Nye County

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Department of Natural Resources & Federal Facilities

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Dr. Jane R. Summerson, EIS Document Manager
U.S. Department of Energy
Yucca Mountain Site Characterization Office
P.O. Box 30307, M/S 10
North Las Vegas, NV 89036-0307

DELIVERED BY MAIL and FASCIMILE

Nye County, Situs Jurisdiction, Comments on the Supplement to the Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada

Dear Dr. Summerson:

On behalf of Nye County, the situs jurisdiction of the proposed action, we are pleased to submit the enclosed comments on the supplement to the draft Environmental Impact Statement (DSEIS). These written comments are intended to supplement oral comments previously made by Nye County officials and/or their representatives in Public Hearings held in Amargosa Valley, the Town of Pahrump, and Las Vegas, Nevada.

1 As has been noted in our oral comments, Nye County believes that the DSEIS, continues to present an inadequate basis for decision-making. The DSEIS is fraught with a lack of data, and in many areas continues to use inappropriate methods and
2 assumptions. On an administrative note, Nye County continues to assert that the 55 days allowed for public review and comment was not adequate to fully review the DSEIS and supporting Science and Engineering Report (S&ER). Nye County also notes for the record that paper copies of the S&ER were **not** provided with the DSEIS. Copies of the S&ER had to be requested from the Department, with the S&ER actually arriving four weeks after the issuance of the DSEIS.

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Nye County understands, however, that the Department of Energy (DOE) will give full consideration to these comments and expects that responses to these comments may necessitate changes in the final EIS. Thus, Nye County is submitting these comments with the expectation that they will empower the DOE to prepare a final EIS that meets the statutory requirements for legal sufficiency, and can be used by the President and other decision-makers in implementing the provisions of the Nuclear Waste Policy Act.

Please feel free to contact us should you have any questions regarding our comments.

Very Truly Yours,
NYE COUNTY, NEVADA

Stanley A. Sims for
Les W. Bradshaw
Department Manager

LB/def

Enclosures: as stated

cc: Governor Kenny Guinn
Senator Harry Reid
Senator John Ensign
Congressman Jim Gibbons
Congresswoman Shelly Berkley

The Supplement to the Draft Environmental Impact Statement (DSEIS) presents the environmental impacts due to changes in design aspects since the issuance of the draft EIS. The proposed alternative designs, referred to in the DSEIS as the Science and Engineering Report (S&ER) flexible designs, focus on controlling the overall temperature of the repository by managing the age and emplacement spacing of the heat source (radioactive waste). The two new designs are termed the Low Temperature Operating Mode (LTOM) and the High Temperature Operating Mode (HTOM).

In the LTOM, the lowering of temperature is accomplished mainly by reducing the density of the waste-package emplacement, thereby increasing the size of the footprint of the repository. Lowering temperature is also accomplished by extending the ventilation time of the repository (from 145 to 325 years), slight modifications to the ventilation system, and heat load management. The proposed surface facility operation mode is modified to enable managing the heat load by blending the waste packages. The newly proposed facility is designed to accommodate storage of new spent fuels that are hotter than the aged fuel packages.

The HTOM is principally the same as that presented in the base case of the draft EIS with slight modification in heat loading and design details.

The comments presented here are limited to review of the repository design evolution, evaluation of impacts, and performance assessment (PA). This review is not intended to comment on the details of the design aspects, but only to comment on the environmental impact of these designs.

GENERAL COMMENTS

3 General The S&ER Flexible Design is a significant improvement over the Draft EIS Design. Increased spacing between emplacement drifts should significantly lower the amount of water entering the drifts. Because of scale effects, localized dry out is more dependable than a repository wide effect. The waste package design has been significantly upgraded. The old concept of multiple independent barriers is making a welcome comeback. Flexibility has been increased.

4 The footprint of the underground facility will need to be expanded considerably from 4.7 for HTOM to 10.1 for LTOM (Table S-1 of SEIS). Although these area requirements are less than those of the DEIS cases, Nye County believes that managing and designing a better ventilation system could reduce the area requirements substantially. Larger area of the footprint means more excavation, material used, and energy consumed. Therefore, increased repository size equals increased environmental impacts. Although Nye County believes that lower-temperature operating modes would enhance the long-term safety of the repository, the increased size and its environmental impacts in the short term are of significant concern.

5 It is erroneous to assume that lowering operating temperature of the repository automatically eliminates corrosion problems. Operating-temperature management of individual canisters will be required to reduce corrosion problems.

6 Nye County has not seen any reference to the environmental effects and impacts of the corrosion products. Although DOE claims that the material used are corrosion resistant, the amount of metal that is exposed in the facility is so large that a risk analyses will need to be performed to demonstrate that the drinking water standards will not be exceeded at any time. Also, it is not known whether the metal surfaces will be clean or treated with some protective substance. The solubility of the substances used on both the canisters and the drip shields should be evaluated and, if present, health risk analyses performed. Similarly, the potential impact of the steel sets should be presented. Unlike the heavy metals (uranium and other radioactive material) that are protected by the waste package cladding and other protective layers, the steel sets and other metals used are subject to degradation from the instant they are placed underground.

DESIGN EVOLUTION

7 In section 2.1 of DSEIS, Proposed Action, DOE states that it intends to eventually close the geologic repository. Although this is a regulatory requirement, Nye County does not believe that the state of the art of the science is such that a repository of this nature can be permanently closed with any degree of certainty. Therefore, from Nye County's perspective, the repository will need to be monitored indefinitely until the level of confidence in performance is increased substantially. The DSEIS alludes to the concept of deferring the decision of closing the repository to the future generations; the current design alternatives should take this into consideration.

REPOSITORY DESIGN

As mentioned earlier, this review is limited to the aspects of the repository design that may potentially affect the environmental impacts. Nye County believes that DOE needs to focus its studies on reducing the size of the repository as well as maintaining a low disposal temperature. In section 2.2.2.2.2 of DSEIS, DOE proposes to use 75 years of forced ventilation. Forced ventilation requires substantial amounts of power. Although solar power is preferred, its
8 construction has environmental consequences. DOE needs to evaluate other design configurations where natural ventilation can be used. Nye County believes that with the heat of the nuclear waste and modification of the design, most of the ventilation can be provided by natural ventilation. Only a few areas of underground facility may need to have supplemental
9 forced ventilation as needed for workers and operational safety reasons. Other potential sources of supplemental power (electricity) may need to be evaluated to reduce environmental impacts.

10 Also, increased size of the footprint and additional protection requirements could mean diversion of resources and funds to certain aspects of the project such as additional excavation and drip shield requirements. The funds could be used in other aspects of the project to improve performance and/or safety. Such improvement could be along the transportation routes, or development of a better ventilation system.

11... Overall ventilation will tend to dry out the repository horizon. However one can postulate several scenarios leading to condensate formation in the ventilation shafts. Transient condensate could theoretically enter fractures prior to drying out. Example 1: The initial thermal pulse would increase the partial pressure of water vapor in the circulating air. As the air rises it contacts

11 cont cooler rock and expands as pressure drops in the shaft. Both processes cool the air, potentially leading to condensate formation. Example 2: During a summer thunderstorm the ambient relative humidity rises. Humid air is pulled into the ventilation system and contacts cooler rock, leading to condensation. Because the fans are located at the shaft exits (negative pressure system) the air expands as it enters the ventilation system, leading to additional cooling. Note that since preclosure ventilation is stated to be under positive pressure, which lowers the likelihood of condensation, current experience may not be a reliable guide to future performance. Has the potential for condensate formation in the ventilation system been fully evaluated?

12 On page 3-4 it is stated that, "The use of natural ventilation rather than forced-air ventilation for some portion of the preclosure period would result in less than half of the radon released to the offsite public for that portion of the period." This is the main reason that DOE needs to continue to strongly evaluate the potential of a naturally ventilated repository.

13 The section on low temperature repository design outlines NWTRB concerns regarding difficulties in reducing large uncertainties related to a high temperature repository. The thermal hydrology, hydrogeochemistry, etc. currently are poorly characterized and poorly understood. Although it is possible that the high temperature repository might be "better" in terms of dose, it is certain that the range of uncertainty for the low temperature repository is much less than for
14 the high temperature repository. The question of overall risk tolerance, risk management, and risk characterization should be explicitly addressed in the FEIS.

15 On page 3-1, the DSEIS states, "To evaluate the environmental impacts of the lower-temperature mode, DOE maximized each of the three primary operational parameters in turn, while assigning the remaining two parameters with the corresponding proportional values that enabled meeting the lower-temperature operating mode criteria. The Department expressed the environmental impact results of this evaluation as a range, dependent on the particular operating parameter maximized for the analysis. DOE expects that the environmental impacts for the lower-temperature mode would fall somewhere within the ranges presented for all areas evaluated." This is not correct. DOE did not examine the universe of possibilities, and whether the best, the worst, or some in between scenarios were selected cannot be determined at this time. DOE must perform additional work to support their analysis of potential impacts, and the limitation of the current analyses must be disclosed in the FEIS.

REPOSITORY SURFACE FACILITIES

16 Section S-1 S&ER Flexible Design (p.S-2): The DOE proposed [land] surface cooling/aging of waste at the repository site prior to loading may constitute "interim storage." The DOE does not specify how much waste might be aging/cooling at any one time, and that this aging process could be accomplished at the nuclear reactor sites.

17... The surface facility required for temperature management of the waste packages would require more construction and further accessibility to the nuclear material. Storage of such large volumes of highly radioactive material for a period of 20 to 50 years is of significant concern. Extending the length of surface-based storage facilities at Yucca Mountain would increase the risk of an aboveground accident and potentially disasters. Any such accident would have

17 cont regional if not statewide consequences. Potential environmental impacts of such accidents have not been discussed in the DSEIS. Risk analyses should be performed for potential release of radioactive material due to accidents such as meteor impact and aerospace object crashes. Risk from other credible scenarios should also be quantified. These additional risk analyses should be performed and the results disclosed in the FEIS.

18 Technological advancement in transportation in the next 50 years could increase air traffic in the area. Aerospace industry is seriously considering rocket-propelled transportation from locations on the Nevada Test Site. If such technologies are to become popular and acceptable, what will be the risk of accidents for an above ground nuclear facility? Is not the reason for an underground nuclear facility to minimize such concerns? The main reason for concern in stockpiling the spent nuclear waste at the nuclear power plant sites is primarily their vulnerability due to surface exposure. Will not DOE be transferring all that risk to Nye County residents by stockpiling the nuclear waste in an above ground facility?

Nye County notes that the Science and Technology Corridor could potentially increase the risk for such accidents. Therefore, Nye County prefers that the length of surface storage of nuclear waste to be minimized as much as possible.

Surface aging is presented as one of four options for management of the heat loading in a low-temperature repository. The four options are: a) fuel blending (which would occur in an enlarged fuel handling facility); b) "derating" (not using the waste package's full capacity); c) use of smaller waste packages; d) surface aging (as much as 40,000 MTHM in dry cask storage, requiring an extended emplacement period).

19 Though surface aging is referenced at several points in the supplement, the proposal is not elaborated:

- How does it rank among the heat management options in a low-temp repository? This information should be included in the FEIS.
- Would Congressional action be required to authorize "surface aging? This information should be included in the FEIS.
- Would surface aging be required if utilities ship the oldest (or older) fuel first? Is interim storage in the site county proposed as a simplified solution to spent fuel management? Is there a reason (other than convenience) that aging cannot be accomplished at the reactor site? This information should be included in the FEIS.
- The inclusion of this interim storage facility for a low-temperature repository alternative requires more than passing reference in a DEIS supplement. Despite the DOE's statements to the contrary, the introduction of interim surface storage is a substantive change from previous proposals, the DEIS, and the current legislative and regulatory framework. What steps is the DOE planning to implement this new proposal?

WASTE EMPLACEMENT OPERATIONS

With respect to the Waste Emplacement Operations (page 2-23), the DSEIS provides a sketch of emplacement operations and states that it "use[s] the same basic method" described in the DEIS.

20 As Nye County understands it, people (workers, operators) would drive the waste packages along a railroad from the waste handling building down to the appropriate point in the main drifts. Then "the operators would leave" (back to the surface?) and remote controls (operated at the surface?) would:

a) Open the door to the intended emplacement drift;
b) Use the locomotive to push the waste package and its pallet into the drift;
c) Close the door (maybe);
d) Remove (by gantry) the loaded waste package from the transporter and onto the metal ground support;
e) Pull the locomotive and transporter out of the emplacement drift, and close the door behind;
f) Then the workers return and drive the locomotive and transporter back to the surface.

The details of these operations must be disclosed in the FEIS (or its supporting documentation) in order to fully evaluate the DOE's assessment of risk.

21 Further, Nye County notes that there is no explanation of how contingencies in remote handling would be met and at what cost in time, money and risk. For example, what happens when:

- A chunk of rock gets lodged in the gantry equipment, or in the emplacement drift door?
- The locomotive dies during gantry operation;
- The gantry sets the package one foot forward or backward, or one foot to the side of where it should be;
- The above contingency is not discovered until emplacement of a subsequent package.

Again, information regarding how contingencies in remote handling would be met must be included in the FEIS or its supporting documentation.

The discussion of Waste Emplacement Operations on page 2-23 states that DOE will "use the same basic method" described in the DEIS. As Nye County understand it, people (workers, operators) would drive the waste packages along a railroad from the waste handling building down to the appropriate point in the main drifts. Then "the operators would leave" (back to the surface?) and remote controls (operated at the surface?) would:

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b) Use the locomotive to push the waste package and its pallet into the drift;
c) Close the door (maybe?);
d) Remove (by gantry) the loaded waste package from the transporter and onto the metal ground support;
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Again, information regarding how contingencies in remote handling would be met must be included in the FEIS or its supporting documentation.

ENGINEERED BARRIER DESIGN

22 Figure 2.2 (p.2-5): This is an artist's conception of the nuclear waste repository rather than a scientist's perception. The high-temperature version of this figure (top) gives no indication where silica might precipitate relative to emplacement drifts, nor where dissolution of minerals caused by condensing steam (in refluxing zones) might occur. The precipitation of silica is important because it can control the flow of water (and gases) around and near the emplacement drifts. Silica precipitation could form a "cap" over the drift deflecting water around it, or it could precipitate between drifts causing flow into the drifts. If drifts are spaced too closely together, the silica caps could merge with adjacent drifts; low spots between drifts could accumulate infiltrated water causing a perched zone. Upon cooling, the blanket of silica precipitate could fracture and the perched water could then flow into the repository. Depending on the velocity of this flow into drift(s), steam explosions are possible. Nye County finds this overly simplistic "artist's" conception of the repository to be inaccurate and misleading. The FEIS should identify all the natural processes that might occur within the repository and explain the potential consequences of these processes on repository performance.

23 As stated in the DSEIS, the drip shield provides an independent corrosion resistant barrier. Independent barriers provide confidence against unforeseen processes and failure modes that cannot be included in PA calculations. However, the quantitative performance improvement provided by the drip shields is unclear. Because the bottom is not sealed, moisture can theoretically enter below the drip shields. Under some sets of conditions, this can lead to condensation forming on the inside of the drip shield. The drip shields would reduce, but not clearly eliminate, dripping on the waste package and waste. The waste package would still be exposed to deposits of dirt and salt prior to closure. This would allow corrosion of the Alloy-22 to begin prior to the failure of the drip shields.

24 Alloy-22 "feet" are to go on the drip shields purportedly to prevent galvanic coupling with the underlying steel members. While this may reduce the potential for galvanic coupling and hydrogen accumulation, it will not prevent it.

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25 Alloy-22 should increase the time to first penetration of the waste package in comparison with the Draft EIS design. It is unclear whether DOE has sufficient data or theoretical models to justify taking performance credit for the material.

26 Placement of the drip shields is scheduled far in the future (at time of closure). Given the proclivity of congress to play games with federal programs, what confidence can one have that the shields will ever be placed? Corrosion of the drip shields occurs in parallel with Alloy-22, rather than in series. Why not affix the titanium so that it is present from the start, corrodes in series with the waste package, and protects the waste package from initial dirt and salt deposits?

27 As discussed in Section 2.3.4, Engineered Barrier Design, the switch from ALLOY-22 inside to the outside of the canister, with stainless steel inside for structural support was justified by its greater performance. Once the outer shell of ALLOY-22 is breached, the rusting of the inner stainless steel shell with accompanying volume increase of iron oxides will quickly destroy the remainder of the outer shell by deformation and cracking. Since at least 90 percent of the performance of the repository is based on the canister, and ongoing experiments on canister materials are not completed (specifically, the effects of trace elements such as lead), it seems premature to justify changes of this sort on performance assessment.

28 The DOE has not identified any potential problems with respect to engineered barrier materials. Specifically, Nye County is referring to the potential effects of trace elements on the canister material alloy, ALLOY-22. Tests being conducted by DOE are beginning with low temperature conditions (70°C) and working up to higher temperature conditions. Given that temperature increases reaction rates exponentially as temperature increases, DOE will not see any significant effect of trace elements until and unless they experiments are performed at sufficiently high temperatures (120°C and above). A better approach would be to look for an effect at high temperatures and work down to see at what temperature the effect is not observable. The FEIS should address the potential effects of trace elements on barrier material performance in the presence of high temperature conditions. Given that the first canister failures are currently projected to occur just after the 10,000-year regulatory period, the potential complications that might result from the presence of trace elements in the canister material under high temperature conditions should be addressed in the FEIS.

29 Rock bolts, as identified in Section 2.3.4.2, Ground Structures, may focus water flow onto the drip shields, and ultimately the canisters, as a result of their radial style of emplacement. What is the effect of grout on the chemistry of any dripping water? What is its trace element content? The FEIS must address these questions or indicate that DOE is uncertain of how these factors might affect performance.

EVALUATION OF IMPACTS

30... The most dramatic change in the impact is related to the change in size and mode of operation of the repository. Nye County believes that the footprint of the repository can be reduced substantially. The extra demand on power and other resources may have adverse impact on the supply and demand in the Amargosa Valley area. It is not certain whether in either case the population growth is considered. DOE considers the fuel and other resources used for the Yucca

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30 cont Mountain project to be "small" compared to what is available in the region. Population growth in the first 50 to 75 years of operation should be considered before such claims can be made. Population growth will put extra demand on these resources. Repository operation will be competing for these resources and may be restricting the growth in the area.

31 The DSEIS goes on to identify several elements to meet the increased power requirement—an upgraded NTS distribution system; backup (diesel generator) power; a three MW solar generator; and the (currently speculative) 436 MW NTS wind farm. The DOE's electrical power plan sounds like a bunch of "cobbled together" elements, rather than a regional electric power system. Nye County believes that DOE should consider the needs of the area's regional grid and coordinate with other entities to develop a well-planned and integrated system.

32 Table 3-1 of the DSEIS provides comparative analysis of the various scenarios considered by DOE. The most noticeable impact, and probably of most imminent concern to Nye County is the volume of the waste and hazardous waste generated by the large excavation required for the LTOM. To assume that the entire Nevada Test Site will be available to DOE for Yucca Mountain operation for the next 50 to 325 years is an unfair and unrealistic assumption. Yucca Mountain Project should attempt to be as self-sufficient as possible in as short of a time frame as practical.

33 With respect to Cask Maintenance (page 2-13), the DSEIS states that "the DEIS assumed that there would be a CMF….at the YM site." In nearly two years, DOE hasn't located such a facility. Its function, Nye County assumes, is to clean and repair DOE-owned casks as delivered by private carriers. Such a facility would likely generate additional volumes of hazardous wastes (spent solvents, metal cuttings, etc.). It not clear whether the impacts from the CMF have been included in either the DEIS or the DSEIS.

34 Similarly, information on page 2-13 indicates that an onsite landfill would be sited to support repository operations. The FEIS should disclose whether the impacts from the proposed landfill have been identified, and the extent to which additional NEPA review may be required at siting to address site-specific environmental concerns.

WATER RESOURCES

35... In Section 2.3.2.4.5 Water Supply (Design Evolution), the DSEIS offers no additional information on the proposed water supply and simply states "DOE would seek the necessary authorization to continue withdrawing water from the wells for repository activities." The DSEIS should be changed to state that the DOE recently sought authorization to withdraw water for repository construction and operation and that the cognizant regulatory authority, the Nevada Division of Water Resources, denied DOE's application. Therefore, the DSEIS is erroneous in stating that the DOE would continue to use existing wells to supply water for repository activities. The DSEIS should, at a minimum, be expanded to include: 1) a statement that the authorization to pump water for repository purposes has been sought and denied; 2) a discussion that identifies what source(s) of water DOE plans to use for repository related purposes in light of the fact that their applications to appropriate groundwater were denied; and 3) what type of water rights will be sought in subsequent attempts by DOE to seek authorization. The impacts of

35 cont water use for repository activities cannot be assessed without the knowledge of the source(s) of water and the manner in which rights to the use of that water will be obtained.

36 As stated by Nye County in its earlier comments on the DEIS, the impacts on water resources in Nye County were not adequately defined or assessed. The DSEIS at Section 3.1.3.1 Water Use, Evaluation of Impacts, does nothing to address these deficiencies, rather it simply restates that potential impacts would be minor and changes for impacts under the S&ER flexible design parameters would be unlikely. Buqo (1999) conducted a thorough evaluation of the impacts of the proposed repository on the water resources of the region and found that there were already significant resource injuries, constraints on water development, and a reduction in long-term productivity, loss of habitat and species, and reduced water availability. The DEIS included a brief statement recognizing that Nye County recognized these impacts and did not refute that these impacts are to be expected. However, the DEIS did not carry these impacts forward in their evaluation of direct, indirect, cumulative direct, and cumulative indirect impacts of the proposed action on the water resources of the region of influence. Rather the DEIS chose an approach that is inconsistent with both the intent and the letter of NEPA. The DSEIS perpetuates the same erroneous evaluation of impacts on water resources as that presented in the DEIS and is thus considered deficient. The DSEIS must be revised to address the impacts on the water resources of Nye County and must present evaluation of the impacts that have been identified by the County.

37 As noted in Nye County's comments on the DEIS, DOE's evaluation of cumulative impacts on water resources was deficient because the analyses were based upon a region of influence that was too restrictive, the past actions were incomplete (especially with regard to the impacts of land withdrawals on water availability and the impacts of federal land management policies), and a grossly incomplete selection of reasonably foreseeable future actions. The DSEIS does not address those deficiencies, but rather carries them forward. The DSEIS is therefore also considered deficient. Section 3.3 Cumulative Impacts of the DSEIS must be revised to address the cumulative impacts of the proposed repository on the water resources of Nye County through the selection of a meaningful region of influence, fair assessment of the impacts of past policies and actions by the many federal agencies that are stakeholders in the region, and the many reasonably foreseeable future actions by both the federal and non-federal sectors.

38 On page 3-7, it is noted that the range of water demand for lower-temperature operations, combined with ongoing NTS water demand, would be slightly below the lowest estimate of sustained yield for the hydrographic area (western two thirds of the Jackass Flats Groundwater basin, see p. 4-29 f the Draft EIS), but the addition of an aging facility could lead to water use of 100 percent of the lowest estimated perennial yield. It would be as low as 16 percent of the maximum estimated perennial yield. Buqo (1999) notes on p. 14 that "Localized water-level declines and changes in flow directions in the vicinity of DOE water supply wells has occurred and will continue to occur in proportion to the level of water needed to support Test Site operations. Overdraft has historically occurred on the NTS in the Yucca Flat hydrographic basin because of its perennial yield (700 acre feet per year). Future DOE water withdrawals on the NTS are not expected to exceed the perennial yields of any of the source basins." The estimates of perennial yield are exactly that – estimates. The estimated use might greatly exceed actual perennial yield.

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FUTURE CLIMATE

39 On page 4-38, the S&ER states that the USGS has conducted evaluations of three climatic conditions, the current climate, an interglacial monsoon climate, and a glacial-transition climate. While these studies did in fact evaluate average annual precipitation and the corresponding average infiltration rates, they did not evaluate the extremes of climate for the present, interglacial, and glacial-transition climates. The studies did not look at the increase in extreme precipitation events and the consequences of those events on 100-year floods, probable maximum floods, recharge or other events. Recharge occurs in response to precipitation events that exceed a given threshold and occurs as pulses follow a given event, typically the period of snowmelt or rarely, during the rare periods when rainfall occurs for several days or more. The threshold at which recharge begins to occur varies with season, antecedent moisture conditions, elevation, aspect, slope, vegetation, and a number of other factors. None of these factors were considered in the evaluations of future climate; only the average values were evaluated. The lack of extreme event evaluations is considered a deficiency in the S&ER. The S&ER and TSPA should be revised to include an analysis of the effects of extreme events on infiltration rates, recharge, flooding, and repository performance using the Nogales, Hobbs, and Beowawe analogue stations as the basis for the extreme events. Consideration of these effects could result in a significant difference in the calculation of releases from the repository and the effects of such releases on potential receptors.

ANALOG MODELS

Figure 4-19 portrays unsaturated zone flow transport, and seepage analogue studies. This figure is misleading however because it only portrays those analogues that exhibit favorable characteristics while excluding a myriad of analogues that exhibit characteristics unfavorable for repository siting. In example A, the caption states "no seepage in dry drifts in nonwelded tuffs ...below perched zones." What about wet drifts such as the ones that are discharging tritiated water to the surface on portions of the Nevada Test Site? Other analogues from Spain, France, Mexico, Turkey, and Idaho are also included and purport to show the lack of moisture, mineral deposition, or other adverse conditions with the implication that such conditions can be expected at Yucca Mountain. Lacking are pictures of stalagmites and stalactites in Lehman Caves in east-central Nevada, the growth of brochantite and other mineralization on mine timbers in the Virgin Mountains, Nevada, fracture filing with mineralization in mines in the Bullfrog District, Nevada, or calc-silicate deposits in the shallow subsurface in a trench excavation located not far from Yucca Mountain in Jackass Flats, Nevada.

40... A worldwide search can no doubt identify analogue models of almost any type of condition. The use of such analogues in lieu of site- or region-specific data for Yucca Mountain is not considered adequate for the purposes of characterizing flow, transport, and seepage at Yucca Mountain. The DSEIS should be revised to fairly state that there are locations within the region that show the transport of water at depth. In the case of the Spirit Cave mummy and the pack rat middens, the analogue approach is particularly misleading. The Spirit Cave mummy and pack rat middens occur very near the surface in caves or small voids in surface slopes, not at depths of more than 1,000 meters in a tunnel, mine, or deep cave. Again, analogues are selected and

40 cont discussed that are favorable while the many analogues that would lead to quite different conclusions were not selected and evaluated.

Findings in caves (page 2-31) analogous to deep geological repository support the idea that the environment of a naturally ventilated underground system, could under certain conditions, preserve materials several thousand years old. The reference to DOE 2001a, Sec. 2.1.5.4 is to the SR Consideration, and refers to cave paintings in southeastern France and a mummy found in Spirit Cave near Reno. For example, there are preserved cave bear skulls, paws, teeth, etc in the Ural Mountains, etc. A comparison of what has been destroyed under similar conditions would also provide useful information. How many caves have had smashed or destroyed artifacts, skeletons, paintings, etc.? How many bodies were not mummified. The analogues are weak, and more work should be done in this area.

IMPACTS NOT ADDRESSED

41 As noted on page 3-18, the titanium drip shields would not be needed until repository closure. However, page 3-19 notes that the titanium for drip shields would require from 47,000 to 66,000 tons of titanium, depending on spacing between waste packages. The annual requirement would be almost 8 percent of current U.S. production capacity. This is a huge percentage of a commodity supply, and methods to assure availability of supply, etc. should be reviewed. The environmental impacts of mining, smelting and purifying such a volume are large, and especially considering that it will be needed at a time when the easiest supplies have already been produced. The reference cited in the DSEIS is to a 1997 Minerals Yearbook.

The FEIS should have an analysis of titanium availability, deposits, price trends, etc. to demonstrate when the optimum time to stockpile titanium will be, the price, etc. Alloy-22 and titanium drip shield performance are critical elements of the engineered barriers, limiting exposure especially in the 10,000-year time frame. For this reason, work needs to continue on Alloy-22 corrosion and decay experiments. There is substantial risk regarding availability of titanium 100s of years in the future, and a strategic assessment of titanium use, capability, reserves, etc. should be undertaken. The YMP may need a strategic titanium reserve to assure the availability of titanium when it is needed. The environmental impacts of titanium mining and recovery were not addressed.

42 Can radon release be reduced? According to the document, radon will account for 99 percent of the public exposure to radionuclides. Can anything be done to mitigate emissions and reduce those levels? Potential mitigation of the emissions should be addressed in the FEIS.

PERFORMANCE ASSESSMENT

43... DOE needs to consider potential for condensation of vapor in LTOM design. Peak dose of zero, seems to indicate that no corrosion is assumed to occur in the first 10,000 years. Surface temperature of all the waste packages should be considered when making such assumptions. To assume that the repository will perform uniformly or with predictability of 100% is to be overoptimistic. Variation in canister and drip shield surface temperature may occur due to uncontrolled or unpredicted conditions of the waste package or the host rock interactions. The

43 cont probability of condensation occurring during some period of time in some location of the repository is high, regardless of the operational mode of the repository. The closer the packing of the canisters and the smaller the repository, the more uniform and predictable the temperature of the surface of the waste canister will be.

44 The low temperature option may improve long term performance but it delays closure of the repository for up to 324 years. The long time delay makes closure uncertain. A scenario should be added to the TSPA that includes the possibility that the repository is never properly closed (i.e., the ventilation shafts are left open to ingress).

45 Table 3-13 Changes to the TSPA model lists 17 changes and their estimated effects. Of these, there are far more increasing than decreasing. The FEIS should explain the causes of these differences.

PERFORMANCE CONFIRMATION

46 On page 2-28, the DSEIS states that "DOE would use the performance confirmation program data to evaluate total system performance…If the data determined that actual conditions differed from those predicted, the results could support further evaluation….." Beyond "further evaluation," what will happen if an actual condition differs from that predicted? The DOE license application will predict performance well above standards. What actions will the DOE take if further evaluations confirm departures of actual conditions from predicted conditions? The FEIS needs to address this potential scenario.