United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

EIS001969

In Reply Refer to:
ER 99/712

FEB 28 2000

RECEIVED

MAR 07 2000

Wendy R. Dixon
EIS Project Manager
Yucca Mountain Site Characterization Office
Office of Civilian Radioactive Waste Management
U.S. Department of Energy
P.O. Box 30307, Mail Stop 010
North Las Vegas, Nevada 89036-0307

Dear Ms. Dixon:

The United States Department of the Interior (Department) has reviewed the draft environmental impact statement (DEIS) for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, and offers the following comments.

BACKGROUND INFORMATION

The Nuclear Waste Policy Act (NWPA) was enacted by Congress in 1982 in recognition of the need to provide for the permanent disposal of spent nuclear fuel and high-level radioactive waste in the United States. Currently, approximately 70,000 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste is housed at some 77 sites across the United States. In 1986, the Department of Energy (DOE) narrowed the number of potentially acceptable sites for a geologic repository to three (3) sites in three (3) States. However, Congress in 1987 amended the NWPA and directed the Secretary of Energy to characterize only the Yucca Mountain as a potential location for a geologic repository, setting forth a process for the Federal Government to decide whether to designate Yucca Mountain as the site for a repository. Yucca Mountain is located in Nye County, Nevada, approximately 100 miles northwest of Las Vegas, Nevada, on the western boundary of the Nevada Test Site (NTS).

POTENTIAL ADVERSE IMPACTS TO BIOLOGICAL RESOURCES

1... The Department's Fish and Wildlife Service (Service) is responsible for protection of trust resources which include species listed as threatened or endangered under the Endangered Species Act of 1973 (ESA), as amended, birds protected under the Migratory Bird Treaty Act, and other biological resources managed under the National Wildlife Refuge (NWR) System. The Service is concerned with possible adverse effects to these and other resources that could

1 cont. result from the operation of the Yucca Mountain facility. Trust resources on or in the vicinity of the proposed waste storage facility include the following:

- Yucca Mountain is at the northern edge of the range for the desert tortoise (*Gopherus agassizii*) which is listed as threatened under the ESA. On July 23, 1997, the Service issued a biological opinion to DOE for programmatic activities associated with site characterization studies at Yucca Mountain (File No. 1-5-96-F-307R).
- Rainfall runoff accumulating in low lying areas at the NTS such as Frenchman Flat, attract migratory birds to the area.
- The Desert National Wildlife Range, located approximately 30 miles to the east of the proposed repository, provides habitat for numerous wildlife species that are unique to the Mojave Desert ecosystem.
- The Ash Meadows NWR is located approximately 25 miles south of Yucca Mountain and provides habitat for 12 species listed under the ESA, including the Devils Hole pupfish (*Cyprinodon diabolis)* and Ash Meadows Amargosa pupfish (*Cyprinodon nevadensis mionectes).* Ash Meadows also provides aquatic and riparian habitat essential for other sensitive species of plants and invertebrates and for migratory and resident bird species. These and other wildlife species are dependent upon several free-flowing springs within the boundary of the refuge.

2... The NWPA requires DOE to provide reasonable assurance that the environment will be protected from the hazards posed by the Yucca Mountain repository. In order to meet this requirement, DOE has conducted numerous detailed analyses of Yucca Mountain's geology and hydrology for the past 15 years. Through these and other activities associated with site characterization, DOE has amassed a large body of evidence to support the likely determination that Yucca Mountain is the most suitable site to store the nation's high-level nuclear waste. Despite the fact that the most advanced technology is being utilized to design a foolproof waste barrier system for the repository and given the fact that the waste would remain radioactive for many thousands of years, we continue to be concerned that a facility of this nature inherently poses some degree of risk to wildlife resources. Our primary concerns are as follows:

Groundwater flows in aquifers below Yucca Mountain are generally to the south. Therefore, radionuclides and toxic chemicals, if introduced to the groundwater either by a short-term catastrophic event (e.g. earthquake, flood) or through long-term (i.e. >1,000 years) degradation of the waste storage containers, could eventually migrate to environmentally sensitive areas such as Ash Meadows NWR. A recent study found that the plutonium compound PuO_2, once thought to be the most stable form of plutonium waste, can be oxidized by water making it more soluble and increasing the risk of groundwater contamination from storage facilities (Haschke et al. 2000).

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2 cont. We find these and other uncertainties associated with containment of high level radioactive waste to be cause for concer..

3 Transportation of high level radioactive waste to Yucca Mountain by truck or rail from nuclear facilities nationwide also has the potential to impact wildlife resources should a breach in containment occur. There is an inherent risk associated with transportation of any hazardous material. Although DOE has conducted detailed analysis of worst-case scenarios, even the best waste management strategies cannot predict every possibility. We understand that the radioactive waste would be transported in a virtually leak-proof stainless steel cask in the form of dry pellets which would make release of any waste material extremely remote. Nevertheless, there remains a potential environmental risk, albeit minuscule, at any given point along the proposed rail or highway transportation corridor.

4 Cumulative environmental effects from the future operation of the Yucca Mountain repository and past activities at the NTS are also of concern. Possible impacts to groundwater and spring discharges resulting from activities at NTS, approximately 25 miles north of Ash Meadows NWR, are being evaluated by DOE, the Service and the U.S. Geological Survey (USGS). Activities at the NTS which may have resulted in contamination of the region include both atmospheric and subterranean tests of nuclear devices and other tests involving radioactive materials, controlled atmospheric releases of numerous gaseous materials, and disposal and destruction of various types of solid and liquid wastes. The extent to which these activities have placed wildlife resources at risk is still under investigation. DOE's Environmental Management Program is focused on identifying the nature and extent of contamination from the nuclear weapons programs at DOE facilities. This process is underway at the NTS with ongoing environmental restoration and waste management activities.

ACCIDENTS

5 We agree with the DOE that a major accident involving a shipment of this material is of low probability with a level of general uncertainty, and therefore, is not quantified to be zero. Moving70,000 metric tons of high- level nuclear waste, including 50 metric tons of weapons grade materials, from sites that are almost entirely east of the Mississippi River, over a 100 year period, almost ensures that an accident will occur, sometime, somewhere. Testing has shown that conditions exist under which shipping casks can be penetrated or ruptured (page 6-33 of the EIS). It is not clear in the draft whether a head-on truck or train collisions and train derailments will produce such conditions but it is important that the final EIS address DOE's plans to contain or control such events and their impacts.

SABOTAGE

6 That there are devices already in existence that can penetrate the truck shipping casks (page 6-33 of the EIS) if used by saboteurs, must not be taken lightly. That the trains and trucks will be guarded solves part of the problem, but not entirely. It is presumed that the guards will be armed, but would that protect against an intentional derailment? If the act of sabotage is successful, how would DOE address response and cleanup or control?

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EIS001969

HIJACKING

7 We could find no mention, in the EIS, of the possibility of one of the trucks being hijacked. A hijacked truck could be driven anywhere and used as a threat. A hijacked trucks would be most vulnerable when they are stopped so that the guards and drivers can eat or sleep. How does DOE plan to address this situation?

RADIATION

8 If we are interpreting Table 4-34 (page 4-59) correctly, over a 70 year life span a person living within 12 miles of the repository would receive a life time radiation dose of between 38 to 100 millirems from the repository depending on the thermal load scenario used. Is this correct? If so, it is significantly lower than the NRC's standard of 100 millirems per year at abandoned mines after reclamation. We believe that it is unusual that a person residing near this repository would receive less radiation than would one who lived near many other areas containing less radiation, such as abandoned mine sites. If our interpretation is incorrect, and the correct dose rate is between 38 and 100 millirems per year, then the low thermal load matches the NRC standard. Perhaps this figure needs to be reevaluated in the final EIS to clear up this ambiguity.

CONFLICTS WITH EXISTING LAND USES

9 The need for rights of way across public lands to access the Yucca Mountain Facility could create conflicts with existing land uses in the area through traffic, construction, accidents and incidental spillage of nuclear materials containers. How will these be addressed?

SPECIFIC COMMENTS:

Draft Environmental Impact Statement, Summary.

10 **Page S-36, 5.4.1.3 Geology, first paragraph.**

Most of the faulting that affected Yucca Mountain occurred during the 11.4 to 14 Ma interval of volcanic activity and not subsequent to the activity, as stated in the text.

11 **Page S-36, 5.4.1.3 Geology, second paragraph.**

The correct name of the repository host rock is the Topopah Spring Tuff, not "Topopah Springs Formation" or "Topopah Springs formation."

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EIS001969

12 **Page S-37, 5.4.1.3 Geology, first paragraph.**

Point (3) states that the Topopah Spring Tuff was chosen because of ". . . its location away from major faults that could adversely affect the stability of underground openings. . ." This statement implies that the Topopah Spring Tuff is not intersected by major faults, which it most assuredly is. Faults cut through all of the Tertiary volcanic units in the proposed repository area, including the Topopah Spring Tuff. Solitario Canyon fault and several other known faults cut through the Topopah Spring Tuff, some immediately adjacent to the underground facilities.

The relationship between faulting and the selection criteria of the Topopah Spring Tuff as the repository host rock in the Summary and the Draft EIS itself (page 3-24) is unclear and needs more detailed and accurate explanation. The selection of Topopah Spring Tuff cannot be predicated on its lack of proximity to seismically active faults. If so, the site would not be viable. Clarification is needed.

13 **Page S-37, second paragraph.**

The statement, "The Solitario Canyon fault forms the major bounding fault on the west side of Yucca Mountain, and volcanic units in the mountain tilt eastward as a result of displacement along this and lesser faults through the mountain . . .," needs clarification. There are faults on the east side of Yucca Mountain. The faults that bound the eastern side of the proposed repository area, the Bow Ridge and Paintbrush Canyon faults, to name just two (see table 3-8, Characteristics of major faults at Yucca Mountain, v. 1 - Impact Analysis, Draft EIS), need to be mentioned here. Additionally, because these latter two north-trending faults dip to the west beneath the repository area and the adjacent material handling facilities that would be built at the north and south portals, understanding the seismic hazard potential of these faults is extremely important.

In addition, easterly tilts are not the result of movement on the Solitario Canyon fault and "lesser faults through the mountain." These tilts are the result of movement on a whole series of block-bounding faults, of which the Solitario Canyon fault is one.

Draft Environmental Impact Statement.

14 **Page 3-14, Section 3.1.3.1 Physiography (Characteristic Land forms).**

This section label and content are confusing. The unnumbered subsections on Site Stratigraphy and Lithology, Selection of Repository Host Rock, and Potential for Volcanism at the Yucca Mountain site should be numbered subsections under the main section 3.1.3, Geology, and not the subsection of Physiography, to which they have little relation.

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15 **Page 3-16, Site Stratigraphy and Lithology.**

The sedimentary history of the region including the Tertiary sedimentary rocks (for example Pavits Springs Formation) need to be discussed in this section and included in Table 3-6 (page 3-19).

16 "Paleozoic and Precambrian" need to be substituted for "pre-Cenozoic" in order to correspond with the wording in the referenced Table 3-6, page 3-19.

17 **Page 3-19, first paragraph.**

The "pre-Cenozoic" (see above) rocks are also exposed at Calico Hills and Striped Hills, which are as close or closer to Yucca Mountain than are the pre-Cenozoic rocks at Bare Mountain, and therefore should be included in the discussion.

For clarity, the borehole (first paragraph) should be described as 2 kilometers east of the crest of Yucca Mountain, because Yucca Mountain is physiographically defined as all the numerous ridges that surround the borehole.

18 **Page 3-21, last paragraph.**

The statement, "Volcanic rocks younger than the Tertiary units. . .," is incorrect. Most of the volcanic rocks are Tertiary in age, including the Skull/Little Skull lava flows, the lava flow at the south edge of Crater Flat, the 10 Ma basaltic dike, and the 3.7-Ma cones and flows in Crater Flat.

19... **Page 3-22, Figure 3-7, General bedrock geology of the proposed repository Central Block area.**

This figure is inaccurate and does not correctly correspond to Figures 3-8, 3-10, or the original geologic map (Day and others, 1998). The following changes and/or additions need to be made:

a. The configuration of the Drill Hole Wash fault needs to be mapped as shown in Figure 3-10.

b. The Ghost Dance fault needs to continue to the southwest and not abruptly terminate as shown is this Figure (see Figure 3-10).

c. The zone of intense faulting between the Bow Ridge and Ghost Dance faults is missing. This zone connects with the Dune Wash fault. These faults are shown in the cross-section (Figure 3-8).

19 cont. d. The small intra block faults need to be included in the Figure because the contacts are drawn incorrectly without them. Figure 3-8 cannot be reconciled with Figure 3-7 without these mapped faults.

e. For clarity, the cross-section line in Figures 3-7 and 3-8 should be named A-A', not B-B', because there is only one cross section on these maps.

f. Because no lower block is shown, the "upper block" text needs to be deleted from the "Proposed drift boundary" in the Legend.

20 **Page 3-23, Figure 3-8, Simplified geologic cross-section of Yucca Mountain, West to east.**

The mismatch of contacts between units, which appears as wiggles, is incorrect. The Figure needs to show these contacts correctly.

21 **Page 3-24, first paragraph, and Page 3-33, Flood Potential.**

Boulders as large as 2 meters in diameter, as well as sand, silt, and clay, are part of the alluvial deposits on these fans and stream beds. This boulder-size material has the potential for significant destructive force during the flash floods.

22 **Page 3-25, Section 3.1.3.2 Geologic Structure.**

Discussion of the occurrence of joints and fractures in the volcanic rock at Yucca Mountain is needed in this section, including mention of the geographic and stratigraphic distribution of fractures, and whether they are fault- and/or stratigraphically-controlled.

23 **Page 3-25, Section 3.1.3.2 Geologic Structure, second paragraph.**

"Major crustal compression" and "crustal extension" need to have an associated direction, such as "Major east-west crustal compression" and "east-west crustal extension."

Crustal compression is stated to have occurred between 350 and 50 Ma, but there is no evidence for east-west compression younger than about 100 Ma in this region.

24 Day and others 1996 should be changed to 1998, both here and in the References (page 12-8).

25... **Page 3-25, Section 3.1.3.2 Geologic Structure, fifth paragraph.**

It is stated here that the ". . . total estimated displacement on the most active block-bounding faults . . . during the past 1.6 million years is less than 50 meters. . . (Simonds and others, 1995)." This statement is from the Conclusion section of Simonds and others (1995) and is misleading

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25 cont. when taken out of context. All measurements of Quaternary (1.6 Ma to present) displacement on these faults range from 0 to 6 m with most displacement in the 1-2.5 m range, as reported in Table 2 of Simonds and others (1995). Reference Table 3-8 in this paragraph to help clarify this point.

26 **Page 3-25, Section 3.1.3.2 Geologic Structure, sixth paragraph.**

The statement, "The Solitario Canyon fault along the west side of Yucca Mountain is **the** major block-bounding fault . . .," is incorrect. The Solitario Canyon fault is one of numerous block-bounding faults that are shown on Figure 3-10. These include the Northern Windy Wash, Fatigue Wash, Solitario, Iron Ridge, Dune Wash Bow Ridge, Midway Valley, Paintbrush Canyon faults, just to name those within 4 km radius of the proposed perimeter of the repository.

27 **Page 3-25, Section 3.1.3.2 Geologic Structure, last paragraph.**

This short treatment of intra block faults (the subsidiary faults between the block bounding faults) places undue emphasis on NW-trending faults by discussing them first. Within the central block, where the repository would be sited, the intra block faults with the longest map traces and the largest amounts of displacement are the Ghost Dance Fault (splitting the center of the block) and the block-margin faults ("Imbricate Zone" of Scott, 1990) that are just west of the Bow Ridge Fault. Day and others (1998, USGS Map I-2601) and Scott and Bonk (1984) also document this. The NW- trending faults, such as the Sundance Fault, though characterized correctly, are relatively minor in comparison (Potter and others, USGS OFR 98-266, in press). It would be more appropriate to mention the much larger Ghost Dance fault first.

28 **Page 3-26, Figure 3-9, Types of geologic faults.**

For clarity, definitions of normal and reverse faults need to uniquely specify the correct sense of motion. For a normal fault reword the description, "dip-slip fault where one block has moved downdip relative to the other," to "dip-slip fault where the upper block has moved downdip relative to the lower block." For reverse fault, reword "dip-slip fault where one block has moved updip relative to the other" to "dip-slip fault where the upper block has moved updip relative to the lower block."

A diagram is needed for low-angle normal faults, such as in Calico Hills east, and Bare Mountain west, of Yucca Mountain.

29 **Page 3-27, Figure 3-10, Mapped faults at Yucca Mountain and in the Yucca Mountain vicinity.**

In the legend, the strike-slip fault symbol should have arrows showing relative sense of lateral motion (as on map), as well as an explanation of the strike-slip symbol. As it is, the legend only shows the dip-slip component on these faults.

30 **Page 3-28, Table 3-8, Characteristics of major faults at Yucca Mountain.**

Define the late Quaternary in years for clarity.

31 **Page 3-29, Section 3.1.3.3 Modern Seismic Activity.**

The seismicity map with faults needs to be shown here as a numbered Figure.

32 **Page 3-30, fifth paragraph.**

The correct statement is that there is no observable strain measured *within the error of the data.*

33 **Page 3-30, Section 3.1.3.4 Mineral and Energy Resources.**

There is no discussion of energy resources in this section. The Yucca Mountain site is about 200 km SW of producing oil fields in Railroad Valley (one of two valleys in the state that have produced commercial oil). Published literature on the presence or absence of oil resources in the Yucca Mountain/NTS area include Chamberlain (1991 AAPG abstract), who suggested that Yucca Mountain is situated over a billion-barrel oil field, and Trexler and others (1996, AAPG Bulletin v. 80, no. 1), who disputed this, as did Grow and others (Hi-Level Waste Proceedings, 1994). Although it appears that there is a low potential for mineral and energy resources in the context of today's recovery technology, a discussion of the potential resources should be included here.

34 **Page 3-36, Section 3.1.4.2.1 Regional Groundwater.**

There is insufficient data to fully characterize the site-scale hydrology of the area. Because of the complexity of the geology and inconsistencies between the Large Hydraulic Gradient and thermal data, additional boreholes, appropriately configured, that penetrate to the Paleozoic carbonates beneath the Tertiary tuffs should be considered.

There is a lack of data on the hydrologic interaction between the Tertiary tufts and the underlying Paleozoic carbonate aquifers.

35 **Page 3-39 and Page 3-51, Section 3.1.4.2 Groundwater.**

The **range** of infiltration rates, hydraulic conductivities, etc. should be used rather than the average, especially in the case where the range is large. For example, apparent hydraulic conductivities range over 3 orders of magnitude (page 3-51). Also, the average infiltration rate of 6.5 mm/yr on page 3-39 is misleading because fracture systems allow much more rapid flow locally. The difficulty of Yucca Mountain hydrology is in the inability to predict which fractures or faults will act as highly transmissive zones. Care must be taken to show ranges of behavior so that best and worst case scenarios can both be evaluated.

36 **Page 3-79, Section 3.1.8 Occupational and Public Health and Safety.**

The radiological hazards and their consequences were discussed in a concise way such that the average citizen can draw conclusions about the risks of the proposed and alternative actions. The background information that was provided to develop an understanding of ionizing radiation and the hazards/risks was especially helpful.

37 In summary, as DOE continues to further characterize the suitability of the proposed Yucca Mountain site in sufficiently isolating high-level radioactive waste and spent nuclear fuel, we look forward to continued coordination on protection of the Department's trust wildlife and other resources. The Service's Southern Nevada Field Office is interested and available to provide technical support in development and implementation of monitoring programs for Yucca Mountain operations. The Service's technical support can be integrated with ongoing groundwater monitoring programs by several other agencies in the vicinity of Yucca Mountain. DOE and USGS have collaborated since 1989 on the Environmental Monitoring Program in order to better understand the hydrology of this area. Monitoring is essential in our view and will help to ensure that any changes in the environment are detected and investigated appropriately. We look forward to working with the DOE on this important national initiative.

The Department appreciates the opportunity to review this DEIS. We hope our comments will be useful in evaluating the Yucca Mountain site for a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. References are included on the following page.

Should you have any questions or wish to discuss our comments further, please do not hesitate to call Dr. Vijai N. Rai of this Office at (202)208-6661.

Sincerely,

Willie R. Taylor

Willie R. Taylor
Director
Office of Environmental Policy
and Compliance

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