

Modification No. 12
Supplemental Agreement to
Contract No. NRC-04-81-224

SUPPLEMENTAL AGREEMENT
BETWEEN
THE ARIZONA BOARD OF REGENTS
AND
THE U. S. NUCLEAR REGULATORY COMMISSION

THIS SUPPLEMENTAL AGREEMENT, effective the 1st day of August, 1985 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 THE ARIZONA BOARD OF REGENTS (hereinafter referred to as the "Contractor"),

WITNESSETH THAT:

WHEREAS, the parties desire to modify Contract No. NRC-04-81-224 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 III - Consideration, the sum "\$932,126.0" is substituted for the sum "\$912,134.00."

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PDR CONTR
NRC-04-81-224 PDR

IN WITNESS WHEREOF, the parties have executed this document.

UNITED STATES OF AMERICA

BY:

Paul J. Edgeworth
Paul J. Edgeworth
Contracting Officer
(title)

Nuclear Regulatory Commission

ARIZONA BOARD OF REGENTS

BY:

FLOYD A. SWENSON
FLOYD A. SWENSON
CONTRACTING OFFICER
(title)

I, James T. Wheeler, certify that I am the
(attester)
Assistant Vice President for Research of the Contractor named under
(title)

this document; that Floyd A. Swenson
(signatory)

who signed this document on behalf of said Contractor was then
Contracting Officer 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.

(SEAL)

James T. Wheeler
James T. Wheeler, Assistant Vice President
University of Arizona, Babcock Bldg. Rm. #3313
Tucson, Arizona 85721

CONTRACTOR: ARIZONA BOARD OF REGENTS

APPENDIX A

For the Contract period beginning September 21, 1981 through November 30, 1985.

I. ARTICLE A-1 RESEARCH TO BE PERFORMED BY CONTRACTOR

The following description of the work scope objective and tasks is an extension of the present Phase II work study and is hereby added.

(1) Preparation of the Site

As outlined in the May 30, 1985 modification request, the Magma Mine site shall be used for the experimental field study.

- (a) The Contractor shall drill access boreholes into the fractured tuff to characterize the unsaturated fractured rock system and to make underground measurements.
- (b) The access boreholes shall be 4-inches in diameter and drilled using a diamond drill bit in order to produce scribed cores for fracture characterization.
- (c) The Contractor shall limit the total drilling footage to 300 linear feet, with at least one inclined borehole in order to intersect vertical fractures. Final plans on the number and location of boreholes shall be agreed upon by the project manager.

(2) Fracture Characterization

- (a) The Contractor shall determine the fracture orientation and aperture size and distributions in the rock system using the scribed cores collected, and field data from straddle packer tests.
- (b) The Contractor shall isolate an individual fracture intersecting the borehole by packing it off, and conducting appropriate tests to determine the permeability of the fracture.
- (c) Previously purchased packer assemblages, tripod and wrenches shall be reused where possible. Purchase of new equipment shall be limited to \$6,600 and only with the approval of the project manager.

(3) Infiltration and Percolation Studies

- (a) Upon completion of Tasks 1 and 2, the Contractor shall assess field methods for characterizing the unsaturated fractured rock system for infiltration of water from natural and artificial rainfall events, and for percolation of the water through the fractured tuff. Specific activities to be performed by the Contractor are the surface application of tracers, to be selected in consultation with the project manager and the measurement of the tracer concentration with depth in the access boreholes.
- (b) The Contractor shall conduct hydraulic tests, including neutron probe measurements, to determine the vertical and horizontal soil water movement.
- (c) The Contractor shall measure the water intake rates and subsequent movement through the fractures using hydraulic tests and measurement techniques to be chosen in consultation with the project manager.

(4) Water Sampling

In addition to the hydraulic tests, the Contractor shall test moisture sampling methods for use in chemical studies. The methods to be examined will be chosen after Tasks 1 and 2 are completed in order to understand the fracture geometries and permeabilities.

The Principal Investigator expects to devote the following approximate amount(s) of time to the contract work: No Change

II. 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 \$408,849.00
- (2) Equipment to be purchased or fabricated by the Contractor \$ 59,120.00
- (3) Travel
 - (i) Domestic \$ 40,085.00
 - (ii) Foreign \$ -0-
 - (iii) All contractor travel must have the prior approval of the NRC Project Officer.
- (4) Other direct costs including fringe benefits. Fringe benefits are based on a predetermined rate of 17.4% S&W for faculty and 1.5% S&W for students based on a fixed rate effective July 1, 1985 through June 30, 1986.

- (5) Indirect costs based on a predetermined rate of 44% applicable to S&W, FB, materials and supplies, services, travel, subgrants and/or subcontracts up to \$25,000 per April 17, 1985 rate agreement with HHS.
- (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

III. ARTICLE A-III

The total estimated cost of items under A-II(a) above for the contract period stated in this Appendix A is \$932,126.00; 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 \$932,126.00.

The estimated NRC Support Cost is funded as follows:

- (a) Estimated unexpended balance from prior period(s) \$-0-
- (b) New funds for the current period \$19,992.00
- (c) The new funds being added in A-III(b)
constitute the basis for advance payments
provided under Article B-X.