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United States Department of the Interior

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Memorandum

To: Charlotte Abrams, Project Officer, Geotechnical Branch, Division of Waste Management, U. S. Nuclear Regulatory Commission Washington, D.C.

From: Ransom F. Read, NRC Program Manager, Division of Minerals Availability

Subject: Letter Report Including Synopses of Papers Pertaining to Site Characterization of High-Level Waste Repositories Presented at 1987 Pacific Northwest Metals and Minerals Conference, Portland, Oregon, April 27-28, 1987 (Interagency Agreement NRC-02-85-004)

FIN D1018

In response to your request, Russell G. Raney of the Bureau's Western Field Operations Center attended the subject conference. Enclosed are synopses (6 copies each) of the papers presented at the Conference Session on "Characterization of the Sites for a High-Level Nuclear Waste Repository." Presentation titles and speakers are as follows:

1) "Geologic Setting of Yucca Mountain, Southern Great Basin, Nevada: A Potential Site for the Disposal of High-Level Nuclear Waste," by Michael D. Carr and James C. Yount, U.S. Geological Survey, Menlo Park, California.

2) "Basalt Geohydrology Beneath the Hanford Site and Vicinity, Washington," by Roy E. Gephart, Rockwell Hanford Operations, Richland, Washington.

3) "Geology of the Columbia River Basalt in the Hanford Area," by Peter Hooper, Washington State University, Pullman, Washington.

4) "Geotechnical Issues in Siting a Hanford Waste Repository," by William A. Brewer, Washington Department of Ecology, Office of Nuclear Waste Management, Olympia, Washington.

A scheduled fifth paper, entitled "Geological Characterization of the Deaf Smith County Site, Texas," was not presented.

Also enclosed is a newspaper article (6 copies) pertaining to an oil and gas lease auction to be conducted by the State of Washington.

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Attachments

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GEOLOGIC SETTING OF YUCCA MOUNTAIN, SOUTHERN GREAT BASIN, NEVADA: A POTENTIAL SITE FOR THE DISPOSAL OF HIGH-LEVEL NUCLEAR WASTE

by
Michael D. Carr and James C. Yount
U. S. Geological Survey
Menlo Park, California
(Synopsized by Russell G. Raney, BOM, Spokane, Washington)

Yucca Mountain is in an arid region of southern Nye County, Nevada, characterized by internal drainage, closed groundwater-flow systems, a deep water table, and active tectonism. The site encompasses several extentional-fault-bounded blocks of Miocene ash-flow tuff, forming the east wall of a middle Tertiary graben complex in which faulting and volcanism still persist. The site is underlain by Paleozoic rocks that form part of the regional aquifer-aquitard system that controls deep groundwater flow. Paleozoic rocks underlying the southern part of the site are carbonates that are part of the regional aquifer; shale underlies the northern part and act as an aquitard. The repository would be mined in welded tuff in the lower portion of the Topopah Springs member of the Paintbrush Tuff above the present water table.

Faulting, seismicity, and volcanism are geologic factors that could affect the acceptability of the site as a repository. Evidence is unequivocal for recurrent motion during the Quaternary on several of the principal faults in and around the site; Holocene movement is probable on some of these faults. Neither the styles nor the recurrence intervals of faulting in the present tectonic regime are adequately resolved. Deposits of calcium carbonate in the Paintbrush Fault (near the area for the proposed surface facility) has engendered lively debate pertaining to their origin. It is yet to be determined whether the calcium carbonate was deposited by ascending hydrothermal fluids[1] or by carbonate solutions moving down the fault zone.

The site lies within a belt of diffuse seismicity; a seismic network was installed in 1979 but has yet to provide sufficient information to assess satisfactorily the seismic hazard.

Quaternary volcanism near Yucca Mountain appears to be associated with the faulting both in time and space, but the detailed eruptive history and its implications remain controversial.

The Crater Flat Volcanic Field (immediately west of the proposed site) is characterized by volcanic rocks of three different ages; subdued volcanic features about 3 million years old, lesser eroded rocks in the center of the flat about 1 million years old, and cones and flows that were reported in the Environmental Assessment as 150,000 years old. However, USGS soil scientists have developed lines of evidence to indicate a soil profile underlying the cones. The cones have been extensively studied as of late, and, using a controversial (Carr's term) method of carbon-14 dating on rock varnish rinds of volcanic bombs, an age of 20,000 years has been calculated. Flows underlying the cones are thought to be 150,000 years old.

[1]This could have implications pertaining to undiscovered resources.

During a post-presentation question and answer period, two questions were posed pertaining to mineral and energy potential at Yucca Mountain. The questions and Mr. Carr's paraphrased responses are as follows:

Q. "What is your assessment of resource potential at the site?"

A. Although the EA reported a low potential for resources in the area, I feel that much more work must be done before this finding can be fully accepted.

Q. "What are the probabilities of breaching the repository as the result of future resource exploration based on a perception of resource potential as well as actual potential?"

A. This issue has been raised by the State (of Nevada). We really do not have an answer other than to say that based on the surrounding geology, the site could become an exploration target in the future.

BASALT GEOHYDROLOGY BENEATH THE HANFORD SITE AND VICINITY, WASHINGTON

by
Roy E. Gephart
Rockwell Hanford Operations
Richland, Washington
(Synopsized by Russell G. Raney, BOM, Spokane, Washington)

The Columbia River Basalt geology beneath the Hanford site and vicinity consists of alternating intraflow units having high- to low-hydraulic conductivities. Such heterogeneity creates rectilenear, three-dimensional groundwater movement to occur with lateral movement in flow tops and sedimentary interbeds and vertical movement across flow interiors. Anticlines and flow barriers contribute to developing local flow systems and complex groundwater patterns.

On a regional basis, the Pasco Basin appears to be an area of groundwater-flow convergence. Gephart proposed that the shallow basalts are locally recharged and discharged while deeper basalts are part of a larger, regional system that is hydrochemically unique compared to groundwater compositions reported in most other parts of the Columbia Basin.

Geohydrological data support a range of conceptual flow models. Two of these models involve groundwater mixing and near-stagnant conditions near the location proposed for geologic repository studies. Major uncertainties exist in all models especially related to quantifying vertical hydraulic conductivity, hydraulic influence of geologic structures, spatial distribution of hydraulic properties and groundwater compositions, and hydraulic head distributions.

Various lines of evidence indicate an overall groundwater discharge to the southeast of the Hanford site.

Mr. Gephart declined to respond to questions pertaining to resources as this subject is not within his field of expertise.

GEOLOGY OF THE COLUMBIA RIVER BASALT IN THE HANFORD AREA

by
Peter Hooper, Washington State University
Pullman, Washington
(Synopsized by Russell G. Raney, BOM, Spokane, Washington)

The Miocene Columbia River Basalt (Columbia Plateau) encompasses large areas of central Washington, western Idaho, and northern Oregon and is bounded on the north and east by the Rocky Mountains, on the south by the Basin and Range Province, and on the west by the Cascade Ranges. Low viscosity, rapidly moving sheet flows emanating from several large fissures and dike swarms (some over 100 kilometers in length) near the southeast margin of the plateau, flowed to the north and west into structural and topographic lows such as the Pasco and Quincy Basins. The Pasco Basin, in which the Hanford site is located, was developing during the eruptive periods. Consequently, basalt thickness in the basin ranges between 4,267 and 6,100 meters; thicknesses on the margins of the Columbia Plateau generally range between 1,219 to 1,829 meters.

Columbia River Basalt in the vicinity of the Pasco Basin is part of the Yakima Basalt Subgroup which includes Saddle Mountain, Wanapum, and Grande Ronde basalts. Units of the Ellensburg Formation (largely clastics and volcaniclastics) are intercalated with the Saddle Mountain and Grande Ronde formations.

Basalt flowing into ponded water in the Pasco Basin was rapidly cooled resulting in large masses of basaltic glass and glass shards that eventually weathered to palagonite. These masses, which occur all over the Columbia Plateau, are highly unsuitable for a geologic repository. Further, it is almost impossible to predict the occurrence of these palagonite bodies as well as fracture and jointing patterns within the Pasco Basin.

The Columbia Plateau, and the balance of the Pacific Northwest, is tectonically active; basining is ongoing within the Pasco Basin. Regional north-south compression and east-west extention were apparently responsible for opening of the eruption fissures as well as producing the Yakima Folds, a series of east-west-trending anticlines and broad synclines. Anticlines in the Yakima Folds are associated with reverse faults on or near the fold axes.

Major faults in the southeastern portion of the plateau are thought to be transform faults; these are probably still active. Future movement is likely on any fault in the area, and it is foolhardy to pretend that we can predict what will happen in the Pasco Basin in the next 10,000 years.

Dr. Hooper declined to respond to questions pertaining to resources in the Pasco Basin.

GEOTECHNICAL ISSUES IN SITING A HANFORD WASTE REPOSITORY

by
William A. Brewer, Washington Department of Ecology
Office of Nuclear Waste Management
Olympia, Washington
(Synopsized by Russell G. Raney, BOM, Spokane, Washington)

Of the three sites under investigation for the first national nuclear waste repository, the Hanford site in south-central Washington presents the most difficult conditions for estimating performance and the greatest potential for failure and release of radionuclides into circulating groundwaters. The layered flood basalts are highly stressed, pervasively jointed, saturated with water at high temperatures (more than 140° F) and pressures (more than 1,200 psi) and, in places, host various concentrations of methane gas. These conditions would result in almost impossible mining conditions and enormous costs.

There is at least indirect evidence of deep faulting which could provide pathways to the environment. It is uncertain that the Department of Energy will be able to assemble and present a convincing technical case that will survive challenges in contested licensing proceedings, even after five more years of work and hundreds of millions of dollars in site studies. A more satisfactory approach at Hanford would be application of the "condemnation" principle employed by all successful exploration managers in the mining and petroleum industries. This principle involves early discovery of any disqualifying conditions, in order to conserve time and money better spent on studies at a more tractable site.

In response to several questions pertaining to actual or perceived resources at the Hanford site, Mr. Brewer stated he feels that there is at least a perception of, if not actual, hydrocarbon (mainly natural gas) resources in and around the site. Recently, according to Brewer, the Washington Department of Natural Resources announced it would auction off a large number of oil and gas exploration leases, mostly in the Columbia Basin. Of the more than 117,000 acres up for bid, Shell Oil has 200 applications covering more than 100,000 acres.

State to auction oil, gas rights

Associated Press

OLYMPIA — The Department of Natural Resources announced Wednesday it would auction oil and gas exploration leases for more than 117,000 acres of state land, mostly in Eastern Washington.

The public auction will be held May 28-29 in Olympia, the department said.

It will feature bidding of 242 applications for 10-year oil and gas exploration rights on state lands located in 16 counties.

"The number of applications indicates a strong continuing interest in oil and gas exploration in the Columbia Basin, despite the slump in world oil and gas prices," said Ken Solt, manager of DNR's land-leasing and recreation division, in a news release.

The announcement said Shell Western E&P has made 212 applications for 100,922 acres, all in Eastern Washington.

Other applicants listed are M&M Properties, G.B. Howell, D.M. Yates, Robert V. Larson, Pioneer Minerals Inc., David R. Faley and Atlantic Richfield Co.

The auction will run 10 a.m. to 4 p.m. May 28 at the Westwater Inn in Olympia, and will resume, if necessary, at 9 a.m. the next day.

Spokesman-Review
Spokane, WA
4/23/87

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