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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Las Vegas, Nevada 89119
Tel: (702) 388-6125
FTS: 598-6125

TO: King Stablein, WMRP
FROM: Paul T. Prestholt, Sr. On-Site Licensing Representative
DATE: December 31, 1986
SUBJECT: Hydrocoin Information for your file

Please find enclosed four letters regarding Hydrocoin
that we discussed on the telephone.

PTP:nan

WM Record File
102

WM Project 11
Docket No.

PDR ✓

LPDR ✓

Distribution:

J. Linehan

K. Stablein

NSHJ

(Return to WM, 623-SS)

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PDR WASTE
WM-11 PDR

1260

Sandia National Laboratories

Albuquerque New Mexico 87185

DEC 22 1986

Donald L. Vieth, Director
Waste Management Project Office
U. S. Department of Energy
Nevada Operations Office
P. O. Box 14100
Las Vegas, Nevada 89114

Dear Don:

Subject: Special HYDROCOIN Workshop on NNWSI-Proposed Sensitivity Analyses

This letter is to inform you of our decision to host a special HYDROCOIN workshop on the application of sensitivity analysis methods to flow through layered, fractured tuff. The topics and format for the workshop are described in the enclosed letter to the HYDROCOIN secretariate.

As you are aware, Sandia is representing NNWSI in HYDROCOIN, the Hydrologic Code Intercomparison Project (see enclosed correspondence on HYDROCOIN). One aspect of the HYDROCOIN work (Level 3) involves sensitivity and uncertainty analyses. The NNWSI team proposed and HYDROCOIN adopted a sensitivity analysis for unsaturated flow through layered, fractured tuff (Level 3, Case 2). We designed this HYDROCOIN case as a generic analysis that complements flow analyses that are planned or already in-progress for the Repository Performance Assessment Division (e.g., COVE 2 benchmarking, two-dimensional lateral flow analyses).

The U.S. Nuclear Regulatory Commission (NRC) and the U.K. Atomic Energy Research Establishment at Harwell (UK AERE) believe that this is one of the more important HYDROCOIN cases and have already begun work on it. Other HYDROCOIN teams that have expressed an interest in the problem are the Japan Atomic Energy Research Institute (JAERI) and the British Geological Survey (BGS).

At the regular HYDROCOIN workshop held last month, it became apparent that it would be difficult, within the planned HYDROCOIN schedule, for the project teams to complete work on three of the sensitivity and uncertainty analyses. The unsaturated-flow problem is one of those cases. The NRC is having considerable difficulty with the problem; their groundwater flow codes may not be able to handle the extreme nonlinearities. The UK AERE, while recognizing the inherent difficulty of the analysis, has a more appropriate hydrologic code and appears to be making reasonable progress.

Sandia National Laboratories

Albuquerque, New Mexico 87185

FEB 19 1986

Donald L. Vieth, Director
Waste Management Project Office
U.S. Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, Nevada 89114

Dear Don:

Subject: NNWSI Project Participation in HYDROCOIN

We have reassessed our reasons for participating in the HYDROCOIN project and have decided on a course of action that we believe (1) does not interfere with high-priority project activities such as the SCP and performance allocation, (2) is consistent with ongoing NNWSI code-certification activities, and (3) represents a useful level of effort.

According to the HYDROCOIN project secretariat, work by all of the project teams is moving ahead on schedule. Work on HYDROCOIN Level 1 (code benchmarking) has been completed; the emphasis is now on Level 2 (code validation) and Level 3 (sensitivity and uncertainty analyses).

Within the international community involved with performance assessment of deep geologic repositories, NNWSI is the focal point for the study of partially saturated flow in fractured, heterogeneous media. Several HYDROCOIN participants, most notably the U.S. Nuclear Regulatory Commission (NRC), have expressed interest in having NNWSI propose test cases for Levels 2 and 3 based on the partially saturated flow conditions at Yucca Mountain. Specifically, they are interested in having us extend an existing NNWSI code benchmarking problem (COVE 2) for this purpose.

At this time, it appears that, given the HYDROCOIN schedule, sufficient field data from Yucca Mountain will not be available to enable us to propose and carry out a code-validation analysis for HYDROCOIN Level 2 in the time available. We will be validating our hydrologic models for partially saturated flow after the HYDROCOIN Project has ended. However, sensitivity and uncertainty analyses similar to those of HYDROCOIN Level 3 are already planned as part of the COVE 2 activity that is now going on. Very little additional work will be required to prepare this analysis for use by the HYDROCOIN project. Because the work planned for HYDROCOIN parallels existing or planned NNWSI analyses, the cost of continued participation will be minimal.

Copy & send to King

DEC 22 1986

To keep HYDROCOIN on schedule and get the widest possible participation in these analyses, it was suggested that special HYDROCOIN workshops be held for each of the more-difficult Level 3 cases. As the pilot team for Case 2, NNWSI was asked to host a workshop on behalf of the HYDROCOIN secretariate. We believe that hosting the workshop is well worth the effort because of the benefits the NNWSI Project will derive from it:

- Interact directly with the NRC
- Observe the capabilities of the NRC's hydrologic codes for modeling conditions like those at Yucca Mountain
- Obtain NRC and international-peer review of, and input to, both numerical and sensitivity analysis methods as applied to flow through layered, fractured tuff
- Complement work we are already doing or have planned
- Focus attention within NNWSI on sensitivity analysis methods as applied to unsaturated flow

I emphasize that this will be a HYDROCOIN workshop, not an NNWSI workshop. The analyses are being dealt with in a generic sense rather than as Yucca Mountain analyses. This will be a technical workshop and licensing issues will not be discussed.

Sincerely,

Thomas O. Hunter

Thomas O. Hunter, Manager
NNWSI Projects Department 6310

Enclosures

Copy to:
P Prestholt, US NRC
J. C. Rotert, WMPO
6310 T. O. Hunter
6312 F. W. Bingham *JWB*
6312 R. W. Prindle
6310 10/12144/COR/NQ
6310 10/12141/COR/NQ

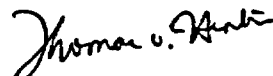
FEB 19 1986

Most of the work on the COVE 2 and HYDROCOIN-related analyses is being done by personnel outside of Sandia's NNWSI Project Department. These people are not directly involved with ongoing high-priority tasks such as the SCP and performance allocation. For this reason, we do not expect any conflicts between HYDROCOIN and other tasks. If any conflicts do arise, high-priority project tasks and milestones will take precedence over HYDROCOIN.

Continued involvement allows us to benefit from HYDROCOIN in several ways. Comparison of our work with that done by groups independent of NNWSI lends authenticity to our work. We learn from the approaches and techniques used by other analysts. Others are exposed to the modeling difficulties posed by the hydrologic characteristics of the partially saturated tuffs at Yucca Mountain.

Since May 1985, when the semiannual HYDROCOIN workshop was held in Albuquerque, NNWSI has given minimal attention to HYDROCOIN because of the press of high-priority tasks. NNWSI was not represented at the November 1985 workshop at which important decisions were made regarding code validation and sensitivity and uncertainty analyses. We believe that attendance at the HYDROCOIN workshops is essential if we are to influence the direction of HYDROCOIN and gain the full benefits of participating in the project. Our input is needed to ensure that cases dealing with partially saturated flow are defined so that they are useful to NNWSI. Many of the benefits of the HYDROCOIN project come from interacting directly with other modelers and analysts, exchanging ideas, and discussing successes and failures. We hope to send a NNWSI project representative to the HYDROCOIN workshops planned for May 1986 in Japan and November 1986 in the Netherlands. The May 1987 workshop will probably be hosted by one of the United States participants.

Sincerely,



Thomas O. Hunter, Manager
NNWSI Project Department 6310

RWP:6312:mjh:1444r

Copy to:

J. C. Rotert, WMPO
C. R. Cole, PNL
6310 T. O. Hunter
6312 F. W. Bingham
6312 R. W. Prindle
6310 CF 10-12144-COR/NQ

Sandia National Laboratories

Albuquerque, New Mexico 87186

December 19, 1986

Mr. Kjell Andersson
Swedish Nuclear Power Inspectorate
Box 27106
S-102 52 Stockholm
Sweden

Dear Kjell:

Subject: Special Workshop on HYDROCOIN Level 3, Case 2, Sensitivity
Analyses of Flow Through Unsaturated, Fractured Tuff

I have discussed with my management the suggestion that Sandia host a special HYDROCOIN workshop on Level 3, Case 2. The idea was well received and I am beginning to make the necessary arrangements.

The special workshop will follow the same style as the regular HYDROCOIN workshops. There will be no formal papers or proceedings. Presentations will be informal and will deal with: the statement of the problem, the formulation of the models, work completed up to the time of the workshop, approaches used, problems encountered, ideas on how to deal with the difficulties inherent in these analyses. The schedule will include plenty of time for open discussions.

I have enclosed a tentative agenda that outlines the technical subjects that I think we should cover during the workshop. The ultimate purpose of this Level 3 case is to explore methods for investigating model sensitivities in a numerically difficult, unsaturated-flow analysis. Therefore, the bulk of the time will be devoted to sensitivity analysis methods as applied to this case, and to the numerical techniques required to solve the equations in the unsaturated-flow model. A basic understanding of the physics involved is needed to properly interpret modeling and sensitivity results, so we will also spend some time discussing the physics of unsaturated flow and the model that was suggested to simulate it.

I would like to hold the workshop during the week of March 9, 1987. We can easily use 2 full days, probably 3 days, to cover the subjects listed in the enclosed tentative agenda.

K. Andersson
Page 3

Copy to:

C. Cole, PNL
B. Grundfelt, Kemakta
C. P. Jackson, UK AERE-Harwell
H. Kimura, JAERI
A. Larsson, SKI
T. Nicholson, US NRC
D. Noy, BGS
P. Raimbault, CEA/IPSN

1511 D. K. Gartling
1511 N. E. Bixler
1511 R. R. Eaton
1511 P. L. Hopkins
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K. Andersson
Page 2

The HYDROCOIN secretariate can assist in the planning for the workshop by informing all of the project teams of our intentions and asking them to respond to the following questions by January 20, 1987:

- Is the project team interested in participating in this workshop?
- If so, how many people from the project team or its support contractors are likely to attend the workshop?
- Are there any serious conflicts with the suggested schedule?
- Would they like to make a presentation on any of the major topics as they relate to Case 2: unsaturated-flow models, numerical analysis techniques, or sensitivity analysis techniques? If so, indicate which topic and give a title for the proposed presentation. More than one presentation will be considered if the schedule permits.
- Will they have results to present? If so, give a title for the presentation.

Responses should be sent directly to me. Any suggestions you might have for organizing the workshop are also most welcome. Thank you for your assistance.

Sincerely,



Robert W. Prindle
NNWSI Repository Performance
Assessments
Division 6312

Enclosure

Tentative Agenda

Special HYDROCOIN Workshop on Level 3, Case 2 Sensitivity Analysis of Unsaturated Flow Through Layered, Fractured Tuff

Dates: March 9-11, 1987

Location: Albuquerque, New Mexico USA

- March 9** Unsaturated-flow phenomena
 Moisture characteristic curves
 Problem statement
 Boundary conditions
 Possible simplifications
 Performance measures that capture relevant
 information about what is happening in this
 system
- March 10** Numerical techniques for highly nonlinear analyses
 1-D and 2-D flow
 Steady and transient flow
 Achieving convergence and numerical stability
- March 11** Sensitivity analysis methods
 Local and global sensitivity analysis techniques
 that will yield useful insights into the
 behavior of this system
 Applying the methods to this case and
 interpreting the results



Department of Energy

Nevada Operations Office

P. O. Box 14100

Las Vegas, NV 89114-4100

JUL 03 1985

Ralph Stein, Acting Director, Engineering and Licensing Division, Office of
Geologic Repositories, DOE/HQ (RW-23) FORSTL

NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS (NNWSI) PROJECT PARTICIPATION IN HYDROCOIN

This letter is in response to your request for confirmation of the NNWSI Project's continued participation in HYDROCOIN. We recognize the potential benefits that can be derived from HYDROCOIN and plan involvement to the extent possible.

Nancy Hayden, the NNWSI Project team leader for the validation of postclosure performance assessment codes and for HYDROCOIN, participated in the workshop May 15-18 and May 22 in Albuquerque, New Mexico. The workshop was very productive in discussing problems that are of primary concern to the NNWSI Project code verification (COVE) task for benchmarking. In addition, the studies proposed for validation are of great interest to us. These include studies of lab and field experiments for flow in fractured rock, for flow in thermal fields, and for scale effects between lab and field studies. Continued involvement in HYDROCOIN will therefore be an efficient mechanism for validating our hydrologic models in an arena of technical peer review and international expertise.

Although we believe this involvement to be useful, NNWSI Project participation will be restricted during the next several months because other tasks (i.e., Final Environmental Assessment, Site Characterization Plan, Performance Assessment Plan, and Exploratory Shaft Test Plan) must be given higher priority. Benchmarking calculations are being done, as time allows, by modelers who support the performance assessment task at Sandia National Laboratories (SNL). These modelers do not include the staff of the performance assessment division at SNL, who must devote full time to the higher-priority tasks. At the May workshop, the project secretariat requested that all benchmarking results be submitted by July 31, 1985, to allow for compilation in time for the next HYDROCOIN workshop in November. However, because of the heavy workload that the modelers must maintain this summer in the absence of technical contributions from the performance assessment staff, the NNWSI Project will endeavor only to complete the benchmarking studies by October 1, 1985.

JUL 03 1985

Ralph Stein

-2-

The final definitions of the validation cases (see enclosure) will be decided at the November workshop. The NNWSI Project has agreed to write up a formal definition of Validation Case 2 and to write a proposal for another case that will model laboratory data for heat and water flow in a porous media. (The experiments that produced these data were funded by DOE for validation of the codes used in the subseabed waste-disposal program.)

Most of the benefit derived from participation in HYDROCOIN requires consistent and direct interaction of the technical staff doing the work. Therefore, we would like to send at least the project leader for the NNWSI Project code validation to the workshops. However, since the SCP, the PAP, and the final EA are scheduled to be completed during the next several months, it may be difficult to participate in the November workshop. After submission of these documents, we anticipate involvement in future workshops to the extent allowed by the priorities assigned to concurrent project work.



Donald L. Vieth, Director
Waste Management Project Office

WMPO:JCR-1205

cc:

T. O. Hunter, 6310, SNL, Albq., NM
F. W. Bingham, 6312, SNL, Albq., NM
N. K. Hayden, 6312, SNL, Albq., NM
J. C. Rotert, WMPO, DOE/NV



ENCLOSURE

Benchmarking Problems (results requested by July 31)

- Case 2. Study of the effects of mesh variations on simulation of saturated flow through rock containing two large fracture sets
- Case 3: Study of two-dimensional, isothermal flow through unsaturated layers of porous media
- Case 4: Study of two-dimensional, nonisothermal heat and water flow surrounding a symmetric source in saturated rock

Validation Problems (preliminary results requested by November)

- Case 1: Modeling of a field study of heat and water flow around a large (50m) cylindrical heat source in Cornish granite quarry
- Case 2: Modeling of five layers of unsaturated tuff based on stratigraphy at USW-G4 at the NTS and hydrologic properties from lab tests of core