

MAY 10 1989

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MEMORANDUM FOR: John D. Randall, Section Leader
Waste Management Performance Section
Waste Management Branch
Division of Engineering, RES

FROM: Donald L. Chery, Jr., Section Leader
Hydrologic Transport Section
Geosciences & Systems Performance Branch
Division of High-Level Waste, NMSS

SUBJECT: REVIEW OF DRAFT STATEMENT OF WORK (SOW) ON FIELD
INVESTIGATION OF FLOW AND TRANSPORT UNCERTAINTIES IN
FRACTURED MEDIA (PPSAS: 411222 & TAC #L60015)

In response to Timothy J. McCartin's request dated 3/15/89, the Hydrologic Transport Section staff (T. Mo, N. Coleman and myself) have reviewed the above subject draft SOW. Our comments are provided in Enclosure 1 and on the markup copies of the draft SOW (Enclosures 2 and 3).

If you have any questions about these comments please contact T. Mo at X20541 or myself at X23461.

LS
Donald L. Chery, Jr., Section Leader
Hydrologic Transport Section
Geosciences & System Performance Branch
Division of High-Level Waste, NMSS

cc: R.L. Ballard, HLGP
D.J. Brooks, HLGP
J.W. Bradbury, HLGP
T.J. McCartin, WMB, RES

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Hydrologic Transport Section Comments on Draft RES Statement of Work entitled: "Field Investigation of Flow and Transport Uncertainties in Fractured Media"

COMMENTS:

1. Page 4, Section entitled: "Relationship to NMSS User Need Statement".

This section discusses proposed work that will contribute to the development of flow and transport models for fracture flow under saturated conditions. The work proposed is limited to evaluating assessment methods for estimating the error in the hydrologic transport models due to transport pathway identification and "scaling" problems only. This is sufficient to get the project started. Other errors and uncertainties, for example, resulting from evaluation of radionuclide source terms, and valence effects on radionuclide sorption, solubility and transport should be evaluated eventually in an expanded SOW. A comprehensive evaluation of errors and uncertainties due to all the factors delineated in item C.3 of NMSS User Need Statement (See p.4, item C.3 of enclosure to February 13, 1989 "User Need Letter" memorandum from Bernero to Beckjord), and bounding of these uncertainties by proper propagation methods should be included as additional work proposed in the expanded SOW. Otherwise, the SOW should state how these other uncertainties will be reduced based on other studies and how they will be folded/propagated into the limited errors and uncertainties proposed to be determined in this current draft of the SOW.

2. Page 5, Section entitled: "Relationship to SECY-88-285", Paragraph 1, Third Sentence: "This work will attempt to quantify the uncertainties of these conditions to circumvent this controversial issue during licensing (.....)" and Paragraph 2.

What is proposed to be done here is adequate to start the work. However, RES should eventually expand the scope of work to fully respond to the NMSS User Need Statement (i.e., item C.3).

Rec'd 3/15/91

Don .

Enclosure (2)

Comments!
Tim

STATEMENT OF WORK

TITLE: Field Investigation of Flow
and Transport Uncertainties
in Fractured Media

EIN:
CONTRACTOR: In-Situ, Inc.
SITE: Laramie
STATE: Wyoming

NRC PROJECT MANAGER: Timothy J. McCartin

PRINCIPAL INVESTIGATOR: Timothy D. Steele

BUDGET ACTIVITY:

WORK PERIOD: 6/1/89 - 9/30/91

Objective: ^{Contribute to} To ~~assist~~ the development of techniques and strategies for
quantifying uncertainty and error in ^{flow and} transport models due ^{for} to
fracture flow under saturated conditions and the presence of
undetected hydrologic features, ^{To develop} ~~such as a high conductivity~~
~~fault zone, through tracer tests conducted in a fractured~~
~~field site with a fault zone~~

Background:

An NRC ^{a DOE compliance determination for} ~~the evaluation of the safety of the~~ HLW repository will require ^{that} ~~the~~ NRC ^{to} ~~analyze the potential of fractures and high conductivity fault zones~~ ^{to analyze the potential of fractures and high conductivity fault zones} ~~to compromise the safety of the site.~~ ^{to compromise the safety of the site.} In the unsaturated zone, it is ^{widely accepted} ~~widely accepted~~ that flow in fractures and fault zones will occur only ^{pastulated} ~~pastulated~~ during saturated conditions. Saturated conditions could occur along fractures at Yucca Mountain after rainfalls, locally due to perched water, and at later times due to climatic changes. The unsaturated conditions at Yucca Mountain make identification of fault zones and examination of fracture flow under field conditions extremely difficult.

RES has been conducting field investigations ^{near} in saturated fractured rock ~~in~~ Creston Washington (FIN D-1163) directed towards understanding flow and transport phenomena ^{applicable to a repository in basalt} ~~applicable to a repository in basalt~~. ^{Because} ~~Based on~~ the DOE selection ^{ed} of Yucca Mountain as the site of an HLW repository, ^{NRC} ~~investigations with a basalt repository as the focus are no longer~~ ^{research} ~~investigations with a basalt repository as the focus are no longer~~ continuing. The Creston field site can be used to perform ^{field} ~~experiments~~ ^{that would} ~~assess the uncertainty in transport calculations due to~~ fracture flow and flow ^{and transport} ~~in a high conductivity fault zones~~, models of fractured rock and

such processes, and ^{Required Work} ~~Studies at the Creston field site will also contribute to~~ ^{NRC's understanding of testing methodologies} ~~for its evaluations of the DOE's saturated zone~~ ^{Investigations at Yucca Mountain.}
Task 1: Program Plan Development

(For _____)

The contractor will produce a detailed program plan. The program plan will include; 1) description of necessary field development, 2) description of the field tests, 3) description of the analyses to be

performed, 4) relevancy of the analyses to understanding ^{and} quantifying the uncertainties in transport calculations due to fracture flow and high-conductivity ^{ZONES} and 5) applicability of the analyses to Yucca Mountain. The program plan will be submitted for approval to the NRC Project Manager.

Task 2: Field Site Development

Upon approval of the project manager, the contractor will perform the necessary field development as described in the program plan.

Task 3: Field Tests

The contractor will perform the field tests as detailed in the program plan.

Task 4: Field Test Analyses

The contractor will analyse the tests and submit a report ~~report~~ that describes the work performed in Tasks 2 and 3 and the results of the analyses. The report will pay particular attention to the influence of fractures and high-conductivity zones on the prediction of ^{radionuclide} ~~solute~~ migration. The report will address techniques for quantifying the

uncertainies in ^{flow and} transport calculations due to the presence of fractures and high-conductivity zones.

Level of Effort

Approximately four staff-months of effort is required to complete Task 1. If approved, Tasks 2-4 will require 1.5 staff-years of effort and approximately \$25K for wellfield development.

Relationship to NMSS User Need Statement

The subject SOW will assist radionuclide transport evaluation in the areas of transport pathway identification and "scaling" problems (Earth Science Area, Radionuclide Transport sub-heading of user need statement) and assessment of and techniques for estimating error and uncertainty for models (Earth Science Area, Groundwater Flow and Radionuclide Transport sub-heading of user need statement).

Relationship to SECY-88-285

The proposed work will develop methods or techniques for estimating uncertainties in transport calculations due to the presence of fracture flow or high-conductivity zones. The NRC review of the DOE License Application will require the staff to consider the influence of fractures and possibly undetected fault zones on the DOE's analysis. This work will attempt to quantify the uncertainties of these conditions to circumvent this controversial issue during licensing (III. Reducing Uncertainties and Refining the Regulatory Framework, B. Reducing Technical Uncertainties of SECY-88-285).

The majority of this work should be accomplished in FY-90. This time frame will allow incorporation of the research results into Technical Positions on Radionuclide Transport and Scenario Identification and Screening.

Sole Source Justification

In-Situ, Inc., under Research Fin D-1163, has developed a field site in Creston, Washington. The contractor has spent considerable time and money developing and understanding the flow field and determining transport parameters. The development of a new field site would involve significant drilling costs in addition to contractor analyses to understand and interpret the field test results.

Additionally, the Creston field site contains a high-conductivity zone. A major portion of this work is to analyse the influence of a high-conductivity zone. The development of another field site in the hopes of finding a similar hydrologic structure would involve excessive costs and be too speculative to perform.

Due to the previous work, the contractor will be able to design the field tests immediately. Another field site will require analyses to understand the flow field and determine transport parameters which will result in excessive delays to the program.

performed, 4) relevancy of the analyses to understanding and quantifying the uncertainties in transport calculations due to fracture flow and high-conductivity ^{zones} and 5) applicability of the analyses to Yucca Mountain. The program plan will be submitted for approval to the NRC Project Manager.

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Task 3: Field Tests

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Task 4: Field Test Analyses

The contractor will analyse the tests and submit a report ~~a report~~ that describes the work performed in Tasks 2 and 3 and the results of the analyses. The report will pay particular attention to the influence of fractures and high-conductivity zones on the prediction of ~~solite~~ ^{*radioactive} migration. The report will address techniques for quantifying the

*the term "solite" may be too limiting in that in chemical nomenclature it refers to "elements or compounds which are soluble". For high-level waste situation we are also concerned with migration of particulates

*OVER

and colloids of radionuclides, radionuclides sorbed onto (or coprecipitated with) particulates and colloids of (nonradioactive) stable element chemical compounds or organic material (including weathered and or biodegraded organic molecules and live and/or dead microorganisms).

[Tim Mo]
T. M. 4/21/89

uncertainties in transport calculations due to the presence of fractures and high-conductivity zones.

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Need some reference to the component of performance evaluation that will be done in the saturated pathway (through fractured rock) at Yucca Mountain \approx 5 Km of pathway. [DLC]

Sole Source Justification

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