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COMPLIANCE DETERMINATION STRATEGY

RR2018 POTENTIALLY ADVERSE CONDITION -- PRESENCE OF NATURALLY OCCURRING MATERIALS
[10 CFR 60.122(c)(17)]

PRIMARY REGULATORY CITATION:

10 CFR 60.21(c)(1)(ii)(B)

PASS ID OF THE COMPLIANCE DETERMINATION STRATEGY:

RR2018/NS0001

TYPES OF REVIEW:

Acceptance Review (Type 1)
Safety Review (Type 3)

RATIONALE FOR TYPES OF REVIEW:

Acceptance Review (Type 1) Rationale:

This regulatory requirement is License Application-related because, as specified in the License Application content requirements of 10 CFR 60.21 and the Format and Content Regulatory Guide (NRC, 1990), it must be addressed by DOE in its License Application. Therefore, the staff will conduct an Acceptance Review of the License Application for this regulatory requirement.

Safety Review (Type 3) Rationale:

This regulatory requirement is related to radiological safety and waste isolation. It is a requirement for which compliance is necessary to make a safety determination for construction authorization as defined in 10 CFR 60.31 (i.e., regulatory requirements in Subparts E, G, H, I and 10 CFR 60.21). Therefore, the staff will conduct a Safety Review of the License Application to determine compliance with the Regulatory Elements of Proof for this regulatory requirement.

This regulatory requirement, concerning a potentially adverse condition (PAC), focuses on the characterization of any identified or undiscovered naturally occurring materials within the proposed site relative to the surrounding region (geologic setting). Naturally occurring materials beyond the site must also be considered in making the resource value comparisons to other areas within the geologic setting as required by 10 CFR 60.122(c)(17)(ii). Additionally, this potentially adverse condition requires that a determination be made regarding the current or potential feasibility of economic extraction of identified or undiscovered naturally occurring materials in the foreseeable future. The presence of this PAC is to be determined not only for naturally occurring materials within the

site but also for those naturally occurring materials beyond the site whose exploration or exploitation could affect isolation within the controlled area.

The determination of the presence of any naturally occurring material or the determination that future generations are likely to perceive the proposed repository site as a target for exploration or exploitation of naturally occurring materials is to be used to structure human intrusion scenarios (e.g., Raney, 1990b) which may be considered in an overall system performance assessment. Such exploration/exploitation activities must be considered when: (1) assessing the potential for human intrusion within and adjacent to the site; and (2) evaluating the consequences of such intrusion on the capability of the proposed geologic repository to isolate wastes.

The Yucca Mountain site is located in a natural resources-rich geologic setting that includes current gold production and exploration for hydrocarbons. Groundwater, however, is the only natural resource known to exist beneath and adjacent to the proposed site (DOE, 1988). Gold has been mined in the site vicinity at Bare Mountain (16 kilometers to the west for over a century (Nevada Bureau of Mines & Geology, 1984, p. 1) and at Wahmonie (28 kilometers to the east (Raney, 1990a)). Interest in gold exploration and exploitation in the site vicinity continues as five new mines and prospects have been located within 48 kilometers of the proposed repository site between January 1988 and July 1990 (Raney, 1990a). In addition, oil exploration was conducted at three separate sites during 1991 within 25 kilometers of the proposed Yucca Mountain repository site (State of Nevada/Department of Minerals, 1990). No exploitable hydrocarbon resources were encountered. The exploration holes were plugged and abandoned (Nevada Oil Reporter, 1991, p. 1). Finally, private exploration for natural resources north and east of the site has been highly restricted for more than 30 years by the presence of weapons testing ranges. These restricted-entry areas include the Nellis Air Force Range and the Nevada Test Site. Based on the historical record (DOE, 1988; Miller, 1989; Nevada Bureau of Mines & Geology, 1990; Petzet, 1991), it is highly likely that exploration for precious metals and hydrocarbons in the vicinity will continue into the foreseeable future.

Given this information, the staff considers that there is a potential for exploration/exploitation of naturally occurring materials adjacent to, and perhaps within, the controlled area following closure of the repository. Because of the presence of groundwater, the extraction of groundwater at the site is currently feasible and as such, this potentially adverse condition may be shown to exist. Considering other natural resources, there is no direct evidence of viable deposits of either gold or hydrocarbons beneath or immediately adjacent to the site. Even though metallic and energy resources may not be present at the proposed repository site, the mineral-rich local environment may yet encourage the exploration of Yucca Mountain and its environs based upon the perception that viable resources might be present.

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Groundwater is a potentially exploitable naturally occurring material which might engender direct intrusion into the proposed repository. As such it is addressed within this regulatory requirement, however, the potential for foreseeable human activity (such as mining activities, military action and extensive irrigation) to adversely affect the groundwater flow system will be addressed under another PAC -- Human Activity and Groundwater [10 CFR 60.122(c)(2)]. Human intrusion, with respect to all naturally-occurring materials (including groundwater) will be addressed from the overall system performance perspective under 10 CFR 60.112.

As a result of these considerations, this regulatory requirement will be reviewed by the staff as a Type 3 (Safety Review). Should future analyses and/or data arise such that this initial assessment is questioned, the type of review this regulatory requirement should receive will be reassessed in light of the additional information (CNWRA, 1991).

For the two Regulatory Elements of Proof the analysts drew the conclusion that a safety determination could be made by evaluating the technical information submitted by DOE in the License Application. Additionally, in the analysts opinion, the information to be reviewed would be such that no additional analyses or tests (Types 4 or 5 review) would be required because sufficient technical knowledge exists to allow for an adequate investigation and evaluation of the acquired information.

To summarize, the following statements and assumptions have been made in developing this CDS:

The proposed Yucca Mountain site is located in a natural resources-rich geologic setting that includes current gold production, exploration for hydrocarbons, and exploitation of groundwater resources.

Groundwater is the only natural resource currently known to exist beneath and adjacent to the proposed site.

With respect to groundwater, this potentially adverse condition may be shown to exist.

Although there is no known direct evidence of viable deposits of precious metals or hydrocarbons beneath or immediately adjacent to the proposed site, the mineral-rich local environment may yet encourage the exploration of Yucca Mountain and its environs based upon the perception that viable resources might be present.

Based on the historical record, it is likely that exploration for precious metals will continue into the foreseeable future.

Although future human activities and their effects cannot be reliably predicted, it is possible, at the present, to identify and evaluate a reasonable range of natural resources-related exploration and exploitation scenarios.

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Human intrusion will be addressed under 10 CFR 60.112.

REVIEW STRATEGY:

Acceptance Review (Type 1):

In conducting the Acceptance Review of this potentially adverse condition [presence of naturally occurring materials -- 10 CFR 60.122(c)(17)], the reviewer should determine if the information presented in the License Application and its references for demonstrating compliance with the naturally occurring materials potentially adverse condition requirement is complete in technical breadth and depth as identified in NRC, 1990. Appropriate information should be provided to enable the staff to determine: (1) the presence (or absence) of the potentially adverse condition; (2) the feasibility of the economic extraction of the naturally-occurring material, if present (or present, but undetected); and (3) the value (gross or net) of such materials compared to areas of similar size within the geologic setting.

The information in the License Application should be presented in a manner such that the assumptions, data, and logic leading to a demonstration of compliance with the requirement are clear and do not require the reviewer to make extensive analyses and literature searches. The reviewer should also determine that controversial information and appropriate alternative interpretations and models have been adequately described and considered.

Finally, the reviewer should determine if DOE has either resolved all the NRC staff objections to the License Application that apply to this requirement or provided all the information requested in Section 1.6 of NRC, 1990, for unresolved objections. The reviewer should evaluate the effect of any unresolved objections, both individually and in combinations with others, on: (1) the reviewer's ability to conduct a meaningful and timely review, and (2) on the Commission's ability to make a decision regarding construction authorization within the three-year statutory period.

Safety Review (Type 3):

In conducting the Safety Review, the reviewer will, as a minimum, determine the adequacy of the data and analyses presented in the License Application to determine DOE's compliance with 10 CFR 60.122(c)(17). Specifically, DOE will need to: (1) provide information to determine whether and to what degree the potentially adverse condition is present; (2) provide information to determine the degree to which the PAC is present, but undetected; (3) assure the sufficiency of the lateral and vertical extent of data collection; and (4) evaluate the information presented under items (1) and (2), with assumptions and analysis methods that adequately describe the presence of the PAC and ranges of relevant parameters. In general, the reviewer will assess the adequacy of DOE's investigations of naturally occurring materials, both identified and undiscovered, within the site and within the geologic setting, in the manner outlined in 10 CFR 60.21(c)(1)(ii)(B).

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The Acceptance Review criteria are identified in section 3 of the License Application Review Plan. If the License Application is found to be acceptable, those specific aspects on which the reviewer will focus are discussed in NRC, 1987 and 1990. Inadvertent human intrusion resulting from natural resources-related activities (e.g., from the future exploration or exploitation of gold or oil and such other naturally occurring materials that may be identified as exploitable) will be addressed under another regulatory requirement (see 10 CFR 60.112 -- Overall system performance objective for the geologic repository after permanent closure).

In order to conduct an effective review, the staff reviewer will rely on his own expertise and independently-acquired knowledge, information, and data in addition to that provided by the DOE in its License Application. For example, gold is known to occur near the site (Raney, 1990a; Miller, 1989). Oil is being exploited in Nye county, within which the Yucca Mountain site is located (Petzet, 1991, p. 48), and exploration was conducted near the site itself in 1991 (State of Nevada/Department of Minerals, 1990). Therefore, it is incumbent upon the reviewer to have acquired a body of knowledge regarding these and other such critical considerations in anticipation of conducting the Safety Review. A compilation of accepted methodologies for the assessment of natural resources at the Yucca Mountain site is contained in Raney and Wetzel (1990).

In addition, the reviewer should determine that DOE, while addressing naturally occurring materials, has included within its considerations the following: (1) appropriateness of the methods applied to the problem (i.e., foreseeable economics, comparison of areas, and undetected resources), (2) limitations of resource evaluations, (3) types and levels of uncertainty in the analyses, and (4) means and methods of verification of the analyses (see Singer and Mosier, 1981). If, as expected, expert judgement has been used extensively to evaluate resource presence and future value, the reviewer should thoroughly investigate the assumptions and methods used by DOE in arriving at and supporting its conclusions.

Additional examples of specific review activities that will be required include: (1) confirmation that DOE has fully considered the most recent exploration and exploitation activities within the geologic setting that are appropriate for the analysis, and (2) confirmation that the current industry and government projections of natural resources potential within that region have been included within DOE's considerations. If DOE determines (and the staff concurs) that naturally occurring materials (whether identified or undiscovered) are present within the site, then the staff will determine if DOE has adequately considered whether: (a) economic extraction of such materials is currently feasible or potentially feasible during the foreseeable future, and (b) such materials have greater gross value or net value than the average for other areas of similar size that are representative of and located within the geologic setting.

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RATIONALE FOR REVIEW STRATEGY (OPTIONAL):

Not applicable.

APPLICABLE REGULATORY ELEMENTS OF PROOF:

Type 3:

REOP

RR2018/EP0100

RR2018/EP0200

REFERENCES CITED:

Center For Nuclear Waste Regulatory Analyses, "Development of Compliance Determination Strategies," Report to the U.S. Nuclear Regulatory Commission/Division of High-Level Waste Management, TOP-001-11 (Rev. 0), April 30, 1991, 35p.

Miller, R., Governor's Office/State of Nevada, Letter to J.D. Watkins, U.S. Department of Energy [Subject: Summary Statement of Geologic and Hydrologic Deficiencies Supporting Disqualification of the Yucca Mountain Potential Nuclear Waste Repository Site], 1989.

Nevada Bureau of Mines & Geology, "Trace Element Associations in Mineral Deposits, Bare Mountain (Fluorine) Mining District, Southern Nye County, Nevada," State of Nevada, Report No. 39, 1984.

Nevada Bureau of Mines & Geology, "Major Mines of Nevada -- 1989," Special Publication No. 10, 1990.

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Nuclear Regulatory Commission/Office of Nuclear Regulatory Research, "Draft Regulatory Guide DG-3003 -- Format and Content For the License Application

for the High-Level Waste Repository," Regulatory Guide DG-3003, November 1990.

Petzet, G.A., "Pine Valley Gains More Attention as Drilling Pace Active in Nevada," Oil & Gas Journal, Vol. 89, No. 23, 1991.

Raney, R.G., "Active Mines and Prospects Within a Thirty-Mile Radius of the Proposed High-level Repository Site at Yucca Mountain, Nye County, Nevada, Subsequent to January 1988 (As of July 1990)," U.S. Bureau of Mines, 1990a.

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Raney, R.G. and Wetzell, N., "Natural Resources Assessment Methodologies for the Proposed High-Level Waste Repository at Yucca Mountain, Nye County, Nevada," U.S. Bureau of Mines," 1990. [Report to the Nuclear Regulatory Commission/Division of High-Level Waste Management.]

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Singer, D.A. and Mosier, D.L., "A Review of Regional Mineral Resource Assessment Methods," Economic Geology, Vol. 76, No. 5, pp. 1006 - 1015 [1981].

U.S. Department of Energy, "Site Characterization Plan, Yucca Mountain Site, Nevada Research and Development Area, Nevada," Office of Civilian Radioactive Waste Management, DOE/RW-0199, 9 Vols.