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Department of Nuclear Energy

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Mr. Everett A. Wick
High Level Waste Licensing Management Branch
Division of Waste Management
Wilste Building
7915 Eastern Ave.
Silver Springs, MD 20555

Dear Mr. Wick:

Review of Golder Associates Design for a Tuff Repository Waste Package

Emil Veakis, Himanshu Jain and I have reviewed Section 3.4.4 (Effectiveness of Engineering Barriers) from pages of the Golder Associates document which you sent to me. We believe that the concept of a multibarrier waste package is desirable but that the design proposed is likely to be difficult to construct and not very convincing from a technical standpoint. The following specific comments are made for consideration:

a) Golder may be unaware that the current NNWSI waste package design specifies that steam/air conditions will prevail for the first 800 years after repository closure (Dublin, CA, meeting held in October, 1983). Thus, discussions on water ingress will be invalid during this time frame.

b) There seems to be an error in terminology in Golder's Figure 3-2 describing the waste package. The layered backfill proposed is part of the waste package, and not distinct from the latter, as shown in the figure.

c) We disagree with the statement that in fine grained backfill the water will leave the host rock and enter the backfill until the saturation levels in the two are similar. Since the backfill will always contain a far larger proportion of voids, it will have a much higher water content than the surrounding tuff host rock. It is therefore probable that water will concentrate in the fine-grained backfill and be induced by capillarity to reside for long periods close to the waste container instead of quickly being removed via fractures in the host rock around the waste package.

d) In the 3-layer backfill design proposed, we believe that it will be extremely difficult to quantify water flow behavior unless full scale tests are conducted. Although qualitatively it seems that water collecting in the outer fine grain backfill will less readily enter the central coarse grained layer, because of capillarity differences, we feel it probably will. It may be reasoned that water collecting in the outer fine-grained layer will develop a sufficiently higher hydraulic head to overcome capillarity forces so that entry into the intermediate layer will occur. Thus, it is expected that both of the outer backfill layers will be saturated with water.

e) Golder states (middle of page 20) that "The central fine layer slows water contact in the event of inundation." They probably mean the innermost coarse grained clay layer.

f) The use of iron or copper in the backfill will require much study because of currently unknown behavior in this application. It is well known that iron in groundwater will greatly enhance glass leaching. Copper, on the other hand, is very expensive and could, if allowed to reside close to an iron or steel container, cause accelerated galvanic corrosion of the latter.

g) The use of clay around the container must also be viewed with caution since it may be subjected to wet-dry cycling. Thus will possible give rise to cracking and thus will compromise its water retardation behavior.

Based on the above comments we conclude that a layered backfill design may be useful but it must be very carefully thought out beforehand, with a substantial data base to support behavioral predictions. Such a data base is lacking in the Golder study. It seems that the design proposed will concentrate water in the waste package, because of capillarity effects, rather than allow it to flow away through natural fractures in the tuff. Thus it would be better to eliminate all of the backfill and emplace the waste container directly into a tuff borehole with a minimal amount of crushed tuff around the container to provide the desired heat transfer rate. This is the current NNWSI plan for vitrified waste.

Sincerely,

Peter Soo

Peter Soo, Associate Division Head
Nuclear Waste Management Division

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