TJ/PLASAR TRANS MEMO

NOV - 2 1989

MEMORANDUM FOR: John J. Surmeier, Chief
Technical Branch
Division of Low Level Waste Management
and Decommissioning, NMSS

FROM: Myron Fliegel, Section Leader
Operations Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

SUBJECT: SURFACE WATER HYDROLOGY AND EROSION PROTECTION
COMMENTS ON BGV PLASAR

In accordance with your recent request, Ted Johnson has completed a review of the surface water hydrology and erosion protection aspects of the BGV PLASAR. This review included Sections 2.4.1, 3.1.5, 3.4.4, 5.1.1, 6.3.1, and Appendix E of the PLASAR. Our comments and questions are enclosed.

In general, the erosion protection design provided for the post-closure period does not appear to be adequate. The designs presented in the PLASAR do not meet the long-term stability requirements of 10 CFR Part 61, particularly in the areas of slope stabilty and designing for no maintenance.

If you have any questions regarding these comments, please contact Ted Johnson at 492-3440.

ORIGINAL SIGNED BY

Myron Fliegel, Section Leader
Operations Branch
Division of Low-Level Waste Management
and Decommissioning, NMSS

Enclosure: As stated

Distribution: Central File # 214.3
RBangart, LLWM JGreeves, LLWM MBell, LLRB NMSS r/f
MFliegel, LLOB TJohnson, LLOB PLohaus, LLOB
JJones, LLOB r/f

PDR YES [X]

PDR NO [ ] Category: Proprietary [ ] or CF Only [ ] ___

ACNW YES [X] NO [ ]

SUBJECT ABSTRACT: SURFACE WATER HYDROLOGY AND EROSION PROTECTION COMMENTS ON BGV PLASAR

OFC	:LLOB	:LLOB	:LLOB	:LLWM	:LLWM	:NMSS	:NMSS
NAME	:TJohnson/jj	:MFliegel	:PLohaus	:	:	:	:
Date	:11/2/89	:11/2/89	:11/ /89	:	:	:	:

OFFICIAL RECORD COPY

214.3
WM-3
WL14

BGV PLASAR
SURFACE WATER HYDROLOGY AND EROSION PROTECTION
COMMENTS AND QUESTIONS

OB - UR - 1 - 2.4.1.6.1 (2-64)

This section of the PLASAR questions NRC policy and conservatisms regarding dam failures. The cautionary statement in the PLASAR indicates that NRC has not commented on the need to analyze worst-case dam failure scenarios.

The NRC staff has, in fact, provided guidance on dam failures and criteria for analyzing worst-case failure modes. Acceptable methods of analysis for dam failures are discussed in Standard Review Plan (SRP) Section 6.3.1. This SRP discusses the need to analyze various types of failures and provides criteria and references for such analyses.

In an actual license application, various types of failures may need to be analyzed. Such failures should include those associated with major floods, major seismic events, and reasonable combinations of both. Criteria for analyzing these events are provided in SRP 6.3.1. The NRC staff notes that, in this particular instance, the site is well above flood levels associated with dam failures. Therefore, the types of analyses that need to be performed could likely be somewhat simplified, and some may not have to be performed at all.

It should also be noted that, in those cases where dam failures establish the critical design flood level, additional details of the dam designs would need to be provided in an actual license application. This information would be needed to determine the seismic capability and storage capacity of the reservoirs.

OB - UR - 2 - 3.1.5 (3-18)

This section of the PLASAR indicates that the surface water drainage system has been designed for an occurrence of the 100-yr, 6-hr rainfall event. Based on our review, it appears that the peak runoff rate has not been properly calculated and that the value of the 100-year event is not correct. Additionally, the NRC staff questions the use of such an event to provide adequate protection.

(a) Based on a review of the information presented in Appendix E (p. E-113), it appears that the rainfall has not been properly distributed within the 6-hour period. It appears that the rainfall intensity was computed simply by dividing the rainfall (26 inches) by the time (6 hours). This is not the correct method for determining the rainfall intensity for short times of concentration. The correct method is to determine the rainfall associated with the time of concentration and to then compute the rainfall intensity associated

with that time of concentration. The design of the ditches may need to be revised to accomodate the larger flows that would be computed using the correct method.

(b) The PLASAR indicates that the value of the 100-yr, 6-hr rainfall is 26 inches. This value is more representative of the Probable Maximum Precipitation (PMP). However, the calculated value of rainfall intensity of 26/6 is not as great as the actual 100-yr rainfall intensity for several minutes. Appropriate revisions should be made in the license application to reflect the proper rainfall and rainfall intensity. Various publications of the National Weather Service are available to determine these rainfall amounts and intensities.

(c) The use of a flood less than the Probable Maximum Flood (PMF) has not been adequately justified in the PLASAR. SRP 3.1.5 indicates that use of the PMF provides an acceptable design basis during the operational period. While not a requirement, the use of lesser floods needs to be justified, in light of the risks of surface water runoff into the excavated areas during the operational period. Accordingly, the license application should be revised to include justification for use of floods smaller than the PMF. Alternately, the design of the drainage system should be revised to accomodate the peak PMF flow rate. (Additional comments regarding the adequacy of the site drainage system and procedures for acceptable resolution of NRC concerns may be found in Comment #6. In light of these comments, the applicant may wish to revise the design of the drainage system during the operational period to correspond with the design that will be used following site closure.)

OB - UR - 3 - 3.1.5 (3-19)

This section of the PLASAR indicates that there is a possiblity that the drainage ditches may become clogged after the closure period and that the resulting infiltration rates could increase. The statement that no problems would result from such conditions has not been adequately justified. Since no credit can be given for maintenance following closure, it appears that significant increases in infiltration rates could occur. Additional information and analyses should be provided to justify the contention that no problems would ensue following blockage of the ditches. Detailed analyses of runoff patterns, flow rates, infiltration rates, degree of ditch blockage, etc. should be provided to demonstrate that blockage will not be a problem. Comment #2(c), above, provides additional information and discussion of acceptable resolution procedures for justification of floods less than the PMF. Additional discussion, comments, and acceptable resolution procedures regarding long-term stability and the need for designing for no maintenance may be found in Comment #6, below.

OB - UR - 4 - 3.4.4 (3-50)

This section of the PLASAR indicates that a significant amount of erosion protection will be provided to protect the site from an adjacent small stream. Based on our review of the information provided, it is not clear what is being protected and how the assumptions used are relevant to the design proposed.

(a) First, it is not clear where the erosion protection will be placed. No drawings or cross-sections have been provided to delineate the areas that will be protected. No information has been provided to state what is being protected and why such a problem will exist at the site. It is not clear if the erosion protection is needed to prevent lateral or vertical erosion and if such erosion could adversely affect the site. This information should be provided in an actual license application.

(b) Second, the assumptions used to determine the rock size may not be appropriate. While it is very likely that the proposed 40-inch riprap is adequate to provide the necesssary erosion protection, the stream cross-section that was used to determine the flood velocity and erosion protection requirements is located nearly a mile away (Figure 3.4-1) from the site. It is not likely that such a section would be appropriate, since it could be significantly different in the site vicinity. If erosion in the site vicinity could be a problem, a section closer to the site should be used for design.

(c) Third, the use of rock durability criteria of the United States Bureau of Reclamation (USBR) may not be adequate for long term stability applications and should be further justified. The NRC staff has recently developed procedures for rock quality evaluation. These procedures are presented in draft Staff Technical Position (STP) "Design of Erosion Protection Covers for Stabilization of Uranium Mill Tailings Sites" and provide an acceptable method for determining rock durability for the long time periods associated with site closure. The rock quality should be evaluated using these procedures and the information presented in the license application. Alternately, the use of the proposed USBR criteria should be justified.

(d) Fourth, the PLASAR indicates that concrete may be used as erosion protection. While this may be acceptable when active maintenance is being performed, it is not likely to be acceptable for the post-closure period. Concrete is subject to weathering when exposed and is not likely to survive for several hundreds of years without maintenance. Concrete which is exposed to weathering elements should not be used as part of the erosion protection material due to its lack of durability. The design of the erosion protection should be revised. Alternately, the use of concrete should be further justified, taking into consideration that it must not weather significantly and must perform its erosion protection function without reliance on routine maintenance. This additional justification should be provided in the license application. Additional comments and discussion addressing the use of concrete for long-term applications are provided in Comment #6.

This section of the PLASAR indicates that sheet erosion has been considered and that the covers will be adequate for a 1500-year period. The rate of soil loss was computed using the Universal Soil Loss Equation (USLE). This method of analysis is not considered adequate to assess the long-term stability of the site, since it does not take in account gully erosion resulting from severe rainfall events. We conclude that additional analyses are needed to demonstrate that the proposed soil covers for the BGV are sufficiently flat and stable to provide the required long-term stability. Comments addressing this aspect of the design and acceptable methods of resolution are provided in Comment #6, below.

OB - UR - 6 - 6.3.1 and Appendix E

Our review of the information provided in Section 6.3.1 and the supporting documentation in Appendix E of the PLASAR indicates that an adequate design for long-term stability has not been provided and that additional justification and/or revised analyses are needed in several areas of the proposed design.

(a) First, the storm drainage system does not appear to be adequate, based on the fact that many ditches and collector channels are designed for only a 100-year flood event. An occurrence of the PMF (or any flood larger than the 100-year flood) could cause significant erosion and damage to the ditches. Such erosion could potentially affect the stability of the protective soil covers over the BGV. Since the ditches must perform their function without maintenance for hundreds of years following closure, the staff concludes that designing for a very rare flood event, such as the PMF, is appropriate. The design of the ditches should be revised. Alternately, additional justification and detailed analyses should be provided to document the capability of the ditches to perform their intended function for several hundred years following site closure.

(b) Second, the PLASAR (E.4.2) indicates that some portions of the drainage system will be capable of withstanding velocites associated with the PMF. It is stated that some of the riprap can withstand velocities of up to 20 feet per second. While this may be true in some cases, it is not true in most cases unless the rock is very large. The sizing of erosion protection is dependent on many factors, including depth of flow, flow velocity, amount of turbulence, channel slope, and scour depths. It is likely that, in this case, the proposed ditch design is not adequate, since the rock does not appear to be large enough to withstand the PMF without significant damage and also because no rock is provided on the channel bottom. The design of the erosion protection should be revised to provide stable channels which do not erode or suffer extensive damage during the occurrence of rare flood events. The staff suggests use of the Safety Factors Method for designing ditch riprap, since it can take into account the factors discussed above. Alternately, additional documentation should be provided to justify the use of the proposed erosion protection. Analyses and detailed calculations should be provided which discuss the actual depths of flow and the shear stresses produced on the rock.

(c) Third, the design of the top and side slopes for all of the disposal units has not been adequately justified. The top slopes have been designed on the basis that they will limit sheet erosion and gully erosion from a series of minor storm events. The side slopes were selected on the basis that steeper slopes have been approved by the NRC in other program areas. These methods of selecting and designing soil cover slopes are not considered to be acceptable. The license application should provide a detailed analysis of the design of stable top and side slopes for all of the disposal units and should provide a rationale and structured design approach. The NRC staff has recently developed guidance on the design of stable soil slopes. This guidance is presented in a draft STP and should be used, since it can address various factors associated with long-term stability, including allowable shear stresses, PMP rainfall intensities, flow concentration, gullying, and slope length. The guidance also provides discussions in many design areas and recommends that various conservatisms need to be used when designing for long time periods, when no reliance can be placed on active maintenance.

OB - UR - 7 - Appendix E (E-109)

The gully erosion model used to predict depths of erosion does not take into consideration rare rainfall events, and only considers a series of rainfall events of lesser intensity. The staff questions the use of such a model when designing for long time periods, without reliance placed on active maintenance. The PLASAR also indicates that gully erosion will not expose the vault roof, since the vault roof is below the natural grade of the site. While this may be true, it may also be possible that erosion in the immediate site vicinity could cause a lowering of local base levels, resulting in increased gullying potential and possible exposure of the vaults. Additionally, even if exposure does not occur, it is possible that increases in infiltration could occur as a result of gully erosion and resulting concentration of flows or ponding in a particular area of the site. The staff concludes that the cover slopes should be designed to be stable and thus prevent any significant erosion. The guidance presented the draft STP on erosion protection covers may be used to design such stable slopes.

OB - UR - 8 - Appendix E (E-112)

The PLASAR indicates that the Type I, II, and III ditches are designed for the 100-year flood. This design is not considered to be adequate. Comment #6(a) provides additional discussion and information regarding the use of these design criteria and methods for acceptable resolution.

OB - UR - 9 - Appendix E (E-117)

The PLASAR indicates that concrete fords will be used to allow site access following site closure and will replace the concrete culverts in the drainage

channels. The fords will be constructed of concrete and will serve as roadways for access to the site. They will be constructed directly across the channels, and it is stated that degradation of these fords will have no adverse effects on the ability of the channels to perform their required function.

In general, such structures are not conducive to long-term stability, due to the fact that they will lose their effectiveness unless routine maintenance is performed. If the ford simply becomes part of the channel, the concrete (probably in a degraded condition) will be exposed to erosive forces during flood events. The statement in the PLASAR that no adverse effects will occur is therefore not adequately justified.

The design of the channels should be revised to eliminate the concrete fords and to provide designs that will be stable over a long period of time. Instead of concrete fords, the staff suggests the use of a rock-protected ditch crossing. The entire ditch could be protected with normal riprap, and at the proposed crossing points, the riprap voids could be filled with soil or gravel to allow the passage of vehicles over the rock. Such a design will be capable of lasting a long time without maintenance. The design criteria for such designs are similar to normal riprap designs.