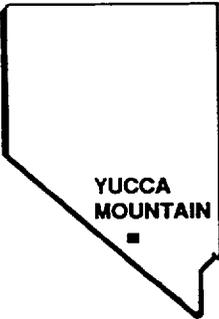


U.S. DEPARTMENT OF ENERGY

**O
C
C
R
W
M**



YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

RESPONSES TO UNITED STATES DEPARTMENT OF THE INTERIOR COMMENTS ON THE SITE CHARACTERIZATION PLAN



DECEMBER 1990

UNITED STATES DEPARTMENT OF ENERGY

9112270156 911219
PDR WASTE
WM-11

PDR

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

COMMENT 1:

The more that is known about the processes that will take place within the waste isolation system, the less uncertainty there will be in predicting system performance, but we believe uncertainties can never be completely eliminated. Convincing empirical tests may be more appropriate for some questions than elaborate models. The approach suggested by Winograd to consider the preservation of archaeological artifacts in the vadose zone over hundred to thousands of years is not included in the SCP but deserves consideration. (I.J. Winograd, U.S. Geological Survey Circular 990: Archaeology and public perception of a transscientific problem--disposal of toxic wastes in the unsaturated zone.)

Response:

The U.S. Department of Energy appreciates your comment and will consider the suggestion.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 3:

The plan indicates that groundwater under the Yucca Mountain site and vicinity is discharged in springs approximately 50 miles southward within the Ash Meadows National Wildlife Refuge. The 12,737-acre refuge was established in 1984. Current acquisition plans will expand the refuge to approximately 24,000 acres. The purpose of the refuge is "to conserve fish or wildlife...and plants which are listed as endangered species or threatened species" (16 U.S.C. 1531-1543).

Our Fish and Wildlife Service is concerned about possible contamination of the groundwater supply to the refuge and any resultant adverse impacts that could occur to the federally listed endangered and threatened species that depend upon the springs and adjacent wetlands.

Response:

Natural discharge of water that flows in the volcanic rocks beneath Yucca Mountain occurs about 50 miles to the south and southwest, principally and perhaps entirely as evapotranspiration at Alkali Flat (also known as Franklin Lake), but possibly also in part as baseflow to the Amargosa River channel south of Eagle Mountain and to the springs of eastern Death Valley near the southern end of the Funeral Mountains. Pumping in the Amargosa Farms area, southwest of the town of Amargosa Valley, and for mineral development in the vicinity of Beatty currently intercepts some flow from this system, which has been designated the Alkali Flat - Furnace Creek Ranch ground water system. Water in the Ash Meadows National Wildlife Refuge is derived from the Ash Meadows ground water system, which is recharged over a large catchment area northeast of Ash Meadows. The western limit of the Ash Meadows system has been estimated (Winograd and Thordarson, 1975; Waddell, 1982) to be about 10 miles east of Yucca Mountain, in the vicinity of central Calico Hills and Topopah Wash. There is a possibility that water in the deeper carbonate aquifer that underlies the volcanic rocks at Yucca Mountain flows southeastward toward Ash Meadows. However, water level measurements in a hole (UE25-p#1) that penetrates the carbonate aquifer near Yucca Mountain shows the potential for upward flow; that is, if there is sufficient permeability for vertical flow to occur, the volcanic rocks receive upward leakage from the carbonate aquifer, rather than the reverse.

These concepts of the flow directions are based on water level (potentiometric) measurements, ground water chemistry, and geologic inferences that will be tested further during site characterization, including also the use of reactive tracers and possibly naturally occurring stable and radioactive isotopes. It is highly unlikely that flow from the volcanic rocks at Yucca Mountain will be found to discharge at Ash Meadows. Furthermore, the long flow paths, slow rates of flow through the porous alluvium of the Amargosa Desert, the sorptive properties of the volcanic rocks and the alluvium, and mixing with much greater flows from elsewhere in the ground-water system combine to provide a diminishingly small probability of contamination at any of the discharge points. Similarly, hydraulic effects at Ash Meadows, such as decreased spring discharge or decline of the water table, are not believed to be credible impacts of site characterization or repository operations. The potential of these impacts occurring will be evaluated during site characterization.

COMMENT 2:

We reiterate our need to formally review the other associated plans which include (1) study plans giving detailed descriptions of site characterization studies and activities (see page 5, SCP Overview), (2) the Environmental Monitoring and Mitigation Plan (see page 5, SCP Overview), (3) copies of comments on the consultation draft of the SCP (see page 7, SCP Overview), (4) Draft Environmental Program overview, (5) Environmental Regulatory Compliance, and (6) Environmental Impact Statement Implementation Plan.

Response:

As a Yucca Mountain Site Characterization Project Participant, the DOI's U.S. Geological Survey (USGS) maintains a complete set of approved Study Plans, which USGS staff maintain as controlled documents. If the DOI desires to have a set of approved Study Plans maintained by an office other than the USGS, please contact the Project Manager to state this request. The DOE would place the DOI on distribution for the environmental plans mentioned in the comment. DOI would remain on distribution for other DOE-approved plans that pertain to the environmental program. A copy of DOE responses to USGS's comments on the Site Characterization Plan/Consultation Draft would be sent to DOI under separate cover.

If a determination of site suitability is favorable, scoping for the Environmental Impact Statement (EIS) would not begin until late 1997. The EIS Implementation Plan is not expected to be issued until 1998, after scoping hearings take place. At these scoping hearings, DOI can comment upon DOE's plans to prepare an EIS for the Yucca Mountain site.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

To address these concerns, an Environmental Field Activity Plan (EFAP) for Water Resources was prepared. This EFAP presents monitoring programs for water quantity and quality at Yucca Mountain and downgradient in the Amargosa Desert, Ash Meadows, and applicable Death Valley National Monument areas, including Devils Hole. New information that is acquired from the planned site characterization studies of the regional hydrology will be used to identify potential impacts and to make warranted changes in the monitoring and study design elements. During the repository construction and operation phase, and subsequent post-closure phase, the environmental monitoring program will be re-evaluated.

REFERENCES

- DOE (U.S. Department of Energy), 1989. Yucca Mountain Project Environmental Field Activity Plan for Water Resources, DOE/NV-10576-19, Las Vegas, NV
- Waddell, R.K., 1982. Two-Dimensional, Steady-State Model of Ground-Water Flow, Nevada Test Site and Vicinity, Nevada-California, USGS-WRI-82-4085, Water-Resources Investigations Report, U.S. Geological Survey.
- Winograd, I.J., and W. Thordarson, 1975. Hydrogeologic and Hydrochemical Framework, South-Central Great Basin, Nevada-California, with Special Reference to the Nevada Test Site, U.S. Geological Survey Professional Paper 712-C, U.S. Government Printing Office, Washington, D.C., pp. C1-C126.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 4:

This potential problem is recognized in the plan. The plan indicates additional groundwater studies to address the issue would be completed by the early 1990s. With regard to these studies, it is important to understand the rate of flow within the saturated and unsaturated zones. The plan (Volume II, pages 3-219 through 3-221) indicates that the flow is very low (millimeters/year). However, the discharge from the springs in the refuge is substantially greater. For example, the rate of flow from Crystal Spring is 6 cubic feet/second.

The proposed studies should be designed to determine the source and rate of these flows and whether contamination of the water is likely to occur. The results of the studies should be used to modify the test program, as appropriate, to fully protect federally listed species in the refuge.

Response:

Average rates of recharge, or of percolation through the unsaturated zone, over the catchment area cannot be compared directly with areally concentrated rates of spring discharge. For example, the total discharge at Ash Meadows is about 0.7 cubic meters per second, but this is collected over an area of about 4,500 km² or 4.5 billion m². An average of about 4 millimeters per year of recharge would supply the Ash Meadows discharge. This rough example calculation does not account for the probabilities that as much as one-third of the Ash Meadows discharge may be naturally diverted from the White River ground water system in Pahranaagat Valley, nor that additional discharge from the Ash Meadows system occurs at Indian Springs and possibly also in Death Valley; these factors are partly offsetting, indicating that the average recharge is a few millimeters per year, rather than several or tens of millimeters per year. In actuality, the recharge rate is higher in the uplands and much smaller in the valleys. Locally, recharge also depends on elevation and topography. The percolation rate at the elevation of Yucca Mountain is currently thought to be less than 1 mm/year, although extensive studies that are described in SCP Section 8.3.1.2.2 will be required to confirm or modify this estimate.

The U.S. Department of Energy will use any new information that is acquired from the planned site characterization studies relating to regional hydrology to address potential impacts and to implement warranted changes in the monitoring and study design elements. The response to U.S. Department of the Interior Comment #3 provides more detail on the monitoring program.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 5:

The refuge provides unique conditions for a great variety of unusual plants and animals. Among these are four endangered fish, one endangered plant, five threatened plants, and one threatened invertebrate. We are concerned about adverse impacts to these federally listed species. However, the plan lacks sufficient information for the Service to adequately assess the impacts of the project on federally listed species. In that regard, the Service fully supports the Department of Energy's commitment to conduct additional groundwater studies to address these data gaps.

Upon completion of these studies, the Department of Energy should prepare a biological assessment for the project to determine if a "may affect" situation exists, pursuant to 50 CFR 402. In accordance with section 7(a) of the Endangered Species Act, the section 7 regulations require Federal agencies to consult with the Service when the agency determines that their action "may affect" listed species or critical habitat. Formal consultation is initiated by submitting a written request to the Service. At that time, the agency should provide a copy of the biological assessment, if required, and other relevant information that assisted DOE in reaching the "may affect" decision. Major construction projects require the completion of a biological assessment to make that determination (50 CFR 402.12).

For technical assistance pertaining to Endangered Species Act matters, you may contact the Field Supervisor, U.S. Fish and Wildlife Service, 4600 Kietzke Lane, Building C, Reno, Nevada 89502, at (FTS) 470-5227 or (702) 784-5227. For information pertaining to the refuge, contact the Refuge Manager, Desert National Wildlife Refuge Complex, 1500 North Decatur Boulevard, Las Vegas, Nevada 89108, at (FTS) 598-6510 or (702) 646-3401.

Response:

The "additional ground-water studies" mentioned in the comment are the subject of the Environmental Field Activity Plan for Water Resources described in the U.S. Department of Energy (DOE) response to U.S. Department of the Interior Comment #3. If the results of these environmental studies show actual significant adverse impacts or a trend toward such impacts, DOE will take the appropriate action, as required by the Endangered Species Act, including preparation of a biological assessment. This is similar to actions DOE has taken with regard to the desert tortoise.

REFERENCES

DOE (U.S. Department of Energy), 1989. Yucca Mountain Project Environmental Field Activity Plan for Water Resources, DOE/NR-10576-19, Yucca Mountain Project Office, Las Vegas, NV.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 6:

As a national monument, Death Valley is an area of designated national significance. The National Park Service Organic Act (16 USC 1) mandates the National Park Service "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired from the enjoyment of future generations." As such, very small seeps that provide water for wildlife and vegetation are of importance for the conservation purposes of Death Valley National Monument.

This unit of the National Park System has been designated an International Biosphere Reserve by UNESCO upon the recommendations of the National Man In The Biosphere Committees of 116 participating nations.

Both units are close to the repository site, and because of their proximity could be impacted by both surface and subsurface activities. For this reason, we request that the park units be shown on all maps in the SCP so that this relationship will be understood by reviewers.

Response:

The importance of Death Valley National Monument and other natural and historic objects is acknowledged by the U.S. Department of Energy (DOE). These objects are identified in appropriate environmental documents. Although DOE will not "revise" the Site Characterization Plan, the Environmental Field Activity Plan for Water Resources will indicate the boundaries of the National Monument where there is substantial support documentation for the site characterization program.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 7:

The SCP's consideration of water use in section 3.8 is limited to human consumption. In terms of Death Valley National Monument, the only water uses acknowledged are limited to National Park Service offices and residences, and commercial inholdings. The SCP fails to identify and treat water availability for riparian resources within the units of the park. Water to support related natural resources, such as springs and oases, are neither acknowledged as uses nor planned for evaluation. The lands cannot be separated from traditional water sources that are inextricably intertwined and regional in nature. Without including these natural resource uses in the assessment of down-gradient users and needs, we believe the hydrological characterization will be incomplete. Our concern is further emphasized by the SCP's extrapolation of the paleohydrologic evidence that the region will continue its long established drying cycle.

We urge the Department of Energy (DOE) to review its projected needs for water and the magnitude of potential cumulative depletion of water resources. To this end, we would like to see DOE expand its water resource characterization efforts to include an evaluation of the interconnections with Death Valley National Monument, currently shown with question marks on document maps. We recommend more information be provided to determine whether the groundwater system can meet the increasing demands being made upon it while supporting traditional perennial desert springs and wetlands. For example, since the preparation of the SCP, there have been substantial changes in the information upon which 3.8, Ground Water Use, was based. Changes are primarily the result of additional high level demands on groundwater from vastly expanded mining and related commercial applicants. The recent recognition of world class gold ore deposits in the neighboring volcanic sequences may lead to greatly increased water use in the vicinity, as indicted on pages 1-280 and 1-353. Ongoing development in this area may occur at the same time the water needs increase for the repository.

Response:

The Yucca Mountain Environmental Assessment (U.S. Department of Energy, 1986) presented the results of preliminary modeling, showing that the anticipated withdrawals of water at Yucca Mountain would produce only very local and minor drawdowns. Improvements of the models and of the data base during site characterization will improve understanding of the regional system and will allow more confident predictions of the effects of water uses associated with the proposed repository. Refer also to the response to Comments 3 and 10.

The U.S. Department of Energy is currently consulting with the National Park Service (NPS) concerning their protest of the Yucca Mountain Site Characterization Project water appropriation permit application. These consultations are addressing the impacts from water withdrawals and will result in a groundwater monitoring program specifically addressing NPS concerns. This monitoring program will be approved by the NPS before their protest will be withdrawn.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

REFERENCES

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

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 8:

It is important to note that high groundwater pumping from wells in the Amargosa Farms area, north of Devil's Hole and Point of Rocks Springs, resulted in a general lowering of the entire groundwater table with serious impact to those springs. The occurrence seems to lend support to strong interrelationships between the several aquifers in the Ash Meadows area. As noted in the SCP, the situation led to the Supreme Court ruling establishing a minimum water level for Devil's Hole to protect its unique and threatened pupfish population.

Response:

The litigation with respect to the water level in Devils Hole, F.L. Cappaert et al. vs. United States et al., involved pumping from wells in eastern Ash Meadows, not in the Amargosa Farms area, which is centered about 15 miles northwest of Ash Meadows. At the scale of the Amargosa Desert, the area of connected aquifers in Ash Meadows is quite small, as described by Dudley and Larson (1976). That report divides the well field operated by the Spring Meadows Ranch (as known in the late 1960s and early 1970s) into four segments based on observed effects at Devils Hole and the various springs. Rather than wells to the north of Devils Hole, it was the wells about 2 miles to the southeast, in the vicinity of Point of Rocks that were observed to cause drawdown in Devils Hole. The area of Ash Meadows west of the "spring line," which extends generally northward from Big Spring to Fairbanks Spring, was found to be composed of poorly permeable deposits, from which only small supplies of poor-quality water could be developed. Pumping from west of the spring line was judged to have no potential effects on Devils Hole or the major springs.

Wells in the Amargosa Farms area are completed in thick sands and gravels deposited in the lower Fortymile Wash drainage and in the Amargosa River floodplain (Claassen, 1986). These deposits are distant, hydrochemically distinct, and hydraulically isolated from the Ash Meadows aquifers associated with Devils Hole and the springs derived from the carbonate aquifer.

REFERENCES

- Claassen H.C., and A.F. White, 1979. "Application of Geochemical Kinetic Data to Groundwater Systems, A Tuffaceous-Rock System in Southern Nevada," Symposium on Chemical Modeling in Aqueous Systems, Speciation, Sorption, Solubility, and Kinetics, E.A. Jenne (ed.), ASTM STP 656, American Society for Testing and Materials, Philadelphia, Penn., pp 99-132.
- Dudley, W.W., Jr., and J.D. Larson, 1976. Effect of Irrigation Pumping on Desert Pupfish Habitats in Ash Meadows, Nye County, Nevada, U.S. Geological Survey Professional Paper 927, U.S. Government Printing Office, Washington, D.C., SCP Chapter 38A.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 9:

As a result of a recent application for groundwater withdrawal by DOE, our National Park Service is currently working with DOE and the Nevada State Engineer to develop a hydrologic monitoring plan to ensure that the water rights of Death Valley National Monument are protected.

We note that other information "not considered a site-characterization activity" but nevertheless necessary for "resolving design and performance issues," is discussed on page 114 of the SCP Overview. We urge water rights issues associated with water use at the Yucca Mountain facilities be addressed in a similar way.

Response:

The U.S. Department of Energy (DOE) recognizes there are a number of issues/studies associated with the Yucca Mountain Site Characterization Project program that are not addressed in the Site Characterization Plan, for example, the environmental programs. Water rights issues associated with water use are being addressed as part of the environmental regulatory compliance (permitting) program for the Project. DOE has submitted the appropriate application and supporting information for the withdrawal and use of ground waters from Well J-13. Also, the Environmental Field Activities Plan for Water Resources (DOE, 1989) addresses water use issues and subsequent ground-water quantity and quality monitoring for the site characterization phase of the program.

REFERENCES

DOE (U.S. Department of Energy), 1989. Yucca Mountain Project Environmental Field Activity Plan for Water Resources, DOE/NV-10576-19, Las Vegas, NV

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 10:

The source of water for the "oases" in the Grapevine and Funeral Mountains is unknown. However, many such springs/seeps are below the groundwater elevation of the alluvial aquifer of the Amargosa Valley and are suspected as having their water source derived from either the regional lower carbonate aquifer (which may be related also to springs issuing at higher elevation) or from the Amargosa Valley alluvial aquifer by faults and/or fractures. Therefore, we recommend the area proposed for detailed study be expanded. The presently designated subregional groundwater flow study area as shown on page 8.3.1.2-135, appears to be too restrictive to adequately describe hydrologic impacts in these areas. Figure 3-2, page 3-3 shows the delineation line of Subbasin B, indicated as a dashed line in California, appears to include only a portion of the Funeral Mountains within the hydrogeologic study area.

Response:

Within the context of site characterization for waste isolation performance, which is intended to evaluate the Yucca Mountain site with respect to U.S. Environmental Protection Agency and U.S. Nuclear Regulatory Commission regulations, regional hydrologic studies serve two principal purposes: (1) to provide the framework for understanding the movement of ground water between the site and the accessible environment (by regulation, not more than 5 km from the proposed site); and (2) to provide sufficient understanding to estimate the impacts (again within the site area) of regional climate changes or tectonic processes within 10,000 years after repository closure. The ultimate licensing criterion addresses the rates and cumulative releases of radionuclides at the 5 km perimeter or to the land surface. If the site cannot be judged with reasonable assurance to meet this criterion, it will not be licensed. A corollary of this is that, for a licensable site, it could not be predicted that harmful contamination might reach any natural discharge areas for water than flows beneath Yucca Mountain, all of which are many times more distant than the 5 km perimeter.

The sources of springs on the east side of Death Valley are of interest to the U.S. Department of Energy (DOE) site characterization program principally because of the implications with respect to the saturated zone ground water flux beneath Yucca Mountain. The uncertainty as to the origins of the springs is precisely the reason why the southwestern boundary of the subregional study area (Subbasin B) is extended with a dashed line into Death Valley. If the springs derive principally by flow draining from the Cenozoic fill of the Amargosa Desert basin through the carbonate rocks of the southern Funeral Mountains, it will be necessary to ensure that the modeled southward flux across central Amargosa Desert is sufficient to balance discharge at Franklin Lake (Alkali Flat) and that in Death Valley. On the other hand, if they derive from more regional westward flowpaths through the Paleozoic carbonate aquifer beneath the younger deposits of the Amargosa Desert or from local recharge (or paleorecharge) in the Funeral Mountains, their discharges need not be accommodated in the subregional model. DOE currently believes that the correct alternative, which may not be the same for all springs, can be identified with acceptable confidence by hydrochemical studies; analyses will include selected natural isotopes such as those of carbon, hydrogen, oxygen, and strontium. As described in SCP Section 8.3.1.2.3.2, regional hydrochemical investigations will support the identification of flow paths

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

and fluxes and more detailed delineation of the boundary of Subbasin B. The first activity in this study is an assessment of data needs; further evaluation of the recommendation to sample remote areas, such as the Tecopa wetlands and the Black Mountains, will be part of this assessment. Where available, such as from exploratory drilling for mineral exploration or for environmental monitoring, water level, temperature, and hydrochemical data will supplement the spring studies. SCP Study 8.3.1.2.1.4. Regional Hydrologic System Synthesis and Modeling, will synthesize hydraulic, hydrochemical, and other data to improve DOE understanding of the regional flow systems.

Recent potentiometric data, obtained from commercial mineral-exploration drilling, indicate the possibility of a ground water divide in the Greenwater Range between the southern Amargosa Desert and Death Valley (Czarnecki, 1987 and 1989). DOE is currently considering, within the context of broader planning, whether the potentiometric high should be further investigated, particularly northward in the southern Funeral Mountains.

Even if the Amargosa Desert Cenozoic deposits are identified as important sources for some of the springs in or tributary to Death Valley, it does not mean that the associated discharge must pass beneath Yucca Mountain. Other sources include the areas beneath Jackass Flats, Fortymile Wash, Crater Flat, and the northwestern Amargosa Desert which, in turn, includes in its catchment area underflow from Oasis Valley, the southern Bullfrog Hills, and the eastern slopes of the Grapevine Mountains and the northern and central Funeral Mountains. The degrees to which it will be necessary to characterize these areas will depend upon the results of the hydrochemical studies, sensitivity studies with modeling, or possibly a decision to conservatively assign a disproportionate share to underflow beneath Yucca Mountain.

REFERENCES

- Czarnecki, J.B., 1987. "Should the Furnace Creek Ranch-Franklin Lake Playa Ground-water Subbasin Simply be the Franklin Playa Ground-water Subbasin? [abs.]," EOS Transactions, American Geophysical Union, Vol. 68, No. 44, p. 1292.
- Czarnecki, J.B., 1989. Hydrologic, Meteorological, and Unsaturated-Zone Moisture-Content Data, Franklin Lake Playa, Inyo County, California, USGS-OFR-89-595, Open-File Report, U.S. Geological Survey.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 11:

We believe intense study of only the immediate vicinity of the proposed repository without due consideration of the region as a whole promotes an incomplete evaluation of environmental concerns. We recommend detailed studies incorporate the Oasis Valley Hydrologic Subbasin and the northern extent of the Amargosa Desert. Moreover, the study area should be extended as well to the south to include the entire Ash Meadows area, and to the west to include wetlands at Tecopa and their subsurface contribution to the Amargosa River and Death Valley.

Response:

It is not clear whether the concerns expressed in this comment relate principally to the effects of repository development and operation or to the much longer postclosure performance of the proposed repository in isolating radionuclides. The response to Comment 3 is applicable to the former: the repository operations cannot credibly be predicted to affect the quantity or quality of water resources in the distant areas that are mentioned.

See response to Comment 10 for further detail.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 12:

The suggested subbasinal study area cannot reasonably be restricted near and terminated as presently suggested at the Franklin Lake Playa. The area indicated by the hydrologic study area, as seen in SCP Figure 3-1, may be more suitable for designation as the subregional model for intense evaluation. Based on the consideration above, modification of the subbasin boundary to include the Grapevine and Funeral Mountains is recommended. Further consideration with respect to inclusion of the Black Mountains is also warranted.

Response:

See responses to Comments 10 and 11.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 13:

Our specific concerns regarding the water resources and water-dependent environments of Death Valley National Monument and Devil's Hole may be summarized as follows:

Death Valley National Monument

Protection of the potable water supplies of the park, including the springs of the Furnace Creek area and Scotty's Castle:

Protection of the springs/seeps of the mountain ranges along the eastern side of Death Valley National Monument to protect the natural environmental regime; and

Protection of the natural flow of the Amargosa River into the Death Valley Basin from the standpoints of both quality and quantity.

Devil's Hole

Protection of the water level and water quality of water in Devil's Hole.

We recommend that these concerns be specifically addressed in terms of the conceptual models identified in Table 8.3.1.2.2-b on pages 8.3.1.2-68 to 8.3.1.2-87. For your convenience, we have listed the potential models that apply to our specific concerns listed above.

Evaluation of Source of Spring Flow at Furnace Creek Area

	<u>Definition of Subregional Boundary</u>		
Model Element	Subregional SZ hydrologic system	Page	8.3.1.2-68
Model Element	Upper Boundary	Page	8.3.1.2-73
Model Element	Temporal	Pages	8.3.1.2-77
			8.3.1.2-78
Model Element	Transient model	Page	8.3.1.2-86

Hydrologic Connection of Deep Carbonate Aquifer to Alluvial Aquifers

Model Element	Hydrogeologic Units	Page	8.3.1.2-69
Model Element	Temporal	Pages	8.3.1.2-77
			8.3.1.2-78
Model Element	Transient model	Page	8.3.1.2-86

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

Evaluation of Source of Seeps within Death Valley National Monument, Grape
Vine and Funeral Mountains

Model Element	Subregional SZ hydrologic system	Page	8.3.1.2-68
Model Element	Faults	Page	8.3.1.2-71
Model Element	Lineaments	Page	8.3.1.2-71
Model Element	Lateral boundary, Subregional	Page	8.3.1.2-76
Model Element	Temporal	Pages	8.3.1.2-77 8.3.1.2-78
Model Element	Porous-media vs. fracture media	Page	8.3.1.2-82
Model Element	Transient model	Page	8.3.1.2-86

Protection of Water Quantity and Quality of Devil's Hole

Model Element	Hydrogeologic Units	Page	8.3.1.2-69
Model Element	Faults	Page	8.3.1.2-71
Model Element	Temporal	Pages	8.3.1.2-77 8.3.1.2-78
Model Element	Porous-media vs. fracture media	Page	8.3.1.2-82
Model Element	Transient model	Page	8.3.1.2-86

Response:

The U.S. Department of Energy appreciates the U.S. Department of the Interior's effort to point out models that apply to their concerns. The Project's site characterization investigation, in conjunction with the environmental monitoring plans, will use all appropriate models in addressing water resource concerns.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 14:

The proposed repository site may impact the Duckwater Indian Reservation. The location of the Duckwater Reservation is approximately 150 miles northeast of the proposed Yucca Mountain site. The Duckwater Tribe is responsible for law enforcement and ambulance service in their localized area. This includes approximately 600 miles of State Highway and County Roads.

If a vehicular accident should occur involving a nuclear waste carrier on roads for which the Duckwater Tribe provides ambulance service, it is unclear how the tribe's law enforcement and ambulance services can protect themselves and the local population while responding to such incidents. We recommend the Department of Energy provide training and specialized equipment to the Duckwater Tribe since they may be responding to transportation accidents involving a possible release of radioactivity. Training in decontamination procedures for ambulance(s) and ambulance personnel should be provided.

The prevailing winds in the region blow from southwest to northeast. The Site Characterization Plan should indicate the risk to members of the Duckwater Tribe if an accident at the repository site should occur. Protective measures which could be taken by the tribe to protect the residents downwind of this area should be presented.

Response:

The Yucca Mountain Site Characterization Project is currently evaluating potential rail spur routes from various main rail lines to Yucca Mountain, two of which pass through Nye County in the area of the Duckwater Reservation. The Nevada Department of Transportation is evaluating alternate truck routes that include US Route 6. Until the State of Nevada identifies other alternate routes, however, the truck shipments of spent fuel and high level waste would travel the interstate highways to Route 95 in Las Vegas and then by Route 95 to Yucca Mountain. When the actual routes are identified, the U.S. Department of Energy is committed to provide emergency response training (per Section 180 of the Nuclear Waste Policy Amendment Act of 1987) to the appropriate people (police, fire, and emergency rescue) that would be in a position to respond to an accident involving radioactive materials. Because many of these responders are volunteers, it would not be effective to start training this early. The present plans are to initiate the emergency response training about three to five years before initiating spent fuel shipments.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 15:

As a general comment regarding the overall safety aspect of the repository in containing the radioactive materials over the next 10,000 years, we believe that consideration should be given to a worst case scenario which would involve a volcanic eruption intersecting the emplaced waste.

The report indicates that (1) "the risk associated with basaltic volcanism at Yucca Mountain is low" (page 1-205), (2), "a small but finite possibility of silicic volcanism affecting Yucca Mountain is suggested" (page 1-337), and (3), "there is a low need to reduce uncertainty" (page 8.3.1.2-621). We suggest that this scenario be given more consideration because remediation from volcanic activity would be different from remedial action after faulting or fracturing in which the integrity of the repository may be restored.

Response:

The possible hydrologic effects of igneous processes and tectonism are addressed in SCP Investigation 8.3.1.8.3, Studies to Provide Information Required on Changes in Unsaturated and Saturated Zone Hydrology Due to Tectonic Events. The detailed study plans for this investigation are in the process of development. The hydrologic effects of volcanism would be a moot point if the probability of the repository being intersected by a volcanic eruption were judged to be sufficiently high to significantly influence the cumulative probability of not meeting the radionuclide release standards. The statement on page 8.3.1.2-62 that the need to reduce uncertainty is low refers to the hydrologic impacts of volcanism, not to the probability and direct effects of volcanic activity.

The U.S. Department of Energy is seriously considering the uncertainty regarding the possibility of future volcanism as demonstrated in Activity 8.3.1.8.5.1.2 (Geochronological Studies), where the volcanism record is established, and Activity 8.3.1.8.1.1.4 (Probability Calculations and Assessment), where the volcanic record is used to refine probabilities of recurrence. Study plans covering these activities provide considerably more detail: 8.3.1.8.1.1, Probability of Magmatic Disruption of the Repository, and 8.3.1.8.5.1, Characterization of Volcanic Features.

REFERENCES

DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.8.5.1, Characterization of Volcanic Features, Yucca Mountain Project Office, Las Vegas, NV.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 16:

Because of its interdisciplinary nature and complexity, the site characterization effort needs special management attention to ensure that information flows freely among various affected parties in a timely way. The revised SCP has added schedules and timelines at the end of each section of Chapter 8 and these are intended to indicate the points of critical information transfer. However, we continue to have concerns about the effectiveness of the information exchange process.

The existence of a schedule that states that information transfer will occur at a particular time may tend to preclude information transfer before that time. Even accepting these schedules and time lines as a viable representation of information transfer, there does not appear to be any recognition of the desirability or need for iterative research efforts. A few examples serve to illustrate the point.

Study 8.3.1.2.2.9, Site Unsaturated-zone Modeling, Synthesis, and Integration, is not throughout its lifetime scheduled to provide information to any other activity, and it is scheduled (as shown in Figure 8.3.1.2-32) to receive information only twice--once in early 1992 from Study 8.3.1.2.2.6, Gaseous-phase Movement in the Unsaturated Zone, and once in early 1993 from Study 8.3.1.2.2.7, Hydrochemical Characterization of the Unsaturated Zone. Study 8.3.1.3.89.1, Gaseous Radionuclide Transport Calculations and Measurements, is not scheduled for information transfer (Figure 8.3.1.3-11) to or from any other study throughout its lifetime.

There does not seem to be any recognition in the SCP that the models, as they develop, should be providing input to the data collection efforts, and that as data are obtained they should be used in the development of the modeling efforts. The same is true of the laboratory studies--they should influence and be influenced by both the modeling and the field studies.

Response:

The schedules developed for Chapter 8 of the Yucca Mountain Site Characterization Plan are summaries of more detailed schedules. As such they show some of the critical information transfer milestones to indicate, for example, that necessary data will be available for performance assessments in time for incorporation in the license application or that geologic data will be available as input to the repository license application design. The iterative process of information transfer between principal investigators of different site studies or between studies in the site program and performance assessments are ongoing and not tied to specific schedules. For example, U.S. Geological Survey principal investigators for the study "Quaternary Faulting Within the Site Area" (Study 8.3.1.17.4.6) regularly exchange information on the nature of Quaternary deposits with the Sandia National Laboratory investigators for the study "Determination of the Location and Recency of Faulting Potential at Prospective Surface Facilities" (Study 8.3.1.17.4.2).

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

The U.S. Department of Energy (DOE) is currently evaluating means to explicitly indicate how to more effectively integrate activities and transfer information. DOE recognizes the need for principal investigators who acquire and interpret data to interact iteratively with performance assessment staff who use those data in modeling studies.

REFERENCES

DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.17.4.2, Determination of the Location and Recency of Faulting Potential at Prospective Surface Facilities, Yucca Mountain Project Office, Las Vegas, NV.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 17:

In last year's review, our U.S. Geological Survey (USGS) discussed the possibility that nitrogen injection planned for Activity 8.3.1.2.2.3.2, Site Vertical Boreholes, would complicate and prevent subsequent collection of critical chemical data. Means for alleviating these problems were suggested, but there is no discussion of these problems in the revised SCP.

Response:

The statement on page 8.3.1.2-207 of the Site Characterization Plan, "Immediately following drilling (or during a pause in drilling), packer nitrogen-injection test will be run ...", is not consistent with the more recent U.S. Department of Energy-approved Study Plan 8.3.1.2.2.3, which describes surface-based test sequence, which is designed to be compatible with the requirements of Activity 8.3.1.2.2.7.1 (Gaseous-Phase Chemical Investigations for In Situ Gas Sampling) is:

- (1) Drill with air tagged with SF₆.
- (2) After completion or interruption of drilling, remove drilling air by pumping until SF₆ concentration is near background level, less than 0.5 ppm by volume.
- (3) Perform gas sampling from intervals isolated with packers.
- (4) Perform nitrogen injection tests, again tagging the gas with SF₆. Dry nitrogen gas (99.99 percent pure) will be injected through an ascarite tube to remove traces, if any, of CO₂ and H₂O.
- (5) Remove injected gas until SF₆ is again near background concentration and nitrogen concentration is reduced to 78 percent.

We believe that this procedure will provide representative baseline data on in situ gas and isotopic compositions and will provide minimum disturbance for subsequent sampling after final completion of the drill holes.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 18:

Presence of the multipurpose boreholes, which have been added to the plan since its earlier version, could affect data collection in the exploratory shafts. The presence of open uncased boreholes near the exploratory shafts could result in substantial barometric pumping that could affect gas chemistry and possibly moisture tensions in the vicinity of the shaft. This effect probably could be minimized by packing off the nonwelded zone. A cap on the shallow surface casing might be inadequate because exchange could still occur between the Tiva Canyon and Topopah Springs units.

Response:

The possible effects of barometric exchange of air with unsaturated zone gases in the multipurpose boreholes on tests in the exploratory shaft are expected to be much less than the effects of opening and ventilating the shafts, drifts, and test rooms. However, baseline gas and isotopic compositions will be obtained from the multipurpose boreholes according to the procedure outlined above in the response to Comment 17; baseline moisture contents will also be obtained. These will allow subsequent recognition of longer-term effects from sustained barometric pumping. In addition, the radial borehole tests in the exploratory "science" shaft (Activity 8.3.1.2.2.4.4, Radial Borehole Tests in the Exploratory Shaft Facility,) are designed explicitly to determine the depth of disturbances from mining and lining. Procedures for drilling and testing of these holes will be similar to those used in surface-based drilling. Similar procedures and objectives apply to Activity 8.3.1.2.2.4.10 (Hydrologic Properties of Major Faults Encountered in Main Test Level of the ESF). Gas and moisture sampling and temperature profiling, although designed principally to characterize conditions in fault zones, will also produce data relevant to less disturbed rock; repeated temperature measurements may also produce information regarding rates of disturbance on in situ conditions by the underground openings and activities. Together with areally more extensive surface-based studies, these investigations should produce an understanding of the extent and rates of disturbance.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 19:

The discussion of mineral deposits which appears on page 1-283, remains unbalanced despite previous comments on this subject. The discussion should acknowledge the possibility for Yucca Mountain area.

Response:

Although the summary discussion based on previous knowledge of precious and base-metal mineral deposits in the Yucca Mountain area (page 1-283) may appear unbalanced, the actual plans for future work during site characterization are quite comprehensive. These plans are outlined in the Site Characterization Plan (in Study 8.3.1.9.2.1, Natural Resource Assessment of Yucca Mountain), and will be presented in more detail in the associated study plan. The future plans call for an extensive evaluation of both existing and new site-specific data at Yucca Mountain, and an evaluation of all economic mineralization models appropriate for the southern Great Basin Province.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 20:

Last year our USGS commented on the calculation of ground-water travel times described on pages 3-205 - 3-221 as lacking clarity in stating assumptions and uncertainties. Uncertainty was discussed in text but only single numbers were given to a precision that is not warranted. The precision has been lowered on travel time estimates but there are no other changes. This issue must be resolved.

Response:

There are no assumptions in the initial modeling that are justifiable based on currently available data. Basic understanding of the mechanisms that govern unsaturated flow, in particular, is still in its infancy. In a recent publication by the National Research Council (1990), the following statement is made, "...present conceptual and mathematical models of convection and dispersion do not provide accurate results or inspire confidence when applied to highly heterogeneous or otherwise complex environments." Through observation, laboratory studies, numerical experiment, field studies, and natural analogs, the following are believed to be essential conceptual elements of the hydrologic system at Yucca Mountain.

1. The system is variably saturated. That is, the conditions under which perched water might occur in the unsaturated zone must be accounted for in the model and the coupling between the unsaturated and the saturated zone must be understood.
2. The system is both multi-phase and multi-component.
3. The system domain is heterogeneous. Layered heterogeneities may or may not be characteristic of the site. Abrupt discontinuities, such as faults, are likely to exist. In addition, the depositional and diagenetic processes will have influenced the distribution of properties.
4. The non-linearity of the unsaturated flow process must be accounted for in the model.
5. The process of flow is essentially multidimensional.
6. Both the process and the domain are anisotropic.
7. Boundary conditions are highly variable in both time and space.
8. The flow process is inherently non-deterministic.

In addition to the data collection and validation activities described in the SCP, a substantial amount of supporting information for the fundamental conceptual issues is being generated in the open literature and through international cooperation or agreements.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

REFERENCES

National Research Council, 1990. Ground-Water Models: Scientific and Regulatory Applications. National Academy Press, Washington, DC.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 21:

Mining methods are discussed on page 1-160. We previously suggested use of a tunnel boring machine (TBM) in place of drill and blast techniques to reduce fracturing along the drifts. No change has been made in the SCP reflecting this comment. An analysis of the benefits and tradeoffs of the use of TBM should be provided.

Response:

The Exploratory Shaft Facility (ESF) Alternative Studies is specifically considering alternative construction methods partly in response to an identical comment by the Nuclear Waste Technical Review Board.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 22:

Our concern with the climate and meteorology program centers on the variables to be measured. The global climate modeling (GCM) activity described on p. 8.3.1.5-79 lists a number of variables that will be obtained from their GCMs to be used as boundary and, presumably, initial conditions for a regional model. These include, among others, surface temperature, average solar flux at the surface, average emitted long wave radiation, and average surface albedo. None of these are included in the meteorology monitoring program, even at a single site. We think the relationship between model-derived values and reality should be indicated. Some kind of evidence should be provided that substantiates the values used in the climate models. Of all the radiation variables mentioned by the climate program, the only one collected as part of the meteorology program is net radiation and then only at one site. Net radiation will vary considerably from place to place depending on surface albedo and humidity. Measurement at a single site may be inadequate.

Response:

The principal purpose of the Yucca Mountain Project (YMP) meteorological program alluded to in this comment is to fulfill various operational needs and to provide data for assessing the radiological consequences of radionuclide releases at the site, not to provide input for the climate modeling. The meteorological radiation-related variables mentioned in the comment are not, in general, of primary importance for these purposes, and therefore detailed information on these variables is not being collected.

In assessing the input requirements of the climate models, it must be understood that the response of the model is a highly integrated response to the inputs over the entire region covered by the model. What is required, therefore, is input reasonably representative of this entire region (the Western U.S. and adjacent Pacific Ocean, for the YMP regional model). It does not matter greatly whether a complete meteorological input data set is available for the YMP site itself even though that is the location for which the model output is of greatest interest. The site meteorology program does include measurements of parameters such as precipitation variables, temperatures, winds, etc., which will be useful for validation of the model output predictions of greatest interest for this site.

The U.S. Department of Energy (DOE) agrees that the model predictions must be validated. This will be done by comparing the climates predicted by the models with those actually observed, both for the current climate and for past climates, insofar as the latter can be inferred from the available paleoclimatological data base. Among other things, these comparisons will help to establish the degree of validity of the global climate model (GCM) predictions that are used as input to the regional climate model.

DOE is following the worldwide efforts to develop GCM to support decision-making through association with the National Center for Atmospheric Research (NCAR), and will use the best available techniques for the climate predictions necessary for performance assessments.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

Some aspects of regional and site meteorology are addressed also by Study Plan 8.3.1.2.1.1 (Characterization of the Meteorology for Regional Hydrology) and Study Plan 8.3.1.2.2.1 (Characterization of the Unsaturated Zone Infiltration). All of the radiation variables, incoming and outgoing long- and short-wave radiation (albedo and emissivity) will be measured and modeled for the site and regional areas. The component parts will be measured both individually (separate instrumentation) and together (net radiometers). Of the 15 parameters listed on SCP page 8.3.1.5-79, numbers 1, 5, 6, 7, 8, 9, 10, 11, 13, 14, and 15 will be collected in support of these hydrologic studies.

REFERENCES

- DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.2.1.1, Characterization of the Meteorology for Regional Hydrology, Yucca Mountain Project Office, Las Vegas, NV.
- DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.2.2.1, Characterization of the Unsaturated Zone Infiltration, Yucca Mountain Project Office, Las Vegas, NV.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 23:

It is not clear which instruments are to be used in measuring the variables to be collected by the meteorological monitoring program. Similarly, accuracy of the measurements requires clarification, specifically atmospheric moisture (we assume relative humidity) and dewpoint temperature. Under the conditions of high temperatures and very low humidity that occur during the summer months in southern Nevada, many sensors do not measure correct values for these variables because sensor design limitations are exceeded by ambient conditions (for instance, commonly used humidity sensors are not accurate below 12 percent humidity, yet summer daytime humidity can fall below 5 percent).

Response:

The purpose of the meteorological program description in the Site Characterization Plan is to explain how such data will be collected to answer certain questions posed by the regulatory requirements of 10 CFR Part 60. Specific instruments used in the program are detailed in study plans, technical procedures, procurement documents and manufacturers' manuals.

Accuracy of the measurements is addressed in the Meteorological Monitoring Plan (MMP) (SAIC, 1985). The instrument specifications for atmospheric moisture measurements are not addressed in the current revision of the MMP, but will be addressed in Revision 2.

The equipment being used and accuracies are described in detail in study plans 8.3.1.2.1.1 (Characterization of the Meteorology for Regional Hydrology), and 8.3.1.2.2.1 (Characterization of Unsaturated-zone Infiltration). Measurements of relative humidity can be made down to about 12 percent. Wet-bulb and dry-bulb temperature measurements can provide lower humidity values until the air temperature gets too cold, a problem that is currently being addressed by many researchers in arid-zone hydrology. Unless this problem is solved, it may be necessary to estimate relative humidity for the comparatively minor periods during which it is less than 12 percent and during which air temperature is too low.

REFERENCES

- SAIC (Science Applications International Corporation), 1985. Meteorological Monitoring Plan for the Nevada Nuclear Waste Storage Investigations Project, Yucca Mountain Site, DOE/NV/10270-5, Las Vegas, NV.
- DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.2.1.1, Characterization of the Meteorology for Regional Hydrology, Yucca Mountain Project Office, Las Vegas, NV.
- DOE (U.S. Department of Energy), 1990. Study Plan 8.3.1.2.2.1, Characterization of the Unsaturated Zone Infiltration, Yucca Mountain Project Office, Las Vegas, NV.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 24:

On p. 8.3.1.12-20 reference is made to "Hourly average surface temperature at standard height..." The term "surface temperature" implies a land surface temperature measurement, but the term "at standard height" implies an air-temperature measurement. No indication is given of the instrument to be used. Finally, it is indicated on that same page that temperature sensors will have an accuracy of only $\pm 0.5^{\circ}\text{C}$. Commonly available thermistors have an accuracy of $\pm 0.15^{\circ}\text{C}$. Also temperature differences between measurement levels are specified to be measured at an accuracy of $\pm 0.003^{\circ}\text{C}$.

We fail to see how two measurements that are only accurate to $\pm 0.5^{\circ}\text{C}$ will yield a difference that is accurate to $\pm 0.003^{\circ}\text{C}$. Such a differential measurement will be accurate to $\pm 1.0^{\circ}\text{C}$. Finally, the measurements of solar radiation are to have an accuracy of ± 5 percent but the instrument to be used to measure solar radiation is not described. On p. 8.3.1.12-19, para. 3 refers to the measurement of net radiation; thus we assume net radiometers will be used. If that is the case, then the accuracy of such instruments would be approximately $\pm 15-20$ percent.

Response:

Surface temperature, as defined in the Glossary of Meteorology (American Meteorological Society, 1980) is "...the temperature of the air near the surface of the earth..." More specifically, surface temperatures are obtained at what is called standard height, or 10 m above the surface.

Ambient temperatures on the NTS-60 Repository tower are measured by individual sensors placed at the 10 m and 60 m levels. These sensors have a design accuracy of $\pm 0.5^{\circ}\text{C}$, as per guidance provided by the U.S. Environmental Protection Agency. The differential temperature between the 10 m and 60 m levels is measured by another, distinct set of temperature sensors, which are more sensitive. The accuracy of ± 5 percent for the net radiometer is a specification made by the manufacturer.

There is a difference between accuracy and precision. Two thermistors that are accurate only to 0.5° , but are matched to each other, can resolve temperature differences of 0.0003°C and, thus, be useful for profiling or Bowen ratio techniques. To our knowledge, the 8.3.1.12 meteorology investigation does not specify these and other important aspects of planning instrumentation, and some aspects of field practices (unheated snow gages, allowing snow to blow out; aluminum ladders beneath net radiometers). The study plans and technical procedures are the sources for this level-of-detail and need very careful preparation and review.

REFERENCES

Huschke, R.E. (ed.), 1980. Glossary of Meteorology, American Meteorological Society, Boston MA.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 25:

The discussion of recharge rates and aquifer transmissivity in chapter 3 requires clarification. Specifically, on p. 3-79, second paragraph "...estimated total flux...was about 4.3×10^7 m³/yr. This value is in good agreement with the total ground-water discharge of 4.0×10^7 m³/yr. ...in table 3-99." It is acknowledged that parameter estimation techniques were used but we suspect that the reason for the "good" agreement is because heads and fluxes were used as givens in the parameter estimation model and that aquifer transmissivities were calculated. In other words, the model is designed to reproduce the designated fluxes (and heads) so it should not be surprising that it calculates the desired flux rates, nor does it prove anything about either flux rates or transmissivities. These values can be evaluated further by using them in a transient flow model to reproduce historic drawdowns. We are not aware of any stress on the aquifer over most of the modeled areas, so accurate verification of the transient response of the models could not have been performed.

The same logic applies to the implication of the last sentence on p. 3-205. It is unclear how the parameter estimation was done; whether specified flux rates were used to obtain transmissivities or visa versa. We suspect that specified boundary fluxes and specified head were used to calculate transmissivities. The particular solution that led to a transmissivity of 3,340 m³/day also yields model-element to model-element flux rates of 2 to 3 m²/day. These are all dependent, however, on the boundary and initial conditions. We believe also that transient analysis should be performed to validate conclusions from the results of the parameter estimation model.

Response:

Citing directly from Czarnecki and Waddell (1984, p. 20): "The evapotranspiration flux estimate ... applied throughout an area of 31.7 km² at Franklin Lake playa ... was obtained by allowing the model to optimize on this flux as the only model parameter. Significant correlation of this flux parameter with upgradient transmissivity parameters prevented convergence to a solution, hence the need to solve for this ET flux parameter individually." The model that was used was a parameter-estimation model. Because no areally significant hydraulic stresses have been observed in historical times, it is not possible to validate conclusions by transient analysis based on the historical record. There is some possibility that paleohydrologic investigations will provide data to perform rough validations although there are several problems that may preclude this: (1) the lack of accepted mineralogic criteria for identifying former water-table altitudes; (2) the apparent restriction of Pleistocene discharge areas to the Amargosa Desert, southern Crater Flat (?), Oasis Valley, and Death Valley with a consequent lack of evidence in extensive upgradient areas; (3) the likelihood of vertical tectonic movements; and (4) the difficulty of dating carbonate discharge deposits, which are predominantly open geochemical systems, and the lack of datable non-carbonate deposits.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

REFERENCES

Czarnecki, J.B., and R.K. Waddell, 1984. Finite-Element Simulation of Ground-Water Flow in the Vicinity of Yucca Mountain, Nevada-California, USGS-WRI-84-4349, Water-Resources Investigations Report, U.S. Geological Survey.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 26:

Page 3-7, 2nd paragraph: Given the uncertainties listed on this page in regard to hydrologic and hydrogeologic data, we must question the statement that in "very general terms, the regional hydrology and hydrogeology are fairly well understood and their levels of uncertainty are relatively low." This sentence should be revised, since it does not take into consideration the apparent contradictory comment on page 3-71 that "...additional work is needed to document recharge mechanisms and rates. ..."

Response:

The U.S. Department of Energy believes that the phrase, "In very general terms, ..." and reference to the regional [emphasis added] hydrology and hydrogeology sufficiently qualify the remainder of the sentence. In comparison to most areas of the world, and particularly those dominated by regional ground water flow, the southern Great Basin has been extensively studied.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 27:

Data presented in the SCP, in regard to recharge estimations on pages 3-70 and 3-204, as others, are subjective based upon broad regional assumptions. We question why regional generalizations were apparently given preferential consideration. When specific data was available, such as on page 3-32, to the effect that only 3 percent of the annual rainfall in the Beatty area may have contributed to recharge of the alluvial aquifer over the 16-year study period.

Response:

Nichols and Akers' (1986) study at the low-level radioactive waste disposal site near Beatty was cited only as an example of the importance of evaporation from soil in estimating water budgets in arid regions. Although the estimated soil evaporation resulting from Nichol's intensive study of a small area of permeable alluvium is useful for providing a conceptual or, at best a semi-quantitative, calibration point, it is not a basis for determining recharge over the vast, topographically and geologically diverse ground-water subbasin. The method of Eakin and others (1951) has certainly been criticized, as is discussed on page 3-71, but no superior method has been proposed for application in arid regions. Instead, its application has provided reasonable balances with quite well known discharges from regional ground-water systems in the desert southwest. The discharge from the ground-water subbasin that includes Yucca Mountain will be determined with a rather high degree of confidence during site characterization, as will be the sensitivity of ground-water models to the areal (and temporal, within a time frame of thousands of years) distribution of the recharge required to support this discharge. At the site scale, infiltration and deep percolation studies of the unsaturated zone will provide estimates to constrain further estimates of recharge at the site itself.

REFERENCES

- Nichols, W.D. and J.P. Akers, 1985. Water-Level Declines in the Amargosa Valley Area, Nye County, Nevada, 1962-84. USGS-WRI-85-4273, Water Resources Investigations Report, U.S. Geological Survey.
- Eakin, T.E., G.B. Maxey, T.W. Robinson, J.C. Fredericks, and O.J. Loeltz, 1951. Contributions to the Hydrology of Eastern Nevada, Water Resources Bulletin No. 12, Office of the State Engineer, State of Nevada, Carson City, 171 p.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 28:

The confidence level of the recharge data, as noted in the SCP, and those of other data bases, should be upgraded. For example, study is recommended to quantify the effective recharge in the highlands speculated to constitute the major recharge zone, SCP Figure 3-7, or the affected aquifers. It is possible that effective recharge to the important carbonate aquifers is from areas considerably more distant than those evaluated in the SCP.

Response:

Section 8.3.1.2 of the Site Characterization Plan explains in considerable detail numerous studies to upgrade various data bases, as well as to improve understanding of processes such as recharge. As is explained in the response to the preceding comment (27), it may be prohibitively difficult to improve substantially on estimates for upland recharge that are based on the method of Eakin and others (1951). With respect to effective recharge to the regionally extensive carbonate aquifer, the comment is correct that it occurs principally beyond the area of intensive site characterization studies. As was discussed in the responses to Comments 3, 10, 11, and 12, it is the nature and locations of discharge from the carbonate aquifer -- not its recharge -- that is most directly applicable to evaluating the Yucca Mountain site.

REFERENCES

Eakin, T.E., G.B. Maxey, T.W. Robinson, J.C. Fredericks, and O.J. Loeltz, 1951. Contributions to the Hydrology of Eastern Nevada, Water Resources Bulletin No. 12, Office of the State Engineer, State of Nevada, Carson City, 171 p.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 29:

Table 3-5, pages 3-36 through 3-39: The listed springs within Death Valley National Monument are a portion of the springs located in Grapevine and Funeral Mountains within the national park unit. A complete inventory of springs has not been made. Recently released, preliminary topographic maps show some 40 springs within the area of interest.

Response:

A more complete inventory of springs within or tributary to Death Valley National Monument will be conducted in cooperation with the National Park Service as part of the studies of the regional hydrology for site characterization, jointly with water resource studies for the environmental program.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 30:

Page 3-47: A statement is made on this page that, "The main source of the groundwater discharge in the Furnace Creek Ranch area is believed to be the lower carbonate aquifer." The SCP goes on to state on page 3-70, in discussing the regional groundwater flow system, that "principal areas of discharge are in the southern Amargosa Desert. Smaller, less significant areas are near Beatty, Indian Springs, and in Death Valley." Also, Figure 3-10 and other figures depict groundwater discharge at the Texas, Travertine, and Nevares Springs within Death Valley National Monument.

The premise that the source of Furnace Creek's water is the lower carbonate aquifer is supported by other statements in the document (see pages 3-79 and 3-205), as well as in numerous publications but has never been conclusively demonstrated. Nevertheless, the interconnection between the discharge point in the park and the aquifer is very important to understanding the regional groundwater flow system and its characteristics, as well as impacts of the Yucca Mountain project on Death Valley. We recommend that test well drilling and other measures be included in the SCP to specifically evaluate this interconnection.

Response:

There is no credible likelihood that characterization, construction, or operation will produce hydrologic effects in Death Valley, but the Environmental Field Activities Plan, nonetheless, provides for monitoring. The source of discharge in the Furnace Creek area is indeed somewhat uncertain, but its importance to site characterization is principally its influence on estimates of saturated zone flux beneath Yucca Mountain. Although some test drilling may eventually be indicated, hydrochemical sampling and analyses -- including for natural tracer isotopes -- and other reconnaissance techniques will be applied first, whether to help guide a drilling program or to support a decision that drilling is not necessary.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 31:

Page 3-92, section 3.7.3.1.2: In the discussion about the discharge from the lower carbonate aquifer on page 3-92, detail is given on the nature of waste discharge at Devil's Hole and Point of Rocks springs. The discussion does provide some insight into the contribution of lower carbonate aquifer water to the valley fill aquifer. However, the actual physical conditions, which include highly variable water quality, believed to be indicative of a complex system should be presented.

The SCP, for example, provides reference (Winograd and Friedman, 1972) to estimate that 35 percent of the Ash meadows discharge is vectored into the Death Valley area via the Pahranaगत Shear Zone from the White River Groundwater Flow System of eastern Nevada. A groundwater system with waters originating at the Ruby Mountains of east-central Nevada certainly attests to the complexity of the system.

Response:

Yucca Mountain is not within the Ash Meadows ground water system and only some aspects of that system bear on an understanding of ground water flow beneath Yucca Mountain, most importantly the rate of underflow in deep Paleozoic rocks beneath the Cenozoic fill of the southern Amargosa Desert from Ash Meadows to Death Valley. The cited complexities of the Ash Meadows system, whether on a regional scale (such as inflow from Pahranaगत Valley) or on a local scale (such as details of the movement of water from the lower carbonate aquifer into the valley fill deposits of Ash Meadows) do not directly impact the evaluation of the Yucca Mountain site.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 32:

Page 3-118, section 3.8.1.1: With respect to water use in the Alkali Flat-Furnace Creek Ranch Basin, statements are made that "Very little groundwater is withdrawn..." and that only one company is presently involved with mineral production in the subbasin. These statements are out of date. Bond Gold Bullfrog Inc., Saga Exploration, and U.S. Nevada Gold Search, are now interested parties in various stages of anticipated mining activities within the subbasin. Their recent gold discoveries are expected to prompt further exploration. The spatial and temporal aspects of groundwater withdrawal, associated with the mining operations, are highly speculative, but may result in reverse groundwater gradients over large areas as substantial cones of depression are developed.

The potential for cumulative impacts on groundwater levels also exist. At the rates of recharge indicated on page 3-29, the resultant water levels may remain at a lowered depth for many centuries, or forever, thus altering groundwater flow paths and perhaps interacting with the lower carbonate aquifer through "upward crossflow into the valley fill," as expressed on pages 3-93, with unknown consequences.

Response:

The statement that discussion of recent and future potential withdrawals of water for mineral production was out-of-date in the Site Characterization Plan is correct, and the impact of such pumping certainly merits observation and analyses. Conservative (that is, maximizing impact) modeling by Hydrosearch, Inc., for Bond Gold Bullfrog, Inc. indicates that an induced westward gradient from Yucca Mountain toward the Beatty area is highly unlikely. The need for additional hydrologic modeling or observation wells to monitor effects between Yucca Mountain and the commercial developments, beyond those specified in current plans is a determination to be made as characterization proceeds.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 33:

Page 3-120: While the "quantity of water required to maintain the National Park Service facilities at their present level of public service" is an important consideration, we again refer to the National Park Service Organic Act which mandates a broad scope of protection for the water resources and water-dependent environments of Death Valley National Monument and Devil's Hole. Studies conducted by many agencies, including the Department of Energy, document no practical local recharge of the highly important aquifers: Nichols (1986) acknowledges the high probability "... that infiltration (by rainfall) may not occur a majority of the time," Site Characterization Plan (SCP) page 3-30, and again at page 3-70 by Claassen (1985) who suggests that recharge of the valley-fill aquifer in the west-central Amargosa Desert, "... resulted from overland snow melt runoff during the late Pleistocene time. ..." Local domestic, commercial development, and the traditional desert springs are obviously dependent upon waters carried to them from distant recharge areas.

Extremely sparse local rain and snowfall are generally overwhelmed by diurnal, barometric and plant root pumping in conjunction with highly elevated levels of evapotranspiration, "... the primary mechanism for discharge of groundwater," as noted on page 3-29. Waters of critical springs and oases transported by the aquifers must be of sufficient volume to overcome the desiccating forces before surface water can be made available for plant and animal populations dependent upon it.

Response:

The U.S. Department of Energy (DOE) response to U.S. Department of the Interior Comment #3 describes the Environmental Field Activity Plan for Water Resources, which addresses the concern regarding availability of water for plant and animal populations.

DOE agrees that the larger discharges, whether natural or artificial, are supplied by regional flow. Some of the smaller springs and seeps within Death Valley National Monument, particularly those at higher elevations, may derive their small flows from local recharge. A representative number of these will be sampled as part of the hydrochemical reconnaissance studies, which are discussed in the context of several earlier comments. The assistance of DVNM staff in prioritizing sampling sites and providing historical perspective on flow characteristics would be helpful.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 34:

Page 3-121, 1st paragraph: The Stovepipe Wells Hotel is not provided with water from on-site wells. In 1973, the National Park Service drilled an off-site well and desalinized (by a reverse osmosis unit) to provide a potable water supply. Other water needs of the site are met by usage of untreated well water.

Response:

The correction to the source of water supply for the Stovepipe Wells Hotel is noted.

U.S. DEPARTMENT OF INTERIOR COMMENTS ON
THE SITE CHARACTERIZATION PLAN

COMMENT 35:

Page 8.3.1.2-3. We recommend that the "... complete an accurate description...that will reflect an understanding of...initial and boundary condition and processes..." should include both the evaluation of the source of spring flow within Death Valley National Monument at Furnace Creek and a more detailed understanding of the relationship between the deep carbonate aquifer and alluvial aquifers. Such assessments relate directly to the Parameter Categories of Saturated-Zone Water Potential (page 8.3.1.2-35) and Saturated-Zone Ground-Water Flux (page 8.3.1.2-37).

Response:

The U.S. Department of Energy (DOE) agrees with the recommendation in general, but disagrees that an intensive program of subsurface exploration is likely to be needed to support a complete and accurate description of the regional ground water systems to support characterization of the Yucca Mountain site. Please refer to the discussions of earlier comments, particularly Comments 10, 11, and 12.

DEPARTMENT OF INTERIOR COMMENTS ON THE EPO
(ER 89/292, 10/13/89)

COMMENT 1

Mineral Resources: No mineral resources are currently known to exist at the site. However, if mineral or energy resources are discovered during the site characterization process, the measures that would be taken to protect these resources should be described.

RESPONSE

As stated by the reviewer, "No energy or mineral resources have been identified on the site or within the controlled area." For this reason, it is felt that neither energy nor mineral resources represents a technical area likely to be impacted in any discernible way by site characterization activities. Consequently, neither is considered appropriate for inclusion in the environmental monitoring and mitigation program. Should these resources be identified during site characterization, the appropriate action will be determined at that time.

COMMENT 2

Page 1-2, Interested Parties: The statement is made that the "EPO will attempt to provide these interested parties with a better understanding of the basis and integrated approach of DOE's environmental program for Yucca Mountain." Also "other governmental officials" are referenced as interested parties but we are unaware of any recent consultation or direct involvement of the Department of Interior or its bureaus in the identification of environmental issues, plans or activities.

We recommend that an integrated approach would include our Service and the National Park Service (NPS). Further, we suggest that most current information be used in the integrated approach rather than by extrapolating data from the environmental assessment completed in 1984.

RESPONSE

On the basis of environmental studies conducted for the Yucca Mountain site, the DOE has concluded that no significant adverse environmental effects are expected to occur from site characterization activities. The Department of the Interior (DOI) was therefore not consulted "directly" in regard to environmental issues, plans, and activities of the DOE's Yucca Mountain Project Office. The DOI did, however, have the opportunity to comment on the Yucca Mountain Environmental Assessment released in 1984. Moreover, the release of the Draft EPO has afforded the DOI, as well as other Federal and State agencies, the opportunity to comment directly on the DOE's environmental program for Yucca Mountain. The DOE is pleased that the DOI has commented directly on DOE's environmental efforts at Yucca Mountain via the Draft EPO, the Draft EMMP, and the Draft ERCP, and the DOE assures the DOI that continued consultations will occur between the DOE and the DOI.

For example, the DOE has been consulting with the U.S. Fish and Wildlife Service (USF&WS). The USF&WS was asked to review the Project first in 1988, when the agency found that the Project would not affect any wetlands or endangered species. When the desert tortoise was listed as endangered, DOE consulted with USF&WS, who issued a no-jeopardy opinion concerning the effects of site characterization on desert tortoise populations.

The DOE has also been consulting with the National Park Service (NPS) to ensure protection of Death Valley National Monument resources. A groundwater monitoring program has been submitted to the NPS and will eventually be implemented to monitor Death Valley water resources and protect regional wildlife.

COMMENT 3

PAGE 1-3, Environmental Program and Siting: The statement is made that this "EPO describes the environmental program being developed for the siting of a repository at Yucca Mountain." It appears that almost all efforts are concentrated on the characteristics and environmental effects of the

immediate repository site. If this is the case, then the geographic scope of the entire effort should be clearly delineated.

We urge this environmental program should be regional in scope in order to address potential adverse environmental effects to Ash Meadows National Wildlife Refuge, Death Valley National Monument, and Devil's Hole National Monument, especially as they relate to the complex groundwater system. Also, we believe that regional information will be important to the environmental process.

RESPONSE

The DOE agrees that regional data will be important to the environmental studies conducted for the site characterization, and the DOE plans to use all data that are relevant to the determination of potential adverse impacts. For example, the EMMP discusses the monitoring of potential environmental impacts from site characterization, and the methods to be used to mitigate these impacts if they are detected. Furthermore, plans have been developed under the EMMP (referred to as Environmental Field Activity Plans or "EFAPs") to monitor the potential impacts of site characterization in the areas of terrestrial ecosystems, archaeological resources and historic sites, air quality, water quality, and the radiological environment. In regard to DOI-administered lands, the EFAP for water resources describes a monitoring program for water quantity and quality at Yucca Mountain, as well as for down-gradient areas including the Amargosa Desert, Ash Meadows, and Death Valley National Monument (including Devils Hole). As a subset of the water resources EFAP, a plan has also been developed to monitor water levels and springflows in the above-mentioned areas to expressly address the concerns of the NPS and the USF&WS regarding water resources in the Ash Meadows and Furnace Creek areas.

COMMENT 4

Page 1-4, Systems Engineering: Although this and similar terms are referenced in several places, they are never defined. More specific

information would be helpful in understanding DOE's environmental program for the project.

RESPONSE

Systems engineering is a method used to manage, integrate, interface, and document technical activities on a project. DOE Orders require the DOE to manage large projects in such a way that technical objectives are defined, cost and schedules are controlled, and overall project management techniques are used. Systems engineering is the technique used by the Yucca Mountain Project to accomplish these requirements. The environmental program is managed and integrated with the other parts of the Project using systems engineering.

COMMENT 5

Page 1-5, "SEMP controls investigations...": The statement is made that the "SEMP controls investigation such that resultant data may be used to produce a repository that adequately satisfies pertinent technical, regulatory, siting and licensing requirements." If such data is to be used in the regulatory and licensing requirements, which we understand will also incorporate the adoption of the EIS by the Nuclear Regulatory Commission (NRC), then we recommend that DOE should ensure that data is generated over an appropriate geographic area that may be impacted, particularly as it related to groundwater.

RESPONSE

As we discussed in the response to Comment 3, regional groundwater data are being collected as described in the EFAP for Water Resources. This program is being developed in consultation with the NPS.

COMMENT 6

Pages 1-6 and 2-5, EFAPs: The Overview states that the current site characterization phase, Environmental Field Activity Plan (EFAPs) will detail

field investigations to support the Environmental Monitoring and Mitigation Plan and the Environmental Regulatory Compliance Plan.

We urge DOE to provide copies of the EFAPs to the Department of the Interior for review, especially for water resources, since regulatory concerns and environmental requirements that could affect the resources of Ash Meadows National Wildlife Refuge and Death Valley and Devil's Hole National Monuments would be addressed in these documents.

RESPONSE

The water resources EFAP has already been sent to the NPS for comment. Other EFAPs will be sent to the DOI as they are completed.

COMMENT 7

Pages 3-1, 3-2, Identification of Environmental Program Requirements: The statement is made that requirements were derived in part "by reviewing issues raised by other Federal agencies..."

Many of the issues with which the Department of the Interior is concerned were not viewed to be as great a concern in 1984 because the utilization of groundwater in the region has changed substantially since that time. Moreover, there has not been a subsequent forum in which we could express new information and new concerns.

RESPONSE

As discussed in the response to Comment 2, consultations will continue with the DOI, NPS, and USF&WS.

COMMENT 8

Page 3-7, NEPA: The relationship between NEPA and other components of the environmental program as described seems unclear. Although by implication, data that is generated will be utilized in the NEPA process, the geographic

scope of the EIS will necessarily be regional given the geographic extent of potential impacts on the groundwater system.

RESPONSE

NEPA requires the preparation of an EIS for siting, constructing, operating, and decommissioning a nuclear waste repository. In DOE's NEPA-compliance guidelines (45 FR 20694, as amended by 52 FR 47662), the DOE has imposed an additional requirement on itself that a "plan" to implement the EIS also be prepared (the EIS Implementation Plan). The Implementation Plan will record the results of the scoping process and guide the preparation of the EIS. The geographic comments received during the scoping process, and documented in the Implementation Plan.

COMMENT 9

Table 3-1: The table should also include the Presidential Proclamation of 1933 that established Death Valley National Monument and Devil's Hole National Monument, as well as the Supreme Court decision that guarantees the water level in Devil's Hole.

The table shows that NPS-related legislation would only apply if regional field studies extended into the NPS areas. We assert that water withdrawal in support of Yucca Mountain Project activities could seriously impact springs within Death Valley National Monument and at Devil's Hole, and could amount to a "derogation of values" as discussed in 16 USC 1a-1.

RESPONSE

The table referenced in the comment (Table 3-1) is not in the EPO, nor is it in the ERCP or the EMMP. Nevertheless, based on the conclusions in the Yucca Mountain EA, it is the DOE's position that no adverse impacts are expected to springs in Death Valley National Monument and at Devil's Hole from water withdrawals to be used for site characterization of Yucca Mountain. The agency consultations and the water resources monitoring program, discussed in previous comment responses, will determine if the EA findings are correct.

COMMENT 10

Pages 3-8 to 3-19, Water Rights: It is stated on page 3-8 that "Of specific interest, in the context of their legal applicability to the repository program, is whether Congress has directed Federal agencies to comply with particular statues and regulations." On page 3-18, the draft Environment Program Overview goes on to state:

"Table 3-2 lists regulatory requirements of the State of Nevada for which there are no Federal laws that mandate compliance by Federal agencies. The DOE will, as a matter of comity, address the concerns evidenced by State and local laws that are not legally applicable to Federal agencies to the extent that these regulations are not inconsistent with the DOE's responsibilities under the NWPA (Nuclear Waste Policy Act Amendments), the Atomic Energy Act (AEA), and other Federal statutes."

In Table 3-2, the Nevada Revised Statutes 533 and 534 "Permit to Appropriate Public Waters" is listed. With regard to the above excerpts, it should be pointed out that a Federal statute concerning water rights, the McCarran Amendment (P.L. 495, July 10, 1952; 66 Stat. 560), states that:

"...Consent is hereby given to join the United States as a defendant in any suite (1) for adjudication of rights to the use of water of a river system or other source, or (2) for the administration of such rights, where it appears that the United States is the owner of or is in the process of acquiring water rights by appropriation under State law, by purchase, by exchange, or otherwise, and the United States, when a party to any such suit. The United States, when a party to any such suit, shall (1) be deemed to have waived any right to plead that the State laws are inapplicable or that the United States is not amenable thereto by reason of its sovereignty, and (2) shall be subject to the judgments, orders, and decrees of the court having jurisdiction and may obtain review thereof, in the same manner and to the same extent as a private individual under like circumstances..."

In light of this Federal statute, it is unclear why water rights statutes for the State of Nevada are listed as regulatory requirements "...for which there are no Federal laws that mandate compliance by Federal agencies." The McCarran Amendment should be included on the regulatory compliance list.

The Wilderness Act may apply since a wilderness recommendation for portions of Death Valley was presented to Congress in December 1984 but never acted upon. Much of the eastern portion of the park has been included in the recommendation.

RESPONSE

The DOE has applied for a Water Appropriations Permit from the State of Nevada. Consultations concerning this permit application and the DOE environmental program will continue with the various agencies to be sure that all applicable environmental regulations and requirements are identified and satisfied.

COMMENT 11

Page 5-2, Topical Data Reports: It is unclear whether Topical Data Reports would be available to interested parties. The Department of the Interior would appreciate receiving copies of these documents.

RESPONSE

The DOE will make Topical Data Reports available to all interested parties.

COMMENT 12

Ash Meadows National Wildlife Refuge: The document indicates on page 3-14 that the National Wildlife Refuge System Administration Act does not apply to the repository program at Yucca Mountain. We do not believe that this interpretation is correct because storage of nuclear waste at Yucca Mountain could impact water emerging from springs in Ash Meadows National Wildlife Refuge.

The Site Characterization Plan (SCP) indicates groundwater under the Yucca Mountain site and vicinity is discharged in springs approximately 50 miles southward within the refuge. The 12,737-acre refuge was established in 1984. Current acquisition plans will expand the refuge to approximately 24,000 acres. The purpose of the refuge is "to conserve fish or wildlife...and plants which are listed as endangered species or threatened species" (16 U.S.C. 1531-1543). Our U.S. Fish and Wildlife Service (USF&WS) is concerned about possible contamination of the groundwater supply to the refuge and any resultant adverse impacts that could occur to the federally listed endangered and threatened species that depend upon the springs and adjacent wetlands.

RESPONSE

The EPO, along with the ERCP and the EMMP, stress the site characterization phase of the repository program, rather than the construction and operation of a repository. Based on the conclusions in the Yucca Mountain EA, it is the DOE's position that no adverse impacts are expected to Death Valley and Devil's Hole National Monuments, or to Ash Meadows National Wildlife Refuge, from site characterization of Yucca Mountain. Hence the National Wildlife Refuge System Administration Act is deemed inapplicable to site characterization.

The DOE concurs, however that if the Yucca Mountain site is selected for development and operation of a repository, then the National Wildlife Refuge System Administration Act may be applicable. If this happens, another ERCP and EMMP will be prepared to address the regulatory requirements of repository, and the environmental impacts potentially caused by such a facility.

COMMENT 13

Endangered Species Act: The Service has special concerns regarding endangered and threatened species. In that regard, the Ash Meadows Refuge provides unique conditions for a great variety of unusual plants and animals.

Among these are four endangered fish, one endangered plant, five threatened plants, and one threatened invertebrate.

In accordance with section 7(a) of the Endangered Species act, the section 7 regulations require a Federal agency to consult with the Service when the agency determines that its action "may affect" listed species or critical habitat. Formal consultation is initiated by submitting a written request to the Service. At that time, the agency should provide a copy of the biological assessment, if required, and other relevant information that assisted in reaching its "may affect" decision. Major construction projects require the completion of a biological assessment to make that determination (50 CFR 402.12). The Department of Energy (DOE) should complete a biological assessment for the project to determine if a "may affect" situation exists.

RESPONSE

The DOE has been consulting with the USF&WS to determine if site characterization activities would ~~affect~~ biological resources at or near Yucca Mountain. In February 1988, the USF&WS notified the DOE that the Project would not affect threatened or endangered species or wetlands in the area.

Since 1988, a biological assessment of the effects of site characterization on the desert tortoise (listed as endangered on August 4, 1989) was sent to the USF&WS in October 1989. On February 9, 1990, the USF&WS informed the DOE by letter of its opinion that site characterization of Yucca Mountain is not likely to jeopardize the continued existence of the desert tortoise.

DEPARTMENT OF INTERIOR COMMENTS ON THE ERCP
(ER 89/294, 10/17/89)

COMMENT 1

Mineral Resources: No energy or mineral resources have been identified on the site or within the controlled area. However, those monitoring or mitigation measures that would be instituted in the event mineral or energy resources are discovered during the course of site characterization should be provided.

RESPONSE

As stated by the reviewer, "No energy or mineral resources have been identified on the site or within the controlled area." For this reason, it is felt that neither energy nor mineral resources represents a technical area likely to be impacted in any discernible way by site characterization activities. Consequently, neither is considered appropriate for inclusion in the environmental monitoring and mitigation program. Should these resources be identified during site characterization, the appropriate action will be determined at that time.

COMMENT 2

Page 2-12, Water Requirements: It is stated that water for drilling, dust suppression and compaction, and human consumption will be trucked daily to each site. On page 2-19, it is stated that water used for infiltration test will be delivered to each site by truck. On page 2-21, it is stated that 3 deep coreholes (approximately 5,000 ft deep) are planned. If mud is used to drill these holes "...it can be expected that a few million gallons will be used. This water will be trucked to the site at lease twice daily." On page 2-39, it is stated that well J-13 will supply all needs at the ESF. Yet there is no indication in the Environmental Regulatory Compliance Plan (ERCP) that well J-13 will supply all water needs for site characterization.

DOE should clearly indicate which wells are to be used as a water supply for site characterization activities, and the necessary permits for water appropriation should be obtained from the Nevada State Engineer. In this way, the Department's bureaus, as well as others, will have opportunity to evaluate the amount of water to be used and respond to water permit applications.

RESPONSE

Water that is required for site characterization will be obtained from Well J-13. This includes water needed for purposes at the Exploratory Shaft Facility, as well as water required for field activities.

The DOE submitted an application for a Water Appropriation Permit to the Nevada State Engineer on July 21, 1988. In a letter dated December 26, 1989, from the Nevada State Engineer to DOE's Yucca Mountain Project Office, DOE's application was returned because of recently enacted State law that forbids the disposal of high-level nuclear waste in Nevada.

COMMENT 3

Page 2-16: It is stated "If feasible, water that is to be discharged as a result of saturated zone investigations will be pumped into trucks and used for other Project purposes, such as dust suppression on roads. Water appropriation permits for these pump tests, as well as all other pump tests, are not expected to be required (see Section 3.4.2 for details)." However, Section 3.4.2 does not provide details as to why water appropriation permits for these as well as other pump tests are not expected.

Further, we are concerned about the possibility of using test well water as an alternative source of supply without first obtaining a permit from the State of Nevada. Some pump tests are for long duration. For example, on page 2-16, it is stated, "For flow testing, a pump with a lift capacity of approximately 1,900 liters (500 gallons) per minute will be installed successively in each of these holes. Thus, each borehole will serve as a

pumping and observation well. Pumping will continue for approximately 30 days..."

Tests of this duration and magnitude done successively might have an effect on existing water rights. Therefore, it is unclear as to why appropriation permits are not expected to be required.

RESPONSE

Informal discussions with the State of Nevada indicate that, at the discretion of the State Engineer, pump tests are generally excluded from the requirements for appropriation permits because they generally are of short duration. The State does require, however, that the operator of the proposed pump test inform the State by letter several weeks in advance that a pump test is to be conducted, specifying the purpose of the test, its location and duration, and the amount of water to be withdrawn. The letter should formally request that the test be excluded from the requirements for a water appropriation permit. If the State Engineer believes that the pump test could affect existing water rights in the area, an appropriation permit would be required to extract the water.

COMMENT 4

Page 3-1, Regional Field Studies: It is stated on this page that "...regional field studies may be needed for completion of studies in the immediate vicinity of the Yucca Mountain site." Why are regional field studies being postponed until after completion of studies in the immediate vicinity? How are studies in the immediate vicinity designed to determine whether regional field studies are needed? The basis for the need for regional studies should be described.

Of particular concern to our National Park Service are potential impacts to resources at Death Valley National Monument, including Devil's Hole. The ERCP, as well as the DEPO and the Environmental Monitoring and Mitigation Plan (EMMP), do not address detection of potential impacts to the Monument's resources, which are of national significance.

RESPONSE

The need for regional field studies has not been determined; hence the type, extent, and location of these studies is not known. If questions concerning the isolation of wastes cannot be satisfactorily answered by planned studies at the site, then regional studies may be required. See the Site Characterization Plan for a discussion of the requirements for regional field studies during site characterization.

The purpose of the ERCP is to identify regulatory requirements for site characterization -- not to address the detection of potential environmental impacts. The EMMP discusses the monitoring of potential environmental impacts from site characterization, and the methods to be used to mitigate these impacts if they are detected. Furthermore, plans have been developed under the EMMP (referred to as Environmental Field Activity Plans or "EFAPs") to monitor the potential impacts of site characterization in the areas of terrestrial ecosystems, archaeological resources and historic sites, air quality, water quality, and the radiological environment. In regard to Death Valley National Monument, the EFAP for water resources describes a monitoring program for water quantity and quality at Yucca Mountain, as well as for down-gradient areas including the Amargosa Desert, Ash Meadows, and Death Valley National Monument (including Devils Hole). As a subset of the water resources EFAP, a plan has also been developed to monitor water levels and springflows in the above-mentioned areas to expressly address the concerns of the NPS and the USF&WS regarding water resources in the Ash Meadows and Furnace Creek areas. If monitoring suggests that a significant adverse impact is developing, mitigation measures to alleviate the problem will be implemented.

COMMENT 5

Pages 3-2 to 3-3, NPS: Please add the Department of the Interior and the National Park Service to the list of agencies that should be consulted to identify laws and regulations that may be applicable to site characterization at Yucca Mountain.

RESPONSE

The U.S. Department of the Interior (National Park Service) has been added to the list of agencies that will be consulted in regard to DOE's environmental program for Yucca Mountain.

COMMENT 6

Page 3-4: The discussion of Federal statutes should include all statutes mentioned in the various environmental documents being prepared.

RESPONSE

The ERCP describes only those regulatory actions that may be required to conduct site characterization; not included are environmental regulations that may be associated with actually constructing, operating, and decommissioning a repository at Yucca Mountain.

All the laws and regulations cited in the EMMP are contained in the ERCP. The EPO, on the other hand, discusses several laws, regulations, and DOE Orders that were not included in the ERCP because (1) they were not relevant to site characterization or (2) no compliance actions were required by the DOE beyond those compliance actions already planned.

COMMENT 7

Page 3-46, Clean Water Act: With respect to the Federal Water Pollution Control Act (Clean Water Act), the discussion included in the ERCP is limited to compliance with NPDES permitting requirements. The ERCP should also address how the Department of Energy plans to conduct site characterization activities in accordance with Section 319 of the Clean Water Act which pertains to the control of non-point source pollution. The State of Nevada's plan with respect to implementing a Section 319 program was recently submitted to the Environmental Protection Agency. The Clean Water Act requires that Federal development activities be consistent with such plans.

RESPONSE

The DOE will evaluate the applicability of Section 319 to site characterization if and when the EPA approves Nevada's plan for implementation. If Section 319 is determined to be applicable to site characterization, the DOE will ensure that its actions are consistent with the State's approved implementation plan.