YMP/90-103

U.S. DEPARTMENT OF ENERGY

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YUCCA MOUNTAIN

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT

RESPONSES TO LINCOLN COUNTY BOARD OF COMMISSIONERS' COMMENTS ON THE SITE CHARACTERIZATION PLAN

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

DECEMBER 1990

UNITED STATES DEPARTMENT OF ENERGY

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PDR WASTE
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U.S. DEPARTMENT OF ENERGY'S COMMENT RESPONSES FOR THE COMMENTS RECEIVED FROM THE BOARD OF COMMISSIONERS OF LINCOLN COUNTY, NEVADA

The Board of Commissioners of Lincoln County, Nevada submitted comments on the Site Characterization Plan in a letter dated May 25, 1989. The U.S. Department of Energy (DOE) first renumbered the pages contained in the letter and identified individual comments within the letter; a total of six comments were submitted. A copy of the enumerated comment package is provided under separate enclosure for cross reference. Each comment number is marked in the margin of the page and the page number is marked in the upper right hand corner of the page. Where multiple comments occur on one page, each is bracketed by horizontal lines.

For each comment, the DOE response package provides a description of the comment, followed by the response to the comment.. Each comment was either furnished an individual response, or cross-referenced to another response addressing comments pertaining to the same overall theme.

ENCLOSURE 1

U.S. DEPARTMENT OF ENERGY RESPONSES TO COMMENTS
RECEIVED FROM THE LINCOLN COUNTY BOARD OF COUNTY COMMISSIONERS
ON THE SITE CHARACTERIZATION PLAN

COMMENT 1:

Pursuant to published notices in the Federal Register, Vol. 53, No. 251, page 53057 and Vol. 54, No. 52, page 11436, Lincoln County, Nevada, is pleased to submit the following comments on the Site Characterization Plan for consideration by the Department of Energy prior to commencing construction of the exploratory shaft. In general, the concerns of the citizens of Lincoln County center on the socioeconomic and transportation implications of the proposed project. We do, however, remain concerned that the physical attributes of Yucca Mountain as a repository site must be determined suitable to contain the nuclear waste that is likely to be placed there.

Section 112(a) of the Nuclear Waste Policy Act of 1982 mandates that the Secretary of energy issue guidelines for the recommendation of repository sites. Though the Nuclear Waste Amendments Act of 1987 provides that only Yucca Mountain shall be studied as a candidate site for a nuclear waste repository, Section 112(a) has not been amended. It states, in pertinent part:

> "Such guidelines shall take into consideration the proximity to sites where high-level radioactive waste and spent nuclear fuel is generated or temporarily stored and the transportation and safety factors involved in moving such waste to a repository. Such guidelines shall specify population factors that will disqualify any site from development as a repository if any surface facility of such repository would be located (1) in a highly populated area; or (2) adjacent to an area 1 mile by 1 mile having a population of not less than 1,000 individuals. Such guidelines also shall require the Secretary to consider the cost and impact of transporting to the repository site the solidified high-level radioactive waste and spent fuel to be disposed of in the repository and the advantages of regional distribution in the siting of repositories... The Secretary shall use guidelines established under this subsection in considering candidate sites for recommendation under subsection (b)."

The guidelines adopted by the Secretary are published at 10 CFR Part 960. Socioeconomic impacts and transportation guidelines are set forth at Sections 960.5-2-6 and 906.5-2-7. Having adopted such guidelines as required by law, which are therefore an integral part of the site recommendation procedure, DOE is now constrained to consider the factors enumerated in its guidelines. These are important elements of consideration for qualification of the site from a preclosure perspective. It is with great dismay that Lincoln County finds that the Site Characterization Plan does not address how DOE intends to evaluate socioeconomic and transportation issues. Instead the SCP focuses almost entirely upon geotechnical concerns of design, containment and retrievability.

Lincoln County is concerned that DOE is planning to ignore its socioeconomic and transportation guidelines during the site characterization process. Lincoln County requests that DOE address each of the favorable and potential adverse socioeconomic and transportation conditions outlined within 10 CFR Part 960 within the context of the SCP. If such factors are to be addressed apart from site characterization, then the SCP should describe the studies to be conducted. When considering socioeconomic and transportation issues, Lincoln County believes that DOE must consider such issues in light of the repository being developed to accommodate greater than the 70,000 metric tons of waste limit imposed by the Nuclear Waste Policy Act. During site characterization DOE should evaluate the socioeconomic and transportation related effects of developing the estimated 2,095 acres of suitable area for a repository, rather than just considering the 1,380 acres now planned for use by DOE.

Lincoln County has a relatively small population base. We remain hopeful that the ultimate location of the nuclear waste repository at Yucca Mountain will enhance economic conditions in Lincoln County by providing new jobs for existing residents and new contracts for existing business without over burdening existing governmental and community services and reducing the quality of life in our rural setting. We are anxious to obtain some of the benefits of such a magnanimous project without being trampled over by outsiders indifferent to our unique community.

Response:

The Site Characterization Plan (SCP) describes the activities that would be conducted to determine the suitability of the Yucca Mountain site for a repository. The SCP was not intended to describe all studies and activities being conducted or planned by the U.S. Department of Energy (DOE) for the Yucca Mountain Site Characterization Project. DOE is continuing to study potential economic, demographic, and transportation effects related to the repository program. These studies include Lincoln County as well as other areas of southern Nevada.

The comment cites 10 CFR 960, which is titled "General Guidelines for the Recommendation of Sites for the Nuclear Waste Repository," and was intended to be used during the site selection process when there still were several sites being considered. The Yucca Mountain site as well as other potential repository sites were evaluated with respect to the 10 CFR 960 guidelines. This evaluation for the Yucca Mountain site is documented in DOE's Environmental Assessment (DOE, 1986). As a result of the Nuclear Waste Policy Amendments Act of 1987, Yucca Mountain was selected as the only site to be studied.

In regard to the concern that the SCP did not address transportation issues, under the Nuclear Waste Policy Act of 1982 and the 1987 Amendment, site characterization is specifically limited to those activities that are undertaken to establish the geologic conditions and parameters of the site. Transportation effects are thus not addressed in the SCP. Transportation is an important issue currently being studied by DOE in greater detail than for the Environmental Assessment and would be addressed in other documents as well as during activities such as the environmental impact statement (EIS) scoping process. DOE has addressed socioeconomic concerns in the Environmental Assessment and would study the socioeconomic effects of transporting high-level radioactive

waste through Lincoln County in the future when additional information is available concerning transportation routes and frequency of shipments. The EIS scoping process is designed to obtain public comment and input, and to address public concerns.

REFERENCES

DOE (U.S. Department of Energy), 1986. Environmental Assessment, Yucca Mountain Site, Nevada Research and Development Area, Nevada, DOE/RW-0073, U.S. Department of Energy, Washington, D.C.

COMMENT 2:

Specific to this concern is the guideline found at 10 CFR Part 960.5-2-1 regarding population density and distribution. Though this guideline provides for three (3) disqualifying conditions including the failure to develop an emergency preparedness program, the SCP states at Volume V, Part B, Chapter 8, Section 8.3.1.10, page 1, "Collection of population density and distribution data is not considered a site characterization activity as defined in the Nuclear Waste Policy Act (NWPA 1983). Therefore, the format and details for data collection will not be presented in this document." See: Exhibit "1" attached hereto.

We believe that DOE is in error in its conclusion that collection of population data is not a site characterization activity since the Nuclear Waste Policy Act of 1982, Public Law 97-425, 42 USC Sec. 10101 et seq., specifically requires the Secretary to consider population factors as well as the impact of transporting nuclear waste to the repository site. A review of the statutes indicates that there is no Nuclear Waste Policy Act of 1983.

Since DOE acknowledges in the SCP that population density and distribution are important components of preclosure radiological safety, the methods for collection of such data should also be set forth within the Plan. Attention to these issues is crucial to determining whether normal operating conditions will be safe or hazardous to the general public. The residents of Lincoln County are extremely concerned about being subjected to exposure to harmful radiation from normal operations of the repository in addition to accident related exposure.

Response:

The U.S. Department of Energy (DOE) recognizes the requirements of 10 CFR 960 concerning population density and distribution. However, the Site Characterization Plan was not intended to describe all studies and activities being conducted or planned by DOE for the Yucca Mountain Project. Population density and distribution data would be gathered as specified in the Socioeconomic Monitoring and Mitigation Plan (DOE,1988). Later in the repository program, should the Yucca Mountain site be found suitable and recommended for repository development, an emergency preparedness program would be prepared, and be described in the Environmental Impact Statement (EIS). For transportation of nuclear waste to the repository, see DOE's response to Comment #1.

The Nuclear Waste Policy Act (NWPA (1983)) was passed in December 1982 and thus is called the NWPA of 1982. It was not published until January 1983, so it was referenced by its published date.

REFERENCES

DOE (U.S. Department of Energy), 1986. Environmental Assessment, Yucca Mountain Site, Nevada Research and Development Area, Nevada, DOE/RW-0073, U.S. Department of Energy, Washington, D.C.

DOE (U.S. Department of Energy), 1988. Socioeconomic Monitoring and Mitigation Plan, DOE/RW-0179, U.S. Department of Energy, Washington D.C.

COMMENT 3:

To the extent that normal operations of a nuclear waste repository will require the transportation of high-level radioactive material through Lincoln County, we are concerned that the SCP fails to address transportation impacts. For example, the index to the SCP indicates at Volume IX, page 269, that transportation impacts are addressed at Chapter 8.3.1.13, page 10. See: Exhibit "3" attached hereto. This section provides for an analysis and evaluation of potential radiation releases from non-repository locations with eighty (80) kilometers of Yucca Mountain.

Response:

The impacts addressed in Chapter 8.3.1.13, page 10 are the impacts on the repository of any nuclear facilities not associated with Yucca Mountain. The transportation impacts cited in the index refer to projected transport of airborne radionuclide concentrations and any impacts these concentrations could have on the repository site. These transportation impacts do not refer to the transport of high-level waste in shipping casks.

The U.S. Department of Energy (DOE) recognizes that transportation of spent nuclear fuel and high-level waste to Yucca Mountain is a major concern of the people of Nevada. Under the Nuclear Waste Policy Act of 1982 (Section 2.(21)), site characterization is specifically limited to those activities that are undertaken to establish the geologic conditions and parameters of the site. Therefore, transportation was specifically excluded from being identified in the Site Characterization Plan. Transportation had been addressed in the Yucca Mountain Environmental Assessment (DOE, 1986) and would be addressed in other documents as well as during activities such as the scoping process for the Environmental Impact Statement, which is designed to obtain public comment and input and to address public concerns.

Over the past twenty years, thousands of shipments of spent fuel from reactor plants have been made throughout the United States in U.S. Nuclear Regulatory Commission (NRC)-certified casks without causing any adverse radiological consequence to the public. These casks have proved extremely reliable, as indicated by the following excerpt from the U.S. Congress, Office of Technology Assessment (OTA) publication, "Transportation of Hazardous Materials" printed in 1986.

> "The proven safety record of NRC-certified casks provides a degree of public confidence in casks. OTA finds that technical evidence and cask performance standards yield spent fuel shipping cask design specifications that provide for a very high level of public protection-much greater than that afforded in any other current hazardous materials shipping activity. Transportation accidents involving shipments of spent fuel will inevitably occur. However, OTA concludes that the probability of an accident severe enough to cause extensive damage to public health and the environment caused by a radiological release from a properly constructed cask is extremely remote."

In accordance with the Nuclear Waste Policy Amendments Act of 1987 Part F, Section 5061, DOE is required to ship the spent fuel to any repository in NRC-certified casks.

OTA, (Office of Technology Assessment), 1986. Transportation of Hazardous Materials, OTA-SET-304, U.S. Government Printing Office, Washington, D.C.

DOE (U.S. Department of Energy), 1986. Environmental Assessment, Yucca Mountain Site, Nevada Research and Development Area, Nevada, DOE/RW-0073, U.S. Department of Energy, Washington, D.C.

COMMENT 4:

DOE is justifiably concerned that potential radiation releases from collateral sources will mask the detection of repository releases. Additionally, there is concern that the cumulative effect of airborne concentrations of radioactive releases from all potential sources may exceed safe levels of exposure to individuals in Las Vegas, Nevada. Though Las Vegas is the major population center within this 80 KM zone, there are other populated areas that should also be considered. Lincoln County specifically requests that the SCP consider potential exposure to individuals in the Pahranagat Valley.

Response:

U.S Department of Energy plans to consider all areas within 84 km of the site when evaluating impacts as described in the Yucca Mountain Project Radiological Monitoring Plan and the Environmental Pathway Analysis Scoping Study. The planned evaluation area includes portions of Lincoln County.

COMMENT 5:

Lincoln County is deeply concerned that DOE has a reputation for callously disregarding the health and safety of the citizens of this great nation who reside in areas proximate to DOE facilities. We are aware of recent media reports that there are plutonium leaks at the DOE operated Idaho Falls nuclear waste dump, that the residents of Fernald, Ohio are dying of cancer at a much higher rate than normal due to the intentional release of radioactive contamination from DOE's weapons plant, that DOE has deliberately covered up numerous accidents and releases of radioactive waste at its Savannah River Plant in South Carolina, and that the residents of Hanford, Washington have been subjected to unsafe releases of radioactive iodine exposure. The citizens of Lincoln County demand that the site characterization process study the potential health hazards and socioeconomic factors of transportation through Lincoln County and permanent storage at Yucca Mountain as it will affect our current and future residents.

Response:

U.S. department of Energy (DOE) fully appreciates the comment's concerns about conducting the Yucca Mountain Site Characterization Project in accordance with all laws and regulations and in an objective, scientific manner. Recognizing the importance of the environment, Secretary Watkins has placed high priority on a "safety-first" philosophy and is making many changes within the Department to carry out this priority. DOE is committed to complying with all applicable Federal and State Laws and regulations. While perceptions cannot be changed overnight, DOE believes that, with regard to the repository program, the safety and environmental regulations, the process of preparing a full environmental impact statement, and the multiple oversight mechanisms afforded this program would ensure that the people, environment,and resources of Nevada or of any other potential repository host state will be protected.

The socioeconomic factors of transporting high-level radioactive waste through Lincoln County would be addressed in the future when additional information is available concerning transportation routes and frequency of shipments.

As explained in the responses to several other Lincoln County comments, site characterization is limited to those activities that are undertaken to establish the geologic conditions and parameters of the site and to determine whether the site is suitable for repository development. Therefore, transportation is excluded from being identified in the Site Characterization Plan. Transportation is an important issue currently being studied by the DOE and would be addressed in other documents as well as during activities such as the Environmental Impact Statement scoping process, which is designed to obtain public comment and input, and to address public concerns. DOE is working with the officials of Lincoln County and Caliente in the development of the potential rail spur from Caliente to Yucca Mountain. The Nevada Department of Transportation is developing potential alternate highway routes that may go through Lincoln County. If Yucca Mountain is determined to be the location for the repository, DOE would provide emergency response training at the appropriate time to first responders along any of the rail or highway routes.

Potential socioeconomic impacts from locating a repository at Yucca Mountain were evaluated in the Environmental Assessment for Yucca Mountain (DOE, 1986) and again in the Secretary of Energy's Section 175 Report to Congress (DOE, 1988a). As with transportation, socioeconomic impacts would be evaluated again in more detail in the EIS. It is DOE's policy to avoid or minimize and mitigate significant adverse impacts to the maximum extent practicable. The Draft Socioeconomic Monitoring Program (DOE, 1988b) has been implemented to identify impacts and develop mitigation strategies for impacts. The program would be closely coordinated with State and local units of government.

DOE (Department of Energy) (1986), Environmental Assessment: Yucca Mountain Site, Nevada Research and Development Area, Nevada, Office of Civilian Radioactive Waste Management, Washington D.C.

DOE (Department of Energy) (1988a), Section 175 Report: Secretary of Energy's Report to the Congress Pursuant to Section 175 of the Nuclear Waste Policy Act, As Amended, Office of Civilian Radioactive Waste Management, Washington D.C.

DOE (Department of Energy) (1988b), Draft Socioeconomic Monitoring and Mitigation Plan for Site Chatracterization, Revision 1, Las Vegas, Nevada: Nevada Operations Office, NV

COMMENT 6:

The Nuclear Waste Policy Act of 1982, as amended, mandates that socioeconomic and transportation issues be studied by DOE in the site selection process. Since the Nuclear Waste Policy Amendments Act of 1987 deleted any consideration of alternatives to Yucca Mountain, it is imperative that site characterization must plan to take into consideration all factors required by law. To the extent that the SCP does not comply with the statutory requirements, we believe DOE is acting consistent with its reputation.

Lincoln County insists that the SCP be amended to include specific analysis of socioeconomic and transportation issues that can be monitored by Lincoln County. We have no desire to become the next group of "down winders." DOE has adopted guidelines for considering these factors; site characterization must make such considerations so that proper health and safety measures are implemented.

Response:

The DOE response to Lincoln County comment #1 explains why transportation and socioeconomic issues are not addressed in the SCP. How transportation impacts would be addressed is further discussed in the response to Lincoln County Comment #5.

YMP/90-101

U.S. DEPARTMENT OF ENERGY

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YUCCA MOUNTAIN

YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT

RESPONSES TO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE SITE CHARACTERIZATION PLAN

9101220296

DECEMBER 1990

UNITED STATES DEPARTMENT OF ENERGY

ENCLOSURE 1

U.S DEPARTMENT OF ENERGY'S COMMENT RESPONSES FOR THE COMMENTS RECEIVED FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY

The U.S. Environmental Protection Agency submitted comments on the Site Characterization Plan in a letter dated May 30, 1989. The U.S. Department of Energy first renumbered the pages contained in the letter received from the EPA and identified individual comments within the letter. The comments were then enumerated from the package that was submitted; the total number of comments was twelve. A copy of the enumerated comment package is provided under separate enclosure for cross reference. Each comment number is marked in the margin of the page and the page number is marked in the upper right hand corner of the page. Where multiple comments occur on one page, each is bracketed by horizontal lines.

For each comment, the DOE response package provides a description of the comment, followed by the response to the comment. Each comment was either furnished an individual response, or cross-referenced to a response addressing comments pertaining to the same overall theme.

U.S. DEPARTMENT OF ENERGY RESPONSES TO COMMENTS
RECEIVED FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY
ON THE SITE CHARACTERIZATION PLAN

COMMENT 1:

In response to Secretary Herrington's letter of December 28, 1988, and in accordance with Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Department of Energy's (DOE) Site Characterization Plan for the Yucca Mountain Site. This site is to be characterized for future possible use as a high-level nuclear waste repository. EPA generally agrees with the proposed characterization plan, and we believe it will provide the necessary data to analyze compliance with EPA's standards for the disposal of high-level radioactive waste.

DOE has described a comprehensive and systematic approach towards determining compliance with the EPA standards that were promulgated in 1985. DOE's approach will consider a wide range of potential release mechanisms with appropriate analytical simplifications and screening procedures to avoid considering insignificant release mechanisms. Similarly, one concern we have with the approach involves human activities. We want to make it clear that the containment requirements of the disposal standards will apply to the total projected releases from all significant processes and events, and that the complementary cumulative distribution function (CCDF) used to determine compliance must incorporate both natural and human-initiated processes and events. Compliance may not be considered separately for these two categories.

Response:

The complementary cumulative distribution function (CCDF), which is the recommended approach to summarizing repository behavior for comparison to U.S. Environmental Protection Agency containment requirements, is a relatively simple concept that is very difficult to implement. U.S. Department of Energy (DOE) understands the philosophy behind the concept of CCDF to include all risks, both from natural phenomena and from human-induced, in a single probability distribution. However, as stated in the comment, very different types of uncertainties will apply to natural and human-initiated events. Compared with the natural phenomena, human activities are more difficult to project into the future. For example, an application of Markov's inequality to the U.S. Nuclear Regulatory Commission's (NRC's) 10 CFR 60.112 can easily demonstrate how one can violate U.S. Environmental Protection Agency's (EPA) containment requirement by assuming a human intrusion scenario that will bring to the surface only a few waste packages for whatever reason and by whatever means. All scenarios, of course, have associated probabilities, but it is impossible to assign a meaningful probability to an activity that is yet to be conceived. When no quantitative or even qualitative estimates of the probability are available, the whole concept of the CCDF becomes invalid. It may make sense to apply the concept of the CCDF only to those activities, natural and human-initiated, whose past history is amenable to statistical treatment so that their associated probabilities can be estimated.

Given the way the EPA standard is currently written, human intrusion must be included in constructing the CCDF. However, as experience with the Waste Isolation Pilot Plant (WIPP) site has shown, human intrusion will most likely dominate all other effects in the CCDF. DOE is evaluating the experience gained to date from WIPP, with the intention of developing a final strategy for the treatment of human intrusion in the assessment of repository system performance. Also, EPA is in the process of revising its containment standards, and when EPA publishes its rule for comment, DOE would comment on the issue of human intrusion.

As extensive as it is, the Site Characterization Plan still is a high level document with a specific emphasis on site characterization. No specific activity is described in the SCP for the development of a CCDF methodology. It is, however, being addressed as a part of performance assessment methodology development, which is an activity under WBS 1.2.1.4.1. The methodology undoubtedly would incorporate human-initiated activities. The extent of these activities, however, would have to be bounded as discussed above. Further details are yet to be developed. DOE looks forward to working with EPA, NRC , and other interested parties in developing a reasonable approach to summarizing the behavior of the repository in a manner that would allow comparison with the curie release limits.

COMMENT 2:

The plan indicates that backfill is not required in the repository for hydrologic reasons. However, backfill and seals are deterrents to human intrusion for those time periods when institutional controls can no longer be relied on.

Response:

It is true that backfill is not required to reduce the flow of liquid water in the host rock, according to current concepts of flow in the unsaturated zone. However, other considerations, including discouraging random human vandalism and curiosity seekers, indicate that backfilling of some type will be used to seal shafts, drifts and boreholes as is stated in Section 8.3.3. Hydrologic effects as well as mechanical stability are among the factors that will be considered in selecting the methods of sealing.

COMMENT 3:

EPA strongly supports DOE's commitment to carry out performance projections for 100,000 years, even though such projections are not required. In addition, we recommend that DOE determine the origin of the calcite-silica veins found in the Yucca Mountain area, since these deposits relate to the geological history and tectonic stability of the site.

Response:

U.S. Department of Energy (DOE) appreciates the endorsement to carry out performance projections for 100,000 years. Note, however, that the uncertainties associated with such long-term projections may be so large that the numerical results should only be interpreted qualitatively. The purpose of the 100,000-year performance projection is by no means to demonstrate compliance to the regulatory requirements for such a long period. DOE plans only to provide confidence that no failure modes are imminently pending in the years following the containment period of 10,000 years and to demonstrate the robustness of the system performance in a semi-quantitative manner.

Performance evaluation for 100,000 years is not required by U.S. Nuclear Regulatory Commission (NRC). Neither was it required by U.S. Environmental Protection Agency in the remanded 40 CFR 191. It is a requirement of 10 CFR 960 for the selection of a repository site.

A determination of the origin of the calcite/silica veins formed in the Yucca Mountain area is indeed a planned high-priority activity outlined in the Site Characterization Plan (SCP) (Activity 8.3.1.5.2.1.5, Studies of Calcite and Opaline Silica Vein Deposits), which is part of Study Plan 8.3.1.5.2.1 (Characterization of the Quaternary Regional Hydrology). The approaches being used in this activity have been developed through the concurrence of numerous program participants, including the NRC, during two workshops conducted in 1986. The established methodology was subsequently endorsed, with minor modifications, by a multidisciplinary peer panel of nationally recognized experts in 1987. The methodology includes analyses of the vein-filling materials, the fractured wallrock, and potential sources of the vein-filling minerals such as groundwater, soil water and deep seated hydrothermal fluids. These materials will be analyzed in terms of their geochemical and isotopic compositions, total mineralogy, geochronology, and paleontology; these analyses will provide the data base that bears upon the origin of the calcite/silica veins. Preliminary results of studies were reviewed with NRC staff and State of Nevada representatives at a technical exchange held on February 6-7, 1990, in Las Vegas, Nevada.

REFERENCES

DOE, (U.S. Department of the Energy), 1989. Study Plan 8.3.1.5.2.1, Characterization of the Quaternary Regional Hydrology, Yucca Mountain Project Office, Las Vegas NV.

COMMENT 4:

Emphasis should be placed on determining the origin of the calcite-silica veins found in the Yucca Mountain Area because this relates to the question of tectonic stability. A U.S. Geological Survey refers to the calcite-silica veins as "hydrogenic" which infers that they could be the result of either descending surface waters or ascending hydrothermal waters from tectonic events. One theory is that the deposits might be hydrothermal and related to Quaternary volcanism. The concern is that hydrothermal activity at or near the site could corrode the waste package and accelerate release of radionuclides to the accessible environment. The resolution of this concern is significant in determining site suitability. To determine the origin of the calcite-silica veins, more focus should be given to the study of other types of minerals in the area, which could yield clues as to the origin of the calcite-silica veins. Also, the study of magma production in the area is important because it relates to tectonic stability.

Response:

The U.S. Department of Energy's plans for determining the origin of the calcite/silica veins are, in part, discussed in the response to the previous comment (U.S. Environmental Protection Agency #3). Studies of other types of minerals in the area are included in Study Plan 8.3.1.5.2.1 (Characterization of Quaternary Regional Hydrology). They consist of mapping, sampling, and analyses of deposits at modern springs (cool, warm, and hot) and paleosprings, as well as apparently hydrothermal deposits along faults or other mineralized zones and undisputed pedogenic accumulations of carbonate minerals. Other studies will provide information that will be useful to the calcite/silica investigations. Study 8.3.1.9.2.1 (Natural Resource Assessment of, Nye County, Nevada) will accumulate and analyze geologic, geochemical, and geophysical information in order to assess the potential for the development of mineral resources at or near the site. The alteration mineralogy of the rocks at Yucca Mountain is addressed in study 8.3.1.3.2.2 (History of Mineralogical and Geochemical Alteration of Yucca Mountain) as part of mineralogic investigations supporting analyses of radionuclide mobility. Study 8.3.1.8.4.1 also addresses alteration mineralogy, but in the specific context of its relation to tectonism.

With respect to possible magma production in the area, studies 8.3.1.8.1.1 (Probability of a Volcanic Eruption Penetrating the Repository), 8.3.1.8.5.1 (Characterization of Volcanic Features), and 8.3.1.8.5.2 (Characterization of Igneous Intrusive Features) will investigate the locations, structural controls, and timing of both extrusive and intrusive igneous activity in the area. Magnetic and geothermal investigations will aid in the assessment of the potential for both igneous and hydrothermal activity. Rates of magma production, as well as geochemical evolution of the magmas, over the last 14 million years are continuing topics of interest in these investigations because of their relation to the probability of future igneous activity and, as the comment notes, the history of tectonic stability in the area.

REFERENCES

DOE, (U.S. Department of the Interior), 1989. Study Plan 8.3.1.5.2.1, Characterization of the Quaternary Regional Hydrology, Yucca Mountain Project Office, Las Vegas NV.

COMMENT 5:

Our hydrology review focused on the matrix and fracture flow characteristics of the saturated and unsaturated zones in relation to the travel time of groundwater from the potential repository horizon to the accessible environment. Although investigations are planned for "characterization of the regional ground-water flow system" in section 8.3.1.2.1.3, the SCP does not indicate any specific plans to determine the boundaries of the subbasins which make up the hydrographic study area. These boundaries are necessary to fully understand the effects of potential hydrological changes in the region. Three subbasins, the Oasis Valley Subbasin, the Alkali Flat-Furnace Creek Ranch Subbasin, and the Ash Meadows Subbasin, make up this area. The boundaries have been inferred "from potentiometric levels, geologic controls of subsurface flow, discharge areas, and inferred flow paths." Suggested methods which could assist in determining the boundaries are: (1) using flow nets to determine the direction of groundwater flow; and (2) performing pump tests, such as the Boulton method, to verify the results of the drawdown recovery method. Other methods which could be used in determining boundaries are: (3) collecting rainfall data along the gradients; and (4) using different methods for measuring evapotranspiration by determining run-off, recharge and precipitation to validate results.

Response:

In addition to Site Characterization Plan section 8.3.1.2.1.3, (Characterization of the Regional Ground-water Flow System), section 8.3.1.2.1.4 (Regional Hydrologic System Synthesis and Modeling) also indicates the use of two-dimensional and two-layer (quasi-three dimensional) models in testing the sensitivity of the regional system to boundary assumptions. The U.S. Department of Energy chose the current boundaries on the basis of areally more extensive modeling but acknowledges that they are subject to re-evaluation. Further details regarding testing the significance of boundary conditions and plans for characterizing them are available in the Study Plans 8.3.1.2.1.3 and 8.3.1.2.1.4.

With respect to the suggested methods for investigation:

1. Digital modeling techniques incorporate those of the suggested flow-net analyses and are much more powerful.

2. The possible need for applying models for heterogeneous conditions (such as the suggested double-porosity, delayed-yield analysis of fractured rocks by Boulton and Streltsove (1977), as reviewed by Moench (1984) is discussed in Activity 8.3.1.2.3.1.3, Analysis of single- and multiple-well hydraulic-stress tests, and Activity 8.3.1.2.3.1.4, Multiple-well interference testing.

Methods for collecting rainfall and for measuring evapotranspiration are discussed in Study Plan 8.3.1.2.3.1 (Characterization of the Site Saturated-zone Ground-water Flow System). These methods will be applied to areas other than those specified in the study plan if it becomes necessary.

DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.2.1.3, Characterization of the Regional Ground Water Flow System, Yucca Mountain Project Office, Las Vegas, NV.

Boulton & Streltsove, (1977). Unsteady Flow in a Pumped Well in a Two-Layered Water-Bearing Formation, Journal of Hydrology, p. 245-256.

Moench, A.F., (1984). Double-Porosity Models for a Fissured Groundwater Reservoir with Fracture Skin, Water Resources Research, V20, #7.

COMMENT 6:

Although the SCP includes plans to investigate the groundwater flow system in the saturated zone, the methods for the investigations should be more explicit, such as indicating the type and number of pump tests to be run, with justification for the type of pump test selected.

Response:

Activities 8.3.1.2.3.1.4 (Multiple-well Interference Testing) and 8.3.1.2.3.1.5 (Testing of the C-hole Sites with Conservative Tracers) as described in the Site Characterization Plan (SCP) will determine what kind of hydraulic and tracer tests are appropriate for Yucca Mountain. Until these activities are completed, it is not appropriate to specify the type and number of pumping tests.

This "methods development" approach is described in much more detail in Study Plan 8.3.1.2.3.1, (Characterization of the Site Saturated Zone Ground Water Flow System (under development)) than it is in the SCP.

COMMENT 7:

In the unsaturated zone, the flow characteristics should be measured to determine where and when fracture flow characteristics dominate over matrix flow characteristics.

Response:

Several studies and activities address measurements applicable to determining the partitioning between fracture flow and matrix flow, including infiltration and percolation studies 8.3.1.2.2.1 (Characterization of Unsaturated-zone Infiltration) and 8.3.1.2.2.2 (Water Movement Tracer Tests using Chloride and Chlorine-36 Measurements of Percolation at Yucca Mountain), surface-based study for percolation characterization (8.2.1.2.2.3 Characterization of Percolation in the Unsaturated Zone--surface-based Study), and Exploratory Shaft Facility studies of percolation, diffusion, and hydrochemistry (8.2.1.2.2.4 (Characterization of Yucca Mountain percolation in the Unsaturated Zone--exploratory Shaft Facility·Study), 8.2.1.2.2.5 (Diffusion Tests in the Exploratory Shaft facility), and 8.2.1.2.2.7 (Hydrochemical Characterization of the Unsaturated Zone). The principal hydrologic characteristics that are important include but are not limited to infiltration flux including spatial and temporal variability; matrix properties of all units including permeability as a function of saturation, porosity, degree of saturation, pore-size distribution, etc.; in situ properties such as water tension and water content; and observations and experimental results in the ESF and the laboratory. Various modeling and synthesis efforts (studies 8.3.1.2.2.8 (Fluid Flow in Unsaturated Fractured Rock and 8.3.1.2.2.9 Site Unsaturated-Zone Modeling Synthesis) will help in integrating and analyzing these applicable data and will result in predictions of the relative importance of fracture flow as a function of percolation flux.

REFERENCES

DOE, (U.S. Department Of Energy), 1989. Study Plan 8.3.1.2.2.2, Water Movement Tracer Tests Using Chloride and Chlorine-36 Measurements of Percolation at Yucca Mountain, Yucca Mountain Project Office, Las Vegas NV.

DOE, (U.S. Department Of Energy), 1989. Study Plan 8.3.1.2.2.4, Characterization of Yucca Mountain percolation in the Unsaturated Zone--exploratory Shaft Facility Study, Yucca Mountain Project Office, Las Vegas NV.

DOE, (U.S. Department Of Energy), 1990. Study Plan 8.3.1.2.2.7, Hydrochemical Characterization of the Unsaturated Zone, Yucca Mountain Project Office, Las Vegas NV.

COMMENT 8:

Several areas of chapter 6 indicate that backfill is not required in the repository for hydrologic reasons. However, while the design for closure currently includes backfilling the underground openings, from section 6.2.7, "the need for backfill must be assessed based on the stability analyses of the underground openings and the analyses of the hydrologic conditions within the repository." Another factor to be considered in the need for backfill is using it as a deterrent for human intrusion, along with the seal system, even if it is found that backfill is not required for stability or hydrologic reasons.

Response:

It is true that backfill is not required to reduce the flow of liquid water in the host rock, according to current concepts of flow in the unsaturated zone. However, other considerations, including discouraging random human vandalism and curiosity seekers, indicate that backfilling of some type will be used to seal shafts, drifts and boreholes as is stated in Section 8.3.3. Hydrologic effects as well as mechanical stability are among the factors that will be considered in selecting the methods of sealing.

COMMENT 9:

Many uncertainties are addressed in the conceptual design, and while this design may exclude certain events which appear to have a low probability of occurrence, the final design should consider all investigation results during the final design process to ensure that no conditions or events have been overlooked. Specifically, on page 7-8, a design condition for the waste package is that it is assumed to be subject to a pressure of one atmosphere. This design condition gives no consideration to the potential for faulting effects on the waste package, which could cause the package to be subject to a pressure greater than one atmosphere. Faulting effects are not identified as being design uncertainties in chapter 7, although the SCP does include faulting in the investigations of section 8.3.1.8.2, which studies effects of tectonic events on the waste package. The integration of the design conditions in chapter 7 and the results of these investigations is unclear.

Response:

The U.S. Department of Energy believes faulting effects on the waste package design are implicitly considered. However, Table 8.3.1.8-2 implicitly infers that failure of the waste package will certainly result from an intersecting fault movement of more than 5 cm, or ground motion that closes the air gap around the waste package--regardless of the waste package construction. The inclusion of hot rolled high-conductivity copper as a candidate waste package container material (Section 7.3.2.2, Table 7-7) underscores a tacit assumption that for the advantage of high corrosion resistance a material of low yield strength may be considered. This, in turn, indicates that breaching of intersected canisters is inevitable during a fault movement of more than 5 cm.

The one atmosphere pressure is based on the containers sitting in an open borehole well above the water table. Therefore, as discussed, there are no significant hydrostatic or lithostatic loads. The container designs will withstand rock falls and sloughing and those pressures associated with anticipated events. The containers are not designed to withstand unanticipated events such as a shear caused by severe faulting. In this case, it is assumed that the container will fail, but this failure rate is expected to be quite low as discussed in Site Characterization Plan Table 8.3.4.2-3.

COMMENT 10:

Compliance with EPA standards. With regard to assessing the system's long-term performance after closure, the Department has described a very comprehensive and systematic approach towards determining compliance with the EPA disposal standards that were published in 1985. This approach will consider a wide range of potential release scenarios, but with appropriate analytical simplifications and with screening procedures to avoid considering scenarios that should not contribute significantly to the overall analyses.

We have one concern with the approach towards determining compliance with the containment requirements (section 191.13). On page 8.3.5.13-23 of the SCP, the Department states that:

> In calculating the CCDF, the DOE intends to take into account all those natural processes and events that are sufficiently credible to warrant consideration. (emphasis added)

The implication of this sentence and the following paragraphs is that processes and events that might be initiated by human activities will be treated in some different, separate way. We recognize that very different types of uncertainties will apply to natural and human-initiated events, and often be appropriate to study them separately while planning site characterization. However, we want to make it clear that the containment requirements will apply to the total projected releases from all significant processes and events, and that the CCDF to be used to determine compliance must incorporate both natural and human-initiated processes and events. Compliance may not be considered separately for these two categories.

Response:

The U.S. Department of Energy (DOE) appreciates the U.S. Environmental Protection Agency's (EPA) favorable evaluation of the SCP approach to postclosure performance assessment. The response to EPA Comment #1 addresses DOE's concern regarding the treatment of human-initiated events for the postclosure performance assessment.

COMMENT 11:

100,000-year performance projections. On pages 8.3.5.18-21 through 18-27, the SCP describes the Department's approach for carrying out performance projections for 100,000 years, as discussed in 10 CFR 960.3-1-5. EPA wants to strongly endorse DOE's continued commitment to do these very long-term projections, even though they are no longer strictly required after passage of the NWPAA. A very useful approach for these analyses was established in 10 CFR 960, and proceeding with them will add confidence to the site characterization process.

Response:

The U.S. Department of Energy (DOE) appreciates the U.S. Environmental Protection Agency (EPA) endorsement of the DOE commitment to performing very long-term projections of performance assessment. The DOE response to EPA Comment #3 discusses the purpose of these projections.

COMMENT 12:

External review of performance assessment methods and results. In many places throughout section 8.3.5, the Department refers to peer reviews of analytical models and data and to the professional and expert judgments that will be needed to do the performance assessments. EPA agrees that such judgments and reviews will be an essential part of the process, and we want to encourage the Department to include a wide spectrum of participants from many organizations in these reviews. In addition, the Department should do all it can to make the computer programs used available and accessible to all who might be interested in carrying out their own evaluations of the protection provided by the site.

Response:

U.S. Department of Energy (DOE) strongly agrees with this comment and appreciates U.S. Environmental protection Agency's endorsement. In addition to many internal and external reviews planned for the site characterization activities and the data from them, the models and data used in performance assessment will be validated. The proposed validation methodology relies to a considerable extent on peer reviews and expert judgment. In addition, DOE is participating and presenting technical information in many domestic and international conferences and workshops such as INTRAVAL, HYDROCOIN and INTRACOIN, GSA meetings, Decision Science Professional Conferences, etc. This participation allows ongoing exposure of information to review by an extended scientific audience. Codes with input and output data sets will be made publicly available in a timely manner to facilitate external parties.