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TO: Mr. John Greeves, WMEG

FROM: Paul T. Prestholt, Sr. OR - NNWSI

DATE: August 8, 1986

SUBJECT: Letter and Review Comments from LLNL staff on February 1986 draft Generic Technical Position on Borehole and Shaft Sealing.

Please find enclosed the above-referenced information.

PTP:nan

WM Record File 108.4

WM Project 1
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Lawrence Livermore National Laboratory

NWM:LR 86-129

May 20, 1986

Donald L. Vieth, Director
Waste Management Project Office
U.S. Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, NV 89114

SUBJECT: Action Item 86-1243; Evaluation of the Nuclear Regulatory Commission Generic Technical Position on Borehole and Shaft Sealing, February 1986

Dear Don:

Enclosed are review comments from several LLNL staff on the February 1986 draft Generic Technical Position on Borehole and Shaft Sealing.

S. Gonzales
(for) L. Ramspott
LLNL Technical Project Officer
for NNWSI

LR:sg

cc: J. Yow, JR.
A. Sacco, WMPO Action Items

EARTH SCIENCES DEPARTMENT
ENGINEERING GEOLOGY GROUP

Mail Stop L-206

Extension 2-3521

May 19, 1986

MEMORANDUM

To: Larry Ramspott

From: Jesse Yow

Subject: 2/86 NRC Generic Technical Position on Borehole and Shaft Sealing

In letter WMPO:JSS-1073, LLNL was asked to review the NRC Generic Technical Position (GTP) on Borehole and Shaft Sealing and provide comments on or before May 20, 1986 (WMPO Action Item #86-1243). Rich Thorpe reviewed this GTP and provided comments in the attached memorandum. My comments are outlined below:

Page 1, Second Paragraph. The scope of this GTP is specifically limited to repositories in saturated media with the caveat that it is applicable to unsaturated media if sealing is necessary. The burden of proof for this necessity is left undefined.

Page 1, Section 1.0. This entire section focuses on the role of seals in controlling preferential pathways for radionuclide migration. Any role of seals in minimizing accessibility to the underground facilities (mentioned in NNWSI Performance Allocation meetings) is not mentioned in this GTP.

Page 2, First Paragraph. While the underground facility is in general exempted from the GTP, portions of shafts and boreholes extending below the repository are not addressed. This may need to be clarified as the repository design progresses.

Page 2, Section 60.134(a). This implies that the hydraulic conductivity of the installed seals should be equal to or less than the conductivity of the host rock. The SNL design approach for shaft and ramp seals ignores this design criterion, and also ignores detrimental effects on the waste package environment. This issue remains unresolved even though these matters were brought up and discussed at several recent NNWSI Performance Allocation meetings.

Page 5, Section 60.142. This section describes a poorly defined, potentially expensive, and time consuming testing program that has not been factored into NNWSI plans. The project can take a lead here in defining the scope of work that is actually needed to assure performance; this should also be integrated with uses

of the Exploratory Shaft Facility after site characterization is complete. LLNL can do this if SNL is unable, and if support is forthcoming from WMPO/NV.

Page 5, Last Paragraph. Is the "disturbed section" related in any way to the "disturbed zone" of another GTP? If not, then a definition of this new term is needed in order to understand the implications of the paragraph.

Page 7, Section 3.1. Model validation is not easy; in any case this logic seems amiss since data for model validation will not be available until after the completion of in situ tests of long duration, which are in turn begun during repository construction. Further, the suggested use of analog studies and accelerated tests may itself need validation. What if test results fail to validate the models after the repository is half built and loaded with waste?

Page 8, Second Paragraph. This paragraph is overly simple. The core of the matter is the "increase in permeability" mentioned in the last sentence of the paragraph, but the increase that is considered significant is not defined. The GTP on the disturbed zone defined a significant increase as a one order of magnitude change in intrinsic permeability; this would be appropriate here.

Page 10. The bullet just before Section 3.5 should be clarified and defended with examples.

Page 10, Section 3.6. This section emphasizes that the hydraulic conductivity of the seals should approach that of the undisturbed host rock. This is contrary to the SNL design approach.

Page 11, Section 4.1, Second Bullet. It is not clear why ambient in situ stresses are important to plug material strengths since they will have been relieved by excavation of the opening.

Page 11, Section 4.1, Fourth Bullet. The discontinuities that are close to parallel to a shaft or borehole may be among the most important but the most difficult to characterize.

Page 12, Section 4.2. Seal materials should be selected for "compatibility with the host rock and groundwater chemistry" and to "contribute to the isolation and containment of radionuclides." This should guide NNWSI efforts in repository sealing.

Page 13, Section 4.4 The second bullet mentions the use of seals to "stabilize zones of weak rock." This is a new application of sealing in this GTP, but it may be related to NNWSI fault zone sealing considerations.

Page 14, Section 4.5. Determination of the in situ quality of an emplaced seal may be impossible without significant advances in nondestructive testing, or without creating a potential hydraulic path past the seal.

Page 15, Section 5.0. This summary section recaps some of the main points that were the subject of comments above. Particular attention should be given to criteria on hydraulic conductivity and on chemical compatibility; these are weak spots in current NNWSI sealing design work.

Please contact me if you need any further information at this time.

Jesse Yow

Jesse L. Yow, Jr.
Principal Investigator
Exploratory Shaft

CC: L. Ballou
T. Buscheck
V. Oversby
A. Ramirez
R. Thorpe

16 May 1986

MEMORANDUM

TO: J. Yow
FROM: R. Thorpe RT
SUBJECT: Comments on NRC's GTP statement on borehole & shaft sealing

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I have reviewed the above draft from the NRC, and aside from many possible editorial or style issues, my technical comments on each section are as follows:

1.0, p.1:
It is not clear as to what additional guidance is necessary in the unsaturated case, nor who is responsible for providing it. Also, the term "adequate" is used in this and other sections, and some definition, however generic it may be, would be helpful.

2.0, pp.2-6:
Throughout this section, there should be a clear distinction between the text of rule 10 CFR Part 60 and the authors' interpretation. Specifically, the indentation is confusing for the first paragraphs on pp. 3 and 6. Quotation marks might help.

3.1, p.7:
Has NRC considered the use of geotextiles or other manufactured products for sealing?

3.2, p.8:
The discussion of "damaged zones" is somewhat confused due to its brevity. Why not leave out the last two sentences of para. 1, and simply cite a reference regarding possible variation in the extent of the damage zone? Also, a concise definition or explanation of "damage zone" is advisable.

3.3, p.9:
It may be a matter of semantics, but this section should be more specific regarding the role of emplacement technique on seal permeability. In my view, there is an important distinction between verifying and demonstrating a technology. Basically, the methodology should be verified by comprehensive laboratory testing in order to substantiate its capability for producing a specified permeability. The empirical results are then used in judging the effectiveness of field demonstration tests, which should focus on measuring permeability either directly or indirectly.

Another point should be added to this section. Very often, the design phase can incorporate measures that will facilitate in-place testing of seals and/or their components. Although performance verification is mentioned elsewhere, the means of accomplishing this may depend on how the seal is designed and constructed. (Of course, LLNL would be the logical choice for developing this technology!)

3.4, p.10:
The last bullet in this section is unclear; could the authors cite a reference as to the mechanism or scenario?

3.5, p.10:
Physical characteristics should include permeability and porosity.

3.6, p.10-11:
This section is redundant, and could be included in 3.1 or 3.5.

4.1, p.11-12:
First bullet should include geologic origin and history of the rock mass. The term "competence" should be defined. In the next bullet, how is knowledge of the existing stress field going to assist in specifying plug strength? Second bullet on p. 12 should include hydraulic conductivity of interbeds.

4.2, p.12:
Third bullet should include shrinkage or cracking due to dessication. Under the third bullet, the properties should be coefficient of thermal expansion, thermal conductivity, heat capacity, and density. The term "thermal stability" should be defined.

4.5, p.14,15:
Under the first bullet, it seems that only the maximum pressure gradient should be important. Another bullet should be added for sampling methods and sample handling and storage.

5.0, p.15:
In this section, the phrase "key design criteria" would be more applicable to the items described in the bullets.

I had no other substantive comments for the remaining sections.