

SUPPLEMENTAL AGREEMENT
BETWEEN
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
AND
THE U. S. NUCLEAR REGULATORY COMMISSION

THIS SUPPLEMENTAL AGREEMENT, effective the 16th day of July , 1979, by and between the UNITED STATES OF AMERICA (hereinafter referred to as the "Government"), as represented by the UNITED STATES NUCLEAR REGULATORY COMMISSION (hereinafter referred to as the "Commission"), and MASSACHUSETTS INSTITUTE OF TECHNOLOGY (hereinafter referred to as the "Contractor"),

WITNESSETH THAT:

WHEREAS, the parties desire to modify Contract No. NRC-04-77-126 as hereinafter provided, and this supplemental agreement is authorized by law, including the Energy Reorganization Act of 1974, as amended, and the Atomic Energy Act of 1954, as amended.

NOW, THEREFORE, said contract is hereby modified as follows:

1. Appendix A, attached to this supplemental agreement and made a part hereof, provides for the research to be performed by the Contractor during the contract period specified therein.
2. In Article II - The Period of Performance, the date " July 15, 1980 " is substituted for the date " July 15, 1979 ".
3. In Article III - Consideration, the sum "\$172,798.00" is substituted for the sum "\$140,101.00".

IN WITNESS WHEREOF, the parties have executed this document.

UNITED STATES OF AMERICA

BY: [Signature]
Kellogg V. Morton, Chief
Research Contracts Branch
(title)

Nuclear Regulatory Commission

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

BY: [Signature]
GEORGE H. DUMMER Director
Office of Sponsored Programs
(title)

APPROVED
HDC

I, C. B. Simonides, certify that I am the
(attester)
Secretary of the Executive
Committee of the Corporation
(title) of the Contractor named

under this document; that GEORGE H. DUMMER
(signatory)

who signed this document on behalf of said Contractor was then
Director Office of Sponsored Programs of said Contractor; that
this document was duly signed for and on behalf of said Contractor by
authority of its governing body and is within the scope of its legal
powers.

IN WITNESS WHEREOF, I have hereunto affixed my hand and the seal of
said Contractor.

[Signature]

(SEAL)

CONTRACTOR: MASSACHUSETTS INSTITUTE OF TECHNOLOGY

APPENDIX A

For the Contract period July 16, 1979 through July 15, 1980

Article A-I RESEARCH TO BE PERFORMED BY CONTRACTOR

- (a) The unclassified scope of work under this contract, entitled, "Thermal Phenomena of Reactor Safety," is as follows:

This research project is intended to support the extensive accident-analysis code development being carried out at the Los Alamos Scientific Laboratory. The code, SIMMER, predicts the behavior of an LMFBR system following an accidental high-intensity power pulse in which a portion of the core is melted and/or vaporized. The potentially harmful consequences of such an accident depend largely upon the rates of heat exchange between the overheated fuel and the surrounding materials. Accurate heat-transfer correlations are thus needed as input data for the SIMMER code.

This project includes two basic components: (1) the development of analytical models which will describe the heat-transfer phenomena between two different materials such as fuel (UO₂) and molten or boiling stainless steel. Cases are considered in which either, or both, of the substances are in a two-phase (liquid/vapor) state. The rates and mechanisms with which the surplus heat becomes distributed throughout the fuel-steel-sodium system influence the potential for conversion of the heat into mechanical energy; and (2) in conjunction with the theoretical effort, experiments will be conducted to test the models that are developed. Since the high temperatures to be encountered in the "real accident" case cannot readily be reproduced in the laboratory, simulant materials will be used. The experiments involve the bubbling of one material through a pool of the other and measuring the rates of condensation and vaporization as a function of temperature difference and droplet size.

- (b) The Principal Investigator expects to devote the following approximate amount(s) of time to the contract work:

M. S. Kazimi: 10% of his time for 9 month academic year

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ARTICLE A-II WAYS AND MEANS OF PERFORMANCE

- (a) Items for which support will be provided as indicated in A-III, below
- | | |
|---|--------------|
| (1) Salaries and Wages | \$ 17,725.00 |
| (2) Equipment to be purchased or fabricated by the Contractor | \$ -0- |
| (3) Travel | |
| (i) Domestic | \$ 500.00 |
| (ii) Foreign | \$ -0- |
| (4) Other direct costs including benefits | |
| (5) Indirect costs based on a predetermined rate of 68.3 percent applicable to salaries and wages plus employee benefits minus half of research assistant's salaries and wages. | |

- (b) Items, if any, significant to the performance of this contract, but excluded from computation of Support Cost and from consideration in proportioning costs:

NONE

- (c) Time or effort of Principal Investigator(s) including indirect costs and fringe benefits contributed by Contractor but excluded from computation of Support Cost and from consideration in proportioning costs:

NONE

Article A-III

The total estimated cost of items under A-II(a) above for the contract period stated in this Appendix A is \$32,697.00 ; the Commission will pay 100 percent of the actual costs of these items incurred during the contract period stated in this Appendix A, subject to the provisions of Article III and Article B-XXVIII. The estimated NRC Support Cost for the contract period stated in this Appendix A is \$32,697.00 .

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The estimated NRC Support Cost is funded as follows:

- | | |
|---|---------------------|
| (a) Estimated unexpended balance from prior period(s) | \$ <u>-0-</u> |
| (b) New funds for the current period | \$ <u>32,697.00</u> |
| (c) The new funds being added in A-III(b) constitute the basis for advance payments provided under Article B-X. | |