COOPERATIVE RESEARCH AGREEMENT

BETWEEN

THE UNITED STATES NUCLEAR REGULATORY COMMISSION

AND

THE JOINT RESEARCH CENTER

FOR THE

EURATOM COMMISSION OF EUROPEAN COMMUNITIES

FOR THE JOINT DEVELOPMENT OF A PROTOTYPE ADVANCED

FLUID DYNAMICS MODEL (AFDM)

N° 3111 - 86 - 12 TP ISP USA

Effective Date:

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ARTICLE 1. AUTHORITY FOR AGREEMENT

This Cooperative Rsearch Agreement Between the United States Nuclear Regulatory Commission (USNRC) and the Joint Research Center (JRC) for the Euratom Commission of European Communities for the Joint Development of a Prototype Advanced Fluid Dynamics Model (AFDM) (hereafter referred to as the AGREEMENT) is established pursuant to, and in conformity with the "Arrangement Between the United States Nuclear Regulatory Commission and the European Atomic Energy Community (Hereafter called EURATOM) Represented by the Commission of the European Communities" dated September 20, 1984 (hereafter referred to as the ARRANGEMENT) which remains in effect until September 19, 1989 -- ARTICLE VIII.1.

ARTICLE 2. PURPOSE FOR AGREEMENT

The specific purpose for this AGREEMENT is the provision of funding support by the JRC for development of a Prototype Advanced Fluid Dynamics Model (AFDM) at the Los Alamos National Laboratory (LANL) under sponsorship of the USNRC, and the furnishing of the AFDM model documentation, an operational version of the AFDM code, computer code test results, and a computer code users manual upon completion of the AFDM development work to the Joint Research Center (JRC).

ARTICLE 3. SCOPE OF WORK

3.1 USNRC OBLIGATIONS

3.1.1 The USNRC will coordinate the funding and staff support provided by all international participants. Kernforschungszentrum Karlsruhe (KfK) of the Federal Republic of Germany, Power Reactor and Nuclear Development Corporation (PNC) of Japan, and Commissariat a l'Energie Atomique (CEA) of France have joined in the development of the AFDM through separate cooperative research agreements.

3.1.2 Technical coordination between the staffs of participating organizations in residence at LANL or with staff members in home countries will be performed by the LANL technical staff as contractors for the USNRC.

3.1.3 Model documentation, results of test calculations, an operational copy of the AFDM code, and a users manual for the AFDM code will be prepared by LANL and furnished to the JRC Ispra in accordance with the provisions of Attachment A to this AGREEMENT.

3.2. JRC ISPRA OBLIGATIONS

3.2.1 The JRC will provide funding support for AFDM development in accordance with the provisions of Article 4, below, of this AGREEMENT.

3.2.2 The JRC will provide a description of the computer operating systems at ISPRA to LANL staff for the computer to be used in implementing the AFDM at the JRC computer center.

ARTICLE 4. FINANCIAL ARRANGEMENTS

Payment by the JRC to USNRC shall be made as follows (after receipt of invoice from USNRC):

$100,000 (one-hundred-thousand U.S. dollars) at the signature of this Agreement within 30 days after the delivery of initial documentation;

$100,000 (one-hundred-thousand U.S. dollars) within 30 days after the delivery of the documentation of phase 1 and in any case not before April 1, 1987.

The above lump sum payments shall be understood to satisfy all financial obligations of EURATOM under this AGREEMENT.

ARTICLE 5. PROJECT MANAGEMENT

5.1 The NRC project manager will appoint a LANL project technical manager responsible for implementing the work to be performed under this AGREEMENT. The name of the LANL project technical manager shall be furnished to JRC in writing by the NRC. The LANL computer facility access, if required, will be managed by LANL following their normal management practices.

5.2 The LANL project technical manager will be responsible for acting as liaison officer for this AGREEMENT.

5.3 JRC can have a representative participate in formal technical committees and meetings of the AFDM program.

5.4 JRC can send a member of its staff to participate in the development work at LANL at JRC expense.

ARTICLE 6. EXCHANGE AND USE OF INFORMATION

The transfer of information developed under this AGREEMENT shall be made in accordance with the provisions set forth in Article V of the ARRANGEMENT signed September 20, 1984 and in Attachment A of this AGREEMENT.

Dissemination of model documentation and computer code test results may be made by the JRC to Establishments in the Member States of the European Community (EURATOM Establishments). However, dissemination of the code and users manual to EURATOM Establishments will require the concurrence of the principal partners in the program (NRC, KfK, PNC).

ARTICLE 7. PATENTS AND COPYRIGHTS

The allocation of rights to patents or copyrights growing out of the implementation of this AGREEMENT shall be governed by the provisions of Article VII of the ARRANGEMENT signed September 20, 1984.

ARTICLE 8. RESOLUTIONS OF DISPUTES

Cooperation under this AGREEMENT shall be in accordance with the laws, regulations, and national policy of the respective countries of the parties. Any issues related to this AGREEMENT arising during its term shall be resolved by negotiation and mutual agreement of the parties.

ARTICLE 9. PERIOD OF AGREEMENT

This AGREEMENT shall become effective on the day and year of the signature last entered below and shall remain in effect until September 30, 1987.

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

FOR THE UNITED STATES NUCLEAR REGULATORY COMMISSION

Signed: _____
Victor Stello, Jr.
Executive Director for Operations
Title:
Date:

FOR THE JOINT RESEARCH CENTER COMMISSION OF EUROPEAN COMMUNITIES

Signed: _____
Director of the Ispra Establishment
Title:
Date: 15 MAR 1985

Attachment A

to Cooperative Research Agreement Between
The United States Nuclear Regulatory Commission
and
The European Atomic Energy Community
For the
Joint Development of a Prototype Advanced Fluid Dynamics Model

Technical Program Description

Objectives

The general objective of this research is to develop a prototype Advanced Fluid Dynamics Model (AFDM) for possible future incorporation into a code such as the SIMMER-II computer code used to analyze core disruption transients in LMFBR accidents. The need for a 3-velocity-field model for the fluid dynamics in SIMMER-II has been identified from past applications, and the planned improvements to address this need will be contained in the changes to the solution of the conservation equations, the multicomponent equation-of-state, and intracell exchange functions. A separate stand-alone version of the AFDM is being developed to expedite checkout of programmed models and to allow isolated assessments of characteristic model behavior.

The specific objective of this cooperative research is to complete the AFDM by the end of U.S. FY 1987 (September 30, 1987) in a form suitable for performing studies by all program participants.

Program Summary

The research program will be conducted by Los Alamos National Laboratory (LANL) staff for the USNRC with financial support from EURATOM. The program work which will be performed is as follows:

(i) the basic conservation equations of the AFDM will be formulated, and an initial version of a multicomponent equation of state (EOS) model will be

formulated. In addition, a literature search on intracell transfer mechanisms and models will be completed, and a set of model equations will be prepared.

(ii) the programming of the conservation equations will be completed and checkout problems will be run. The programming of the EOS model will be completed, and the intracell transfer models will also be programmed.

(iii) the EOS and intracell transfer models will be integrated into the conservation equation framework, and will be tested using checkout problems.

(iv) LMFBR applications problems such as the boiling pool problems will be run to demonstrate the characteristics and capabilities of the new code. The code models and applications problems results will be fully documented, and recommendations for future development will also be drawn up.

The contract will be divided into two phases as follows:

Phase 1: From date of agreement to March 31, 1987

Phase 2: From April 1, 1987 to September 30, 1987

At the signature of this Agreement the following documents will be delivered to EURATOM:

1. Copies of all progress reports regarding the AFDM prepared to date.

At the completion of the first phase the following documents and other materials will be delivered to EURATOM:

1. A first report on the models of the AFDM and of the code. This will include draft documentation of the conservation equations used, the initial version of the equation of state, and the initial versions of the intracell transfer functions.

2. A provisional version of the code. There is no requirement that this provisional version of the code should be compatible with JRC computing facilities.

Following the completion of the second phase, the following documents and other materials will be delivered to EURATOM within 30 days:

1. Draft versions of full documentation of the AFDM models and of the code users manual.

2. A version of the complete code suitable for installation on the JRC-ISPRA computer.

3. Draft documentation of the boiling pool and other test case calculations.

4. Recommendations for future development of the AFDM.

Final documentation will be delivered to EURATOM after a reasonable delay for editing and printing (4 to 6 months).