

OCT 13 1988

OPEN ITEMS MEMO 2

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MEMORANDUM FOR: Ronald L. Ballard, Chief
Geosciences and Systems Performance Branch
Division of High-Level Waste Management

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

SUBJECT: YUCCA MOUNTAIN PROJECT (YMP) HYDROLOGY OPEN ITEMS
(SEPTEMBER 1988)

At my direction, the Hydrologic Transport Section staff assembled a set of hydrologic open items derived from reviews of DOE's Yucca Mountain program. This set is provided as Attachment A. This activity was prompted by the June 21, 1988 memorandum from DOE listing NRC QA "open items" and the concern that the hydrologic issues had not been explicitly identified and listed.

The process of assembling open items began when I had the staff review the formal communications between the NRC and DOE concerning hydrology. Jeff Pohle collated relevant background material and assigned portions to each hydrology staff member for review and further development as open items. Jeff also provided an example set of open items based on that portion of background material he assigned to himself for developing open items. After all background material was considered and a complete set of open items drafted, the staff held two lengthy sessions where the scope and expression of each draft open item were discussed. Based on these sessions, a set of open items was completed.

To develop this set of open items, we needed to make a number of decisions. These decisions were that:

- Open items were to be based on only those items formally communicated to DOE in NRC comments on the CDSCP or FEA.
- Open items must be relevant to the requirements of 10 CFR 60 and those requirements will be delineated by the regulatory analysis provided in the "relational database" being developed by the CNWRA. However, CDSCP and FEA comments, from which open items were to be developed, are most often expressed in terms of their technical significance; a regulatory significance would have to be inferred. It was realized that some thought and internal guidance was needed for developing the scope and expression of open items with respect to a regulatory concern. Jeff Pohle developed the example categorization of open items, listed in Appendix B, for the groundwater travel time regulation and used it to guide his discussion of the relevance and reasonableness of open items with

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respect to the broader aspects of compliance demonstration methods and information requirements.

- ° Open items are defined by the program architecture glossary of terms for HLW. The original task group studying open item tracking and development (Open-Item Tracking System Task Group; refer to memorandum for WM Branch Chiefs from Avi Bender, March 7, 1986) attempted to keep open items at a somewhat broad level of detail by combining as many "issues" or "concerns" as possible. On the other hand, it appears that current thinking within the Division would define each and every CDSCP, SCP or Study Plan comment as a trackable open item. We decided to use the definition of an open item provided in the program architecture glossary of terms for HLW (memorandum from Joseph O. Bunting dated June 21, 1988). That definition is "those regulatory, technical, or institutional uncertainties, compliance demonstration methods, information requirements, uncertainty questions, and decisions, both proactive and reactive, that have been approved by the Program Architecture Configuration Authority for inclusion in the Open Item Tracking Module of the Program Architecture Support System." This definition allows for a very wide spectrum of open items in terms of level of detail.
- ° Appropriate open items developed at this time will be at a broader level than study plan level comments or even narrower comments as discussed below under Results. The most difficult part of this exercise has been to answer the question "What is an appropriate open item at this stage of the program?" For example, the CNWRA is required to delineate compliance determination methods and information requirements (fields 25 and 42 of the "relational database") by the end of the year. We anticipate that their first effort will be very broad and general, such as the items identified in Attachment B. However, the staff (who are responsible for the SCP and Study Plan reviews) are required to develop very specific questions or technical concerns based on their judgement of the scope of compliance determination methods and information requirements being identified by the CNWRA. Furthermore, distinguishing at this level of detail between technical concerns having regulatory significance from those having only academic significance is a difficult task.
- ° A slight modification of the format developed by the original Open-Item Tracking System Task Group (1986) would be used. We assumed that management will be reevaluating formats in light of the computer text databases and text management systems in use and the "relational database" being developed by the CNWRA. This format was chosen for consistency.

- The applicable regulations would not be listed on the forms. To do so would require the complete regulatory analysis still under development.

Results

Open items developed from CDSCP or FEA comments generally fell into two categories:

- Open items developed by combining two or more comments. It must be noted that many review comments have a very narrow perspective. The comments were directed toward a specific document. By studying these comments in combination, a more broad concern was developed that we conclude was implicit, but not necessarily expressed explicitly, in the original comments. Examples would include open items 001 and 005. In these cases, satisfactory resolution of the original comments would not necessarily result in closure of the open item.
- Open items which are essentially a direct summary of the original comment provided to DOE.

Not all of the NRC hydrology comments were translated into open items. This was because further review of the CDSCP indicated that the comment was at a level of detail typical of a Study Plan and therefore, out of the scope of the CDSCP. In all such cases, it would be appropriate for DOE to defer a response to a future study plan. Thus, it is premature to raise such comments or develop such open items at this time.

A summary of the disposition of each FEA or CDSCP comment with respect to the final set of open items is given in Attachment C.

Experience Gained

The development of open items has been a useful experience for Section staff. The opportunity to reevaluate and express our CDSCP comments in terms of their broader regulatory significance will provide a more focused and consistent SCP review at the appropriate level of detail. Further, we now have a better awareness of the importance of reviewing DOE's Study Plans. Review of DOE's Study Plans will be necessary to reach conclusions on the adequacy and feasibility of the site characterization program. Detailed information on number and location of tests, test procedures and quality assurance is contained in the Study Plans, not in the SCP. (Refer to SCP/Study Plan content requirements defined by Enclosure 4, Attachment B of the summary of the NRC/DOE "Level of Detail" meeting.) It is the review of that information by the NRC staff that leads to identification of specific technical uncertainties (open items) with respect to the tests (compliance demonstration methods).

Guidance Needed

It is not clear that the "Program Architecture Configuration Authority" (PACA) provides a mechanism [procedure] to evaluate open items from the NRC staff for inclusion in the "Open Item Tracking Module" of the "Program Architecture Support System (PASS)." Regardless, the staff needs guidance in developing, submitting, resolving and closing out open items. Specifically, guidance is needed with respect to:

- ° Procedures for developing and submitting new open items into the PASS system. For example, will open items dealing with compliance demonstration methods and information requirements be developed only in response to a DOE submittal? Further, how are new open items submitted for inclusion in the tracking system?
- ° Procedures for resolving and closing out existing open items. The process for resolving open items related to regulatory uncertainty is reasonably clear, at least in general terms (rulemaking, for example). The resolution process (written agreements, NRC/DOE workshops, etc.) and formal close out procedures, under the authority of the "Program Architecture Configuration Authority (PACA)" for other types of open items is not clear.

We request your assistance in obtaining the needed guidance.

Recommendation

I recommend that this set of open items be submitted to the CNWRA for inclusion in the "relational database" of the PASS (field 49), and that the Center develop all the preceding fields of the "relational database" for these items.

Following Work

Dave Brooks has followed the development of the hydrology open items. He and the other geochemists are presently reviewing the geochemistry issues and developing a set of open items. That set will be conveyed to you as soon as it is completed.

/S/
Donald L. Chery Jr., Section Leader
Hydrologic Transport Section
Geosciences and Systems Performance Branch
Division of High-Level Waste Management

cc: D. Brooks

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Concur with the understanding that this is an initial set of open items. Other open items will be developed as site characterization proceeds. NC

OFC : HLGP	: HLGP	: HLGP	: HLGP	: HLGP	: HLGP
NAME : JPohle/11/cj	: FRoss	: TVerma	: WFord	: NColeman	: DChery
DATE : 10/13/88	: 10/13/88	: 10/13/88	: 10/13/88	: 10/13/88	: 10/13/88

ATTACHMENT A

**SET OF HYDROLOGY OPEN ITEMS FOR
THE YUCCA MOUNTAIN PROJECT**

OPEN ITEM SUMMARY

- 1 -

OPEN ITEM NUMBER

HYDROLOGY OPEN ITEM

- | | |
|-----|---|
| 001 | Role of unsaturated zone prototype testing in the site characterization process and the implications of that role with respect to quality assurance and site characterization schedules |
| 002 | Development and implementation of calculational procedures for addressing the regulatory requirement for groundwater travel time |
| 003 | Completeness of the saturated zone testing program with respect to activities identified for characterizing the relationship of faults lying within and east of the repository block to the hydrologic system at Yucca Mountain |
| 004 | Potential interference to hydrologic testing in the exploratory shaft facility from previous investigations of the unsaturated zone at Yucca Mountain |
| 005 | Development of a performance allocation for groundwater travel time that considers alternative assumptions and provides the basis of the testing program for characterizing the hydrologic system within the geologic setting |
| 006 | Description of geohydrologic testing activities after drifting in the Topopah Springs Member to the Ghost Dance fault, the Imbricate-Normal fault zone, and beneath Drill Hole Wash |
| 007 | Information needs regarding "significant sources" of groundwater outside the controlled area |
| 008 | Isotopic dating of groundwater in the upper part of the water table |
| 009 | Adequacy of flooding debris-hazard studies |
| 010 | Use of dendrochronology as an activity parameter for evaluation of regional paleoclimatology |
| 011 | Consideration of the controversy over the interpretation of packrat middens as indices of late Pleistocene and Holocene climate |

OPEN ITEM SYSTEM RERPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

- OPEN ITEM: Role of unsaturated zone prototype testing in the site characterization process and the implications of that role with respect to quality assurance and site characterization schedules
- INITIAL IDENTIFICATION: CDSCP Comments 6, 7 and 11
- BACKGROUND: The CDSCP indicated that methods for characterizing the unsaturated zone are to be divided into a prototype component and a site characterization component (CDSCP; page 8.3.1.2-120). The stated purpose of the prototype component is to determine how equipment and methods must be adapted to be used successfully on Yucca Mountain during site characterization. Three comments raised by the NRC staff during review of the CDSCP are related to the prototype component of the unsaturated zone characterization methodology.
- First, while noting that the CDSCP identified the need for prototype testing before field testing could begin, the NRC staff commented that no specific activities [studies] describing the prototype testing program were presented in the CDSCP. As a result, there will be no opportunity for NRC staff to review specific study plans on the prototype component of the unsaturated zone characterization methodology in order to comment on detailed technical plans, assigned quality assurance levels or testing schedules. A recommendation to develop an activity [study] describing the prototype testing program was made (CDSCP Comment 6).
- Second, while acknowledging the experimental nature of available techniques and devices for testing unsaturated, fractured rock, NRC staff commented that theories for the flow of liquid within and across fractures have not been tested in the field or in the laboratory. A recommendation was made to the effect that the current concept of moisture characteristic relations for fracture/matrix flow be supported by laboratory or field tests on dry, fractured rock similar to that at Yucca Mountain, and thus should also be one of the objectives of the prototype testing program (CDSCP Comment 11).

Third, because of the failure rate of available monitoring devices and uncertainty in the length of time necessary for in situ conditions to return after drilling and instrumenting vertical boreholes (CDSCP Comment 7), the NRC staff is concerned about the feasibility of the unsaturated zone characterization methodology with respect to the time available (scheduled) to complete site characterization. This concern coupled with the previous concern that no activity guiding or tracking prototype testing was presented in the CDSCP implies a potential for impacts to site characterization schedules. The degree to which the prototype testing schedules are accounted for in the site characterization "component" schedules is not clear.

Although specific parameter values (data) from prototype tests will not likely be used directly in describing the site groundwater flow system in a license application, the test equipment and procedures to be used in site characterization will likely be adapted or developed based on experience and results gained from prototype testing. In addition, there will be an element of confirmatory research to the prototype testing program if used to evaluate the current concepts of moisture characteristic relations for fracture/matrix flow in dry, fractured rock as recommended by NRC staff. Therefore, the NRC concludes that there are some concerns related to the prototype component of the unsaturated zone characterization methodology that need to be resolved. These include:

- ° Objectives of the prototype component of the unsaturated zone characterization methodology
- ° Development of activities/studies describing the prototype component of the unsaturated zone characterization methodology
- ° Level of quality assurance to be applied to the prototype component of the unsaturated zone characterization methodology
- ° Impact of prototype testing schedules on critical path schedules for the site characterization component of the unsaturated zone characterization methodology

KEY WORDS:

Groundwater, unsaturated zone, prototype testing, QA level, characterization schedules

STATUS: (5/11/88) CDSCP Comments forwarded to DOE

HYDROLOGY OPEN ITEM 001

REPORT DATE: 88/09/30

REFERENCES: NRC Staff Review Of The Department Of Energy's January 8,
1988 Consultation Draft Site Characterization Plan For
The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY: J. Pohle/HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Development and implementation of calculational procedures for addressing the regulatory requirement for groundwater travel time

INITIAL IDENTIFICATION: FEA Comment 3 and CDSCP Comment 86

BACKGROUND: FEA comment 3 (Groundwater Travel Time) noted problems related to computational procedures used to generate frequency distributions of predicted groundwater travel times. Although the FEA suggested that the frequency distributions showed "true" probabilities, uncertainties resulting from the defensibility of assumptions and conceptual models, uncertainty about the validity of boundary conditions, and uncertainty in the mathematical flow model were not accommodated in the analysis that generated the predicted travel times.

A CDSCP review comment on Section 8.3.5.12 (Groundwater Travel Time) noted that procedures for calculating pathways and groundwater travel times may not be adequate for addressing 10 CFR 60.113 (a)(2), the regulatory requirement for groundwater travel time. The groundwater travel time CDF's discussed in the CDSCP may be construed to represent groundwater travel times for ensembles of pathways, flow tubes, or particle tracks as opposed to travel times along the fastest path of likely radionuclide travel as required by regulation. It is the responsibility of the NRC staff to clarify regulatory uncertainties and provide elements of proof for the groundwater travel time regulatory requirement. DOE has the burden of developing methodologies adequate for satisfying elements of proof. Therefore, it was recommended that the NRC staff concern regarding calculational procedures be considered in the issue resolution strategy for groundwater travel time.

KEY WORDS: Groundwater, groundwater travel time

STATUS: (12/22/86) FEA Comment forwarded to DOE
(05/11/88) CDSCP Comment forwarded to DOE

REFERENCES: NRC Staff Comments On The DOE Final Environmental Assessments, December 22, 1986

HYDROLOGY OPEN ITEM 002

REPORT DATE: 88/09/30

NRC Staff Review Of The Department Of Energy's January 8,
1988 Consultation Draft Site Characterization Plan For The
Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY:

F. Ross/HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Completeness of the saturated zone testing program with respect to activities identified for characterizing the relationship of faults lying within and east of the repository block to the hydrologic system at Yucca Mountain

INITIAL IDENTIFICATION: CDSCP Comment 13

BACKGROUND: The CDSCP indicates that because west-dipping normal faults lie within and east of the repository block and the block is bounded on the west by the Solitario Canyon Fault, an important aspect of saturated zone studies will be evaluating the imposition of structure on hydrologic boundary conditions (CDSCP; page 8.3.1.2-292). A CDSCP comment on Section 8.3.1.2.3.1 (Study: Characterization of the Site Saturated Zone Groundwater Flow System) noted that activities for the study did not appear to be adequate for characterizing saturated zone hydrologic boundary conditions, flow directions and magnitudes particularly with respect to the influence of faults lying within and east of the repository block. It was recommended that the study contain activities for addressing the influence of these faults on groundwater flow magnitude and direction, or on further consideration by the staff, an explanation for not investigating these faults should be provided.

KEY WORDS: Groundwater, saturated zone, faults

STATUS: (5/11/88) CDSCP Comment forwarded to DOE

REFERENCES: NRC Staff Review Of The Department Of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY: F. Ross/HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Potential interference to hydrologic testing in the exploratory shaft facility from previous investigations of the unsaturated zone at Yucca Mountain

INITIAL IDENTIFICATION: CDSCP Comment 10

BACKGROUND: It is essential that site characterization investigations do not interfere with or preclude conducting other necessary investigations. A CDSCP review comment on Section 8.3.1.2.2.4 (Study: Characterization of Yucca Mountain Percolation In the Unsaturated Zone--Exploratory Shaft Facility Study) noted that hydrologic and geochemical tests planned for the exploratory shaft may have been compromised by past drilling activities associated with hole USW G-4. It was recommended that drilling effects (loss of fluid) at USW G-4 on planned hydrologic and geochemical tests at the exploratory shaft site be evaluated.

KEY WORDS: Groundwater, exploratory shaft facility, USW G-4, test interference

STATUS: (5/11/88) CDSCP Comment forwarded to DOE

REFERENCES: NRC Staff Review Of The Department Of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY: F. Ross/HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

- OPEN ITEM: Development of a performance allocation for groundwater travel time that considers alternative assumptions and provides the basis of the testing program for characterizing the hydrologic system within the geologic setting
- INITIAL IDENTIFICATION: FEA Comment 3, CDSCP Comments 87 and 88, and CDSCP Objection 1
- BACKGROUND: The CDSCP states that confidence in the outcome of the overall project depends on the process of testing and refining of hypotheses and conceptual models that in turn help to guide and modify the investigative program, including information needs (CDSCP; page 8.3.1.2-39). The NRC staff believes that it is equally important to a successful project to have the issue resolution strategies logically integrated into this process. This integration is the function of performance allocation. The performance allocation process provides the rationale for establishing particular information needs considered necessary to resolve issues and relates them to parameters obtainable from testing. NRC staff review of the CDSCP raised concerns regarding the absence of any systematic and logical connection between the issue resolution strategy for groundwater travel time and the program of hydrologic investigations, the process of conceptual model confirmation, site flow-transport model validation and other related performance issues.
- CDSCP review comment 87 on Section 8.3.5.12 (Groundwater Travel Time) noted that the process of connecting the geohydrology program of investigations to the strategy for demonstrating compliance with the groundwater travel time performance objective is incomplete with respect to providing logical, direct ties to the parameters or data that must be obtained by the testing program (performance parameters). It recommended that the performance parameters should be correlated with the tests described in SCP Sections 8.3.1 to 8.3.1.6.

To fully integrate issue resolution with testing, CDSCP objection No. 1 recommended that a full range of alternative conceptual models and associated boundary conditions suggested by available preliminary evidence should be systematically and clearly identified, and should be the basis for any preliminary performance allocations. The NRC Staff had previously noted in FEA comment 3 (Groundwater travel time) that alternative conceptual models and assumptions related to matrix and fracture flow, flux, vertical groundwater flow, matrix saturated hydraulic conductivity, and boundary conditions were not considered in the Groundwater travel time analysis.

Recognizing that performance allocation is an iterative process founded on conceptual model validation, the NRC staff noted in CDSCP comment 88 on Section 8.3.5.12 (Groundwater Travel Time) that no plan incorporating technical or management activities to provide the information necessary to validate groundwater flow model concepts was provided. It was recommended that a plan incorporating parameters, activities, logic, milestones and schedules be developed and included in the SCP.

KEY WORDS:

Groundwater, performance allocation, performance parameters, conceptual models

STATUS: (12/22/86) FEA Comment forwarded to DOE
(05/11/88) CDSCP Comment forwarded to DOE

REFERENCES:

NRC Staff Comments On The DOE Final Environmental Assessments, December 22, 1986

NRC Staff Review Of The Department Of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:**PREPARED BY:**

F. Ross/HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Description of geohydrologic testing activities after drifting in the Topopah Springs Member to the Ghost Dance fault, the Imbricate-Normal fault zone, and beneath Drill Hole Wash

INITIAL IDENTIFICATION: CDSCP Comment 9

BACKGROUND: A CDSCP review comment on Section 8.3.1.2.2.4 (Study: Characterization Of Yucca Mountain Percolation In The Unsaturated Zone-Exploratory Shaft Facility Study) pointed out that the SCP should provide a description of hydrologic testing activities that will take place after drifting in the Topopah Springs Member to the Ghost Dance Fault, the Imbricate-Normal fault zone and beneath Drill Hole Wash.

KEY WORDS: Groundwater, exploratory shaft facility, hydrologic tests

STATUS: (5/11/88) CDSCP Comment forwarded to DOE

REFERENCES: NRC Staff Review Of The Department Of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY: W. Ford/HLGP

OPEN ITEM SYSTEM REPORT

HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Information needs regarding "significant sources" of groundwater outside the controlled area

INITIAL IDENTIFICATION: CDSCP Comment 96

BACKGROUND: Knowledge about the presence or absence of a "significant source" of groundwater outside of the controlled area (see CDSCP Section 3.10.3) is needed to address Issue 1.2 (regulatory requirement for limiting individual doses). The individual protection requirements of 40 CFR 191.15 require that all potential pathways from the disposal system to people shall be considered, including the assumption that individuals consume 2 liters of drinking water per day from any "significant source" of groundwater outside the controlled area. The strategy presented in the CDSCP to resolve this issue failed to explicitly express the need for identifying the possible presence or absence of a "significant source" of groundwater outside of the controlled area and should be added to the issue resolution strategy as an information need.

KEY WORDS: Significant source, groundwater, individual dose

STATUS: (5/11/88) CDSCP Comment to DOE

REFERENCES: NRC Staff Review Of The Department Of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY: N. M. Coleman/HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Isotopic dating of groundwater in the upper part of the water table

INITIAL IDENTIFICATION: CDSCP Question 4

BACKGROUND: Current DOE plans include drilling a well to total depth and then pumping the well for a water sample. This water sample would be composed of groundwater from various depths below the water table surface, and would not indicate how fast water might be flowing from the surface to the water table.

Water samples should be collected from the upper several meters of the water table for age determinations. The samples should be analyzed for carbon-14, tritium, iodine-129, and chlorine-36 at a minimum.

The collection of samples (for isotopic analyses) from the top of the saturated zone immediately beneath or adjacent to the proposed site will help determine whether modern water is present and can provide additional information about the rate of groundwater movement from the surface to the water table. (See CDSCP Section 8.3.1.2.3.2.2). These samples can provide important information in conjunction with proposed tritium profiling studies (CDSCP Section 8.3.1.2.2.1.2) and in conjunction with isotopic dating of any perched groundwater that is encountered (CDSCP Section 8.3.1.2.2.4.7) above the water table.

KEY WORDS: Groundwater, hydrochemistry, isotopic dating, water table, saturated zone, perched groundwater

STATUS: (5/11/88) CDSCP Question forwarded to DOE

REFERENCES: NRC Staff Review of The Department of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY: N. M. Coleman/HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Adequacy of flooding debris-hazard studies

INITIAL IDENTIFICATION: CDSCP Question 28

BACKGROUND: Flash floods, and the debris flows associated with some floods, are a potential hazard for repository facilities. See CDSCP Sections 3.2.1 and 3.2.2). The occurrence of debris flows is quite likely in the steep drainages that exist just west of the proposed surface facilities. The conceptual design of the repository calls for dikes and diversion channels to convey potential flood waters around the surface facilities. From the information presented, these dikes and diversions have been sited and scaled on preliminary estimates of "clear water" flood flows. Channel slopes west of the surface facility area range from 5% to 25% where debris flows are possible. Material movement initiated upslope from the surface facilities would encounter channel slopes of no more than 1% to 2% around the facilities. These lower slopes could result in deposition. Thus, the potential would appear to be substantial for debris blockage in diversion facilities.

Site-specific information about debris hazards will mainly be derived from six proposed fluvial suspended sediment samplers and qualitative field evaluations during post-flood evaluations. This short-term monitoring of the infrequent, complex process of debris flow may not result in a level of understanding sufficient for adequate engineering design.

KEY WORDS: Surface water, flooding, debris flow, diversion channels

STATUS: (5/11/88) CDSCP Question forwarded to DOE

REFERENCES: Campbell, Russell H., Soil slips, debris flows, and rainstorms in the Santa Monica Mountain and vicinity, southern California, US Geological Survey professional paper 851, 1975.

NRC Staff Review of The Department of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

HYDROLOGY OPEN ITEM 009

REPORT DATE: 88/09/30

REGULATION:

PREPARED BY: N. M. Coleman/HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Use of dendrochronology as an activity parameter for evaluation of regional paleoclimatology

INITIAL IDENTIFICATION: CDSCP Comment 31

BACKGROUND: A CDSCP review comment on Section 8.3.1.5.1.1.1 noted that dendrochronology [written as dendroclimatology in the comment] was not specifically included in the proposed study plans as a separate activity.

KEY WORDS: Climate, paleoclimatology, dendrochronolgy

STATUS: (5/11/88) CDSCP Comment forwarded to DOE

REFERENCES: NRC Staff Review Of The Department Of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY: D. L. Chery, Jr./HLGP

OPEN ITEM SYSTEM REPORT
HYDROLOGY SYSTEM INFORMATION
AND INVESTIGATIONS

OPEN ITEM: Consideration of the controversy over the interpretation of packrat middens as indices of late Pleistocene and Holocene climate

INITIAL IDENTIFICATION: CDSCP Comment 32

BACKGROUND: A CDSCP review comment on Section 8.3.1.5.1.5.1 noted that a controversy presently exists whether vegetation changes observed in packrat middens reflect primarily variations in temperature or precipitation or some combination of the two factors. The proposed studies may not provide definitive answers to distinguish between these factors. Possible climatic variations that can produce most of the observed paleovegetation changes can range between: a) increase in precipitation only; b) decreases in temperature only; and c) some intermediate combination of both types of changes. These simple scenarios do not even consider the potential effects on climatic modeling of specific assumptions about seasonal distribution of climate parameters.

KEY WORDS: Paleoclimate, vegetation, temperature, precipitation

STATUS: (5/11/88) CDSCP Comment forwarded to DOE

REFERENCES: NRC Staff Review Of The Department Of Energy's January 8, 1988 Consultation Draft Site Characterization Plan For The Yucca Mountain Site: Final Point Papers, May 11, 1988

REGULATION:

PREPARED BY: D. L. Chery, Jr./HLGP

ATTACHMENT B

**EXAMPLE OUTLINE IDENTIFYING BROAD COMPLIANCE DETERMINATION
METHODS AND INFORMATION REQUIREMENTS**

SPECULATIVE LIST OF OPEN ITEMS

- 1 -

LIST OF POTENTIAL HYDROLOGY OPEN ITEMS (BY CATEGORY)
RELATED TO 10 CFR 60.113 (a) (2)

REGULATORY REQUIREMENTS (NRC responsibility)

- TBD

ELEMENTS OF PROOF (NRC responsibility)

- TBD

REGULATORY UNCERTAINTY (NRC responsibility)

- Adequacy and completeness of the definition of groundwater travel time
 - * Postulated elements of proof
 - * Supporting rationale
 - * Rulemaking action
- Adequacy and completeness of the definition of disturbed zone
 - * Postulated elements of proof
 - * Supporting rationale
 - * Rulemaking action

COMPLIANCE DETERMINATION METHODS (DOE responsibility)

- Development of a performance allocation for groundwater travel time that considers alternative assumptions and provides the basis of the testing program for characterizing the hydrologic system within the geologic setting
- Development and implementation of a testing program for characterizing the regional hydrologic system surrounding Yucca Mountain
- Development and implementation of a testing program for characterizing the unsaturated zone hydrologic system at Yucca Mountain
- Development and implementation of a testing program for characterizing the saturated zone hydrologic system at Yucca Mountain
- Development and implementation of evaluative procedures for delineating the extent of the disturbed zone at Yucca Mountain

SPECULATIVE LIST OF OPEN ITEMS

- 2 -

- **Development and implementation of evaluative procedures for calculating groundwater travel time**

INFORMATION REQUIREMENTS (DOE responsibility)

- **A description of the regional hydrologic system surrounding Yucca Mountain**
- **A description of the unsaturated zone hydrologic system at Yucca Mountain**
- **A description of the saturated zone hydrologic system at Yucca Mountain**
- **Boundaries of the disturbed zone at Yucca Mountain**

ATTACHMENT C
SUMMARY OF THE DISPOSITION OF FEA
AND CDSCP COMMENTS

COMMENT SUMMARY

<u>CDSCP/FEA COMMENT</u>	<u>OPEN ITEM</u>	<u>FOLLOWING WORK</u>	<u>STUDY PLAN</u>
CDSCP COMMENT 5	NONE	RECONSIDER DURING STUDY PLAN REVIEW	8.3.1.2.2.1
CDSCP COMMENT 6	001	ADDRESS IN SCP REVIEW	NONE PROPOSED
CDSCP COMMENT 7	001	ADDRESS IN SCP REVIEW	NONE PROPOSED
CDSCP COMMENT 8	NONE	RECONSIDER DURING STUDY PLAN REVIEW	8.3.1.2.2.3
CDSCP COMMENT 9	006	ADDRESS IN SCP REVIEW	8.3.1.2.2.4
CDSCP COMMENT 10	004	ADDRESS IN SCP REVIEW	8.3.1.2.2.4
CDSCP COMMENT 11	001	ADDRESS IN SCP REVIEW	NONE PROPOSED
CDSCP COMMENT 12	NONE	RECONSIDER DURING STUDY PLAN REVIEW	8.3.1.2.2.5
CDSCP COMMENT 13	003	ADDRESS IN SCP REVIEW	8.3.1.2.3.1
CDSCP COMMENT 31	010	ADDRESS IN SCP REVIEW	8.3.1.5.1.1 & 8.3.1.5.1.2
CDSCP COMMENT 32	011	ADDRESS IN SCP REVIEW	8.3.1.5.1.5
CDSCP COMMENT 33	NONE	RECONSIDER DURING STUDY PLAN REVIEW	8.3.1.5.2.1
CDSCP COMMENT 40	NONE	RECONSIDER DURING STUDY PLAN REVIEW	8.3.1.12.2.1
CDSCP COMMENT 41	NONE	RECONSIDER DURING STUDY PLAN REVIEW	8.3.1.12.1.2 & 8.3.1.12.2.1
CDSCP COMMENT 86	002	ADDRESS IN SCP REVIEW	8.3.1.2.2.10 & 8.3.1.2.3.3
CDSCP COMMENT 87	005	ADDRESS IN SCP REVIEW	NOT APPLICABLE
CDSCP COMMENT 88	005	ADDRESS IN SCP REVIEW	NOT APPLICABLE
CDSCP COMMENT 96	007	ADDRESS IN SCP REVIEW	NOT APPLICABLE
CDSCP QUESTION 3	NONE	RECONSIDER DURING STUDY PLAN REVIEW	8.3.1.2.1.2

COMMENT SUMMARY

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<u>CDSCP/FEA COMMENT</u>	<u>OPEN ITEM</u>	<u>FOLLOWING WORK</u>	<u>STUDY PLAN</u>
CDSCP QUESTION 4	008	ADDRESS IN SCP REVIEW	8.3.1.2.3.2
CDSCP QUESTION 24	NONE	RECONSIDER DURING STUDY PLAN REVIEW	8.3.1.12.2.1
CDSCP QUESTION 28	009	ADDRESS IN SCP REVIEW	8.3.1.16.1.1
FEA COMMENT No. 3	002 & 005	ADDRESS IN SCP REVIEW	8.3.1.2.2.10 & 8.3.1.2.3.3