed, case-by-case basis, shall be pursuant to an agreement of confidentiality, and shall be marked with a restrictive legend substantially similar to that appearing in Article VI. C. above.

3. With the prior written consent of the party furnishing proprietary information under this Implementing Agreement, the receiving Party may disseminate such proprietary information more widely than otherwise permitted in subsections 1. and 2. The parties shall cooperate in developing procedures for requesting and obtaining approval for such wider dissemination, and each party will grant such approval to the extent permitted by its national policies, regulations, and laws.

E. Marking Procedures for Other Confidential or Privileged Information of a Documentary Nature

A party receiving under this Implementing Agreement other confidential or privileged information shall respect its confidential nature, provided such information is clearly marked so as to indicate its confidential or privileged nature and is accompanied by a statement indicating

1. that the information is protected from public disclosure by the Government of the transmitting party; and

2. that the information is transmitted under the condition that it be maintained in confidence.

F. Dissemination of Other Confidential or Privileged Information of a Documentary Nature

Other confidential or privileged information may be disseminated in the same manner as that set forth in paragraph D., Dissemination of Documentary Proprietary Information.

G. Non-Documentary Proprietary or Other Confidential or Privileged Information

Non-documentary proprietary or other confidential or privileged information provided in seminars and other meetings arranged under this Implementing Agreement, or information arising from the attachments of staff, use of facilities, or joint projects, shall be treated by the parties according to the principles specified for documentary information in this Implementing Agreement; provided, however, that the party communicating such proprietary or other confidential or privileged information has placed the recipient on notice as to the character of the information communicated.

H. Consultation

If, for any reason, one of the parties becomes aware that it will be, or may reasonably be expected to become, unable to meet the nondissemination provisions of this Implementing Agreement, it shall immediately inform the other party. The parties shall thereafter consult to define an appropriate course of action.

I. Other

Nothing contained in this Implementing Agreement shall preclude a party from using or disseminating information received without restriction by a party from sources outside of this Implementing Agreement.

ARTICLE VII – FINAL PROVISIONS

A. This Implementing Agreement shall be effective from the date of signature by the USNRC and the IBRAE/RAS and shall be effective for a period of 5 years. It may be extended for a further period of time by written agreement of the parties.

B. Either party may withdraw from the present Implementing Agreement after providing the other party written notice at least 180 days prior to its intended date of withdrawal.

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DONE at Rockville, Maryland on _____, 2001 , and at Moscow, Russia on _____, 2001 .

FOR THE UNITED STATES NUCLEAR REGULATORY COMMISSION:

BY: _____
William D. Travers
TITLE: Executive Director for Operations

FOR THE INSTITUTE OF NUCLEAR SAFETY OF THE RUSSIAN ACADEMY OF SCIENCES:

BY: _____
Leonid A. Bolshov
TITLE: Director, Nuclear Safety Institute/RRC

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- literary, artistic and scientific works,
- performances of artists, phonograms, and broadcasts,
- inventions in all fields of human endeavor,
- scientific discoveries,
- industrial designs,
- trademarks, service marks, and commercial names and designations,
- protection against unfair competition,

and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields."

C. This Addendum addresses the allocation of rights, interests, and royalties between the parties. Each party shall ensure that the other party can obtain rights to intellectual property allocated in accordance with the Addendum by obtaining those rights from its own participants through contracts or other legal means, if necessary. This Addendum does not otherwise alter or prejudice the allocation between a party and its nationals, which shall be determined by that party's laws and practices.

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applicable rules of international law. Unless the parties or their designees agree otherwise in writing, the arbitration rules of the United Nations Commission on International Trade Law (UNCITRAL) shall govern.

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B. Rights to all forms of intellectual property, other than those rights described in Section II(A) above, shall be allocated as follows:

1. Visiting researchers, for example, scientists visiting primarily in furtherance of their education, shall receive intellectual property rights under the policies of the host institution. In addition, each visiting researcher named as an inventor shall be entitled to national treatment with regard to awards, bonuses, benefits, or any other rewards, in accordance with the policies of the host institution.

2. (a) For intellectual property created during joint research, for example, when the parties, participating institutions, or participating personnel have agreed in advance on the scope of work, each party shall be entitled to obtain all rights and interests in its own country. The party in whose country the invention was made shall have first option to acquire all rights and interests in third countries. If research is not designated as "joint research," rights to intellectual property arising from the research will be allocated in accordance with paragraph II.B.1. In addition, each person named as an inventor shall be entitled to national treatment with regard to awards, bonuses, benefits, or any other rewards, in accordance with the policies of the host institution.

   (b) Notwithstanding paragraph II.B.2.(a), if a type of intellectual property is available under the laws of one party but not the other party, the party whose laws provide for this type of protection shall be entitled to all rights and interests worldwide. Persons named as inventors of the property shall nonetheless be entitled to royalties as provided in paragraph II.B.2.(a).

BENEFITS FROM RESEARCH CONDUCTED BY THE
RUSSIAN RESEARCH CENTER AND RUSSIAN ACADEMY OF SCIENCES

Russian Research Center

The cost of this work is leveraged by about 20 as a result of low staff costs and the sharing of costs with the French safety institute, IPSN, and the Russian ministry, MINATOM, and other Russian organizations. Further, large quantities of raw data are brought into this program for assessment from other Russian programs that did not receive USNRC support. These programs include (a) testing under reactivity accident conditions in two test reactors, (b) testing under loss-of-coolant conditions in the Impulse Graphite reactor, (c) testing of fresh and irradiated cladding out of pile under loss-of-coolant conditions, and (d) studies of properties of zirconium alloys, especially those with niobium.

Standard Russian VVER cladding is a Zr-1%Nb alloy that is almost identical in composition to the Framatome M5 alloy and similar to the Westinghouse ZIRLO cladding that are being used in the U.S. High-burnup studies of these alloys have not yet been made in the U.S., and the Russian work gives some insights into the behavior of these cladding types under postulated accident conditions that must be considered in safety analyses.

The first major result from this program was the demonstration that the niobium alloy cladding with its much lower corrosion level behaved much differently than Zircaloy under conditions of a reactivity accident. The failure mechanism was a ductile burst rather than a brittle fracture and it occurred at a significantly higher energy deposition. This demonstrated the importance of the failure mechanism, corrosion level, and alloy type, and it indicates a potential for improved transient behavior of the newer alloys being used in the U.S.

A Russian-French-American round-robin tensile test was performed on Russian cladding tubes to check reproducibility of measurement techniques. This led to state-of-the-art developments of ring-tensile specimen design that will allow testing of small specimens of irradiated material to obtain mechanical properties. These properties are needed to perform analyses that will reduce the number of in-reactor and large integral tests in hot cells to determine damage criteria for new cladding alloys at high burnups.

A recent Russian handbook of zirconium alloy properties was given to the USNRC along with permission to pass the information along to the U.S. industry. The USNRC had this handbook translated and then gave the original and translated versions to EPRI for distribution to the U.S. industry, subject to cost and copyright arrangements with the publisher.

Information on phase transformations and mechanical properties of Zr-1%Nb alloys generated in this Russian program were used by USNRC's reviewer in the review of Framatome's licensing topical report on M5 cladding. These results helped the reviewer perform this review on schedule and issue an approval in 1999.

Results show that the difference between mechanical properties of unirradiated and irradiated cladding disappears completely at temperatures above 860 K and that a pronounced anisotropy effect in unirradiated cladding is insignificant in irradiated cladding. These insights help design

related tests being done in the U.S. and contribute to our understanding of the behavior of new cladding alloys in the U.S. at high burnups.

Models and coding were developed in this program for calculating heat transfer and rewetting in water-filled test capsules where there is no flow over the fuel rod surface. These models were installed in the VVER version developed by the Russians of USNRC's FRAP-T6 fuel rod transient code. These models will be imported into USNRC's current FRAPTRAN fuel rod transient code, and the models will improve the analysis of data from Japanese tests in stagnant water capsules. Such analysis will help avoid unnecessary conservative biases in interpreting the important data set from Japan.

Excellent agreement between the Russian neutron kinetics code, BARS, and western codes like USNRC's PARCS code gives added confidence in all of these codes to predict fuel rod power during transients, and the studies of uncertainties being done in this program will allow more accurate uncertainty estimates thus avoiding unnecessary conservative margin. These codes are used primarily for the postulated reactivity accidents.

Russian Academy of Sciences

The work performed by the RAS has involved analytical modeling of core melt progression, assessment of RELAP against Russian thermal-hydraulic data and PRA methods development.

RAS analytical modeling work led to the development and implementation of four analytical models for USNRC's SCDAP/RELAP code. These models address:

- steam/zirconium interactions
- fuel and clad melting
- zirconium and UO_2 dissolution
- cladding mechanical behavior

These analytical models are based more on first principles than the previous models and thus make the code applicable to a wider range of conditions.

RAS thermal-hydraulics work screened and identified unique Russian thermal-hydraulic data of potential use in assessing USNRC's RELAP code. This will help focus assessment efforts on the data most relevant to RELAP.

RAS has also developed a report on the desired attributes of a consolidated severe accident code, which will be used to assist USNRC severe accident code consolidation work.

RAS PRA work led to the development of a technique for incorporating uncertainties into a risk assessment not traditionally modeled (i.e., success criteria). This method was used in follow on work to assess the sensitivity of LOCA PRA analyses to uncertainties in LOCA success criteria. Such work is being used in our efforts to risk-inform 10 CFR 50.46 (Option 3).