

2. AMENDMENT/MODIFICATION NO. <div style="text-align:center;">9</div>	3. EFFECTIVE DATE 11-30-87	4. REQUISITION/PURCHASE REQ. NO. RFPA RES-83-174 dtd 10-30-87
6. ISSUED BY U.S. Nuclear Regulatory Commission Division of Contracts Washington, D. C. 20555		5. PROJECT NO. (if applicable) 7. ADMINISTERED BY (If other than Item 6) CODE

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)  Massachusetts Institute of Technology Office of Sponsored Programs 77 Massachusetts Avenue Room E-19-702 Cambridge, Massachusetts 02139	(u)	9A. AMENDMENT OF SOLICITATION NO.
		9B. DATED (SEE ITEM 11)
	X	10A. MODIFICATION OF CONTRACT/ORDER NO. NRC-04-83-174
		10B. DATED (SEE ITEM 13) 8-1-83
CODE		FACILITY CODE

**11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS**

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a) By completing Items 8 and 15, and returning \_\_\_\_\_ copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)			
B&R 601940	FIN B8956	Increase	\$56,869.00

**13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

(u)	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: Mutual agreement of the parties.
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☒ is required to sign this document and return 2 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCP section headings, including solicitation/contract subject matter where feasible.)

(See Page 2)

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NRC-04-83-174 PDR

15A. NAME AND TITLE OF SIGNER (Type or print) David J. Harrigan, Associate Director, OSP		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Elois J. Wiggins	
15B. CONTRACTOR/OFFEROR <i>David J. Harrigan</i> (Signature of person authorized to sign)	15C. DATE SIGNED 1/11/88	16B. UNITED STATES OF AMERICA BY <i>Elois J. Wiggins</i> (Signature of Contracting Officer)	16C. DATE SIGNED 12/31/87

The purpose of this modification is to: (1) revise Article I, Section 3.0, to include within scope changes to provide for completion of the effort described in Modification 6 to the Contract, in accordance with MIT proposal dated November 24, 1987 and Attachment No. 1 to this modification, which are hereby incorporated by reference; (2) to extend the Period of Performance through November 1, 1988; and (3) under Article III, increase both the contract ceiling amount and the obligated amount.

Therefore, the following revisions are made:

1. Under Article I, the following is hereby added:

The Contractor shall continue the effort, initiated under Contract Modification No. 6, with Pacific Northwest Laboratory (PNL) and New Mexico State University (NMSU) in accordance with MIT proposal dated November 24, 1987 which is incorporated by this reference.

2. Under Article II- Period of Performance, the period is extended from November 30, 1987 through November 1, 1988.
3. Article III - Consideration and Payment, is changed to read:

"A. Estimated Cost and Obligation

1. The estimated total cost to the Government for full performance of the contract is increased from \$481,713.00 by \$56,869.00 to \$538,582.00.
2. Total funds currently available for payment and obligated to this contract are increased from \$481,713.00 by \$56,869.00 to \$538,582.00.
3. It is anticipated that the amount obligated will enable the Contractor to perform through November 1, 1988."

All other contract terms and conditions remain unchanged.

## STATEMENT OF WORK

### STOCHASTIC ANALYSIS OF SOLUTE TRANSPORT IN UNSATURATED SOILS

#### 1.0 Introduction:

The MIT investigators have conducted research studies into unsaturated flow and transport in soils. They have developed a stochastic theory and subsequent numerical models which need to be tested. A set of field experiments is ongoing at Las Cruces, New Mexico (FIN B2887, PNL/NMSU) to obtain field-scale in-situ data to validate the stochastic theory. This Statement of Work provides continued involvement of the MIT investigators in the validation effort (see NUREG (CR-4622) "Validation of Stochastic Flow and Transport Models for Unsaturated Soils: A Comprehensive Field Study"). The major thrust of this work is to allow interaction between the PNL-New Mexico State University (NMSU) (FIN B2887) researchers and MIT staff on the design of the validation experiments. Both the MIT research (FIN B8956) and the PNL field study (FIN B2887) have produced findings and discovered new issues not previously anticipated. In order to successfully complete both the MIT and PNL studies, both groups of investigators, the modelers and experimentalists need to address these findings and issues jointly. The research products from this continued joint cooperative studies will provide information for the use of the LLW licensing staff in assessing the utility and applicability of stochastic and deterministic models for the LLW performance assessments.

#### 2.0 Objectives:

The primary objective of this research is to design the field experiments and analyze the observed data at the Las Cruces, New Mexico site so that a comprehensive validation experiment and accompanying data set is produced.

### 3. Project Task:

The contractors will provide ideas and design information to the PNL-NMSU investigators (FIN B2887) for conducting the field validation experiments at the Las Cruces site. The contractor will analyze the field data using the MIT stochastic flow codes for a range of conditions including variance equal to zero (deterministic). The contractor will make formal presentations to the NRC staff and PNL-NMSU investigators on their computer simulations and analysis of the field data. The contractor will assist in the strategy development for spatial and temporal sampling for the unsaturated flow and transport parameters. The contractors will reexamine their earlier (pre-experiment) stochastic and deterministic model simulations and compare those calculations to the simulations using data for the field experiments.

#### 4.0 Final Technical Report:

The contractor will provide input for a NUREG/CR report to be co-authored with the PNL-NMSU and RES staff on the field experiments.

#### 5.0 Presentation and Publication of Technical Results:

The NRC technical monitor encourages the dissemination of research results in peer-reviewed publications but reserves the right to review all technical papers and journal articles (which may discuss research activities of NRC confirmatory research programs) prior to presentation and submission for publications.

#### 6.0 Meetings and Travel:

Travel to NRC Headquarters, to other NRC contractors, and to the Las Cruces field site is contemplated and authorized to the extent required for the performance of the tasks.

7.0 NRC Furnished Material:

The NRC funded Vax computer at MIT, and information on the Las Cruces field site provided by the other NRC contractors (FIN B2887).

8.0 Technical Direction:

The NRC Project Manager is:

T. J. Nicholson

Waste Management Branch

Division of Engineering

Office of Nuclear Regulatory Research

USNRC, Mail Stop NL-007

Washington, DC 20555

Telephone: (301) 443-7672

9.0 Disposal of Property:

Upon completion of the project, a reconciled report will be developed to record available material if purchased with NRC funds. This report should be developed as soon as possible after program completion or termination decision has been made, but not later than 60 days after work termination data. The report should be submitted to the Property and Supply Branch and the applicable program office of NRC.