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ATTACHMENT 1

NOD Comments for the Grout Treatment Facility

NO.	Page	Comment
1.	1-1	Although the U.S. Government holds legal title to this facility the DOE-RL, for the purposes of defining RCRA facilities, is considered the legal owner of this facility. A statement to this effect should be added. (51 FR 7722)
2.	1-1	The Grout Treatment Facility must also include the Dry Materials Facility. The blending of this material is an integral aspect of the grout treatment process and must therefore be reviewed as part of this application. (173-303-040(30))
3.	1-7	All references listed here, as well as throughout this application, must be made available for review, upon request, to any regulatory agency or public commentor. A statement to this effect must be made. (173-303-840(6))
4.	2-1	Washington State Dangerous Waste Regulations (WAC 173-303) were revised in January 1989. The application should reflect this most current version. Please update. (173-303-806(3))
5.	2-4	The permit application must address the most current design. The definitive design now scheduled for submittal in September 1989 will be reviewed before issuance of the permit. Therefore, all statements in this application which address the proposed, definitive design should be amended after the incorporation of this information.
6.	2-5	Is the GTF transfer piping above or below ground? How is this piping marked to identify mixed waste hazards and prevent inadvertent damage? (173-303-310)
7.	2-6	Typo. "progressive" should be "progressing".
8.	2-7	Comment #6 also applies to the distribution piping.
9.	2-9	Is the nonradioactive grout used to fill the void space and cover penetrations also a non-dangerous waste grout? How long is the grout monolith allowed to cure before filling the last four feet of the vault with non-radioactive grout?
10.	2-13	List the dry solids, and their quantities, actually used for the phosphate/sulfate waste campaign and those which are intended for use in the following campaigns.

11. 2-13 Fly ash is a potentially dangerous material based upon toxicity criteria. This material must be designated (including aquatic bioassay testing). Similarly the phosphate/sulfate grouted waste must also be designated (including aquatic bioassay testing). (173-303-070)

12. 2-15 The "Hanford standard flange assembly" should be detailed for our review since it is not typically used outside of the Hanford Reservation.

13. 2-21 At what location were the flow rates on the Columbia and Yakima Rivers recorded? The average flow rates were calculated from data collected prior to dam construction as well as data collected subsequent to the dam construction. Average and peak flow rates should also be reported as they occurred exclusively after dam construction. This provides the most accurate characterization of flow as it presently occurs.

14. 2-30 The first sentence of the last paragraph should be rewritten as "The dry material blended at the DMF...".

15. 3-1 Table 3-2 indicates the presence of approximately 3000 ppm of organic materials in the waste to be processed. The majority of this concentration consists of organic acids. The West Valley Demonstration Project reported difficulties in grouting materials with 150 ppm of organic acids. Explain why the concentration of organics in the waste to be managed at Hanford's GTF will not adversely effect the solidification process.

16. 3-5 The text here provides justification for the presence of less-than signs (<) in Tables 3-1, 3-2, 3-3. Does the absence of these signs in Tables 3-2 and 3-3 indicate that all of the constituents on these two tables where detectable, or is their absence due to a typographical error?

17. 3-6 The analysis conducted on each candidate grout feed must be submitted to our office for approval before grouting continues. A statement to this effect must be made.

18. 3-7 The columns in Table 3-5 are incorrectly labeled. The column which is labeled "mg/g" should be relabeled "Molecular Weight". This quantity is not a compound concentration and should therefore not be located under the "Compound Concentration" column. Please correct.

19. 3-9 Explain why a "corrosive" environment (pH>12.5) complies with DST specifications for corrosion protection of tanks and piping.

20. 3-10 The formation of hydrogen gas and slurry growth have been reported in the double-shell tanks. A discussion of these two mechanisms should be presented as they relate to reactivity and/or ignitability.

21. 3-12 The reference to Table 3-8 is incorrect. Please determine proper reference and amend.

22. 3-13 Designation by carcinogenicity is based, in part, on waste quantities exceeding 220 pounds (100 kilograms), not 400 pounds. Please correct. (173-303-084(7))

23. 3-13 The last sentence on this page is confusing. In light of the fact that specific conductance is high in relation to groundwater properties, explain why specific conductance would not be a useful release detection parameter in the groundwater. Unless we state otherwise, specific conductance must be measured. (173-303-645(4)(a))

24. 3-15 As is stated, the use of technetium 99 as a tracer is highly dependent on the background concentration. This concentration may be as high or higher than that found in the tanks or grout system. There is some data already available for the 200 Areas, but perhaps not for this immediate area. This historical data should be compared to newly gathered data.

25. 3-17 As is stated here, this treatment technology involves "complex chemistry" which "does not allow a precise calculation of treatment effectiveness". With this in mind, what actions can and will be taken should the slurry, or portions of the slurry, not set after being pumped into the vault?

26. 3-17 Post-curing verification of the actual vault monolith must be conducted to prove the effectiveness of this treatment process. Discuss the type of verification to be utilized. (173-303-283)

27. 3-17 A means to sample the grout slurry as it passes from the pump to the vault should be developed. This will allow sampling of actual feed material for lab testing. (173-303-300)

28. 3-18 What are the "other materials" which may be combined with DST wastes to bring their composition within the formulation envelope? Will different tank wastes be mixed? If so, is each tank pumped separately to the feed tank or are they combined prior to transfer?

29. 3-20 The heat of hydration that will develop in the vault may raise the curing temperature above 90 degrees centigrade. These higher temperatures may have adverse effects on the

solidification process. A discussion of how to mitigate this effect along with supporting justification must be provided before a permit can be issued.

30. 3-20 The frictional pressure drop criterion given here, 10 lb_f/in^2 per 100 ft, does not correspond with that given in Table 3-9 (11.2 $lb_f/in^2/100$ ft). Please clarify.

31. 3-20 Upon substitution of the figures provided into the equation given for frictional pressure drop, it appears that grout slurry densities greater than 11 lb/gal would cause a frictional pressure drop greater than your criterion. In addition, your reference was found to be superseded by a 1987 version. It is recommended that the equation and units be rechecked with the latest edition. Please clarify or provide updated information.

32. 3-22 The NRC criterion for unconfined compressive strength has been raised to 60 PSI. Furthermore, it is expected that this limit be doubled to add a factor of safety. It is suggested that your compressive strength criteria be raised to 120 PSI in order to avoid future changes should you choose to meet NRC standards.

33. 3-23 The free liquid criterion was reported as less than or equal to 3.0% at a June 21, 1989 presentation by WHC and USDOE. The text indicates 5%. Which limit will be used?

34. 3-23 40 CFR 268 toxicity levels are based upon the Toxicity Characteristic Leaching Procedure (TCLP) and not the EP Toxicity Test. Therefore, EP Toxicity results cannot be used to evaluate 40 CFR 268 applicability. Please correct. (40 CFR 268.40)

35. 3-25 Section 3.5.2 does not adequately provide sampling and analysis details of waste feed candidates. The application must provide more detailed information or reference the applicable documents containing these details. (173-303-300)

36. 3-25 How are sludges evaluated when sampling candidate wastes?

37. 3-25 Do sampling procedures change if the candidate waste must be "blended"? (173-303-300)

38. 3-38 Certain radionuclides should be included in toxicity testing. These radionuclides are not only considered radioactive but also toxic (i.e., uranium).

39. 3-43 It appears that the generator is the Tank Farm Surveillance and Operations Department. The transporter is also the T.F.S.& O. Department. Is the receiver and operator of the GTF also the T.F.S.& O. Department?

40. 4-3 How does the slope in the waste feed pipeline allow drainage back to the feed tank <u>and</u> TGE? It seems logical to think it could only drain one way or the other.

41. 4-3 How do 90-degree long radius bends alleviate the effect of thermal expansion or contraction?

42. 4-3 As per the Part A Application, a large percentage of the waste to be treated at this facility is corrosive. What is the effect of this waste on the carbon steel transfer line and distribution piping as well as other carbon steel equipment used in this facility?

43. 4-3 How much leakage must occur before leak detection sensor (LDE-621) is activated? This figure should be provided for all leak detectors in the GTF.

44. 4-4 The cover blocks should be described. What is their design and function?

45. 4-5 What does the symbol consisting of a circle with radiating lines indicate on Figure 4-1?

46. 4-7 What is the turn-around time for lab analysis of the dry blend? What is the frequency of this analysis?

47. 4-9 As stated on Page 4-8, "The rate at which dry material is fed to the mixer is important..." in light of this, why add an extra variable to the mixing proportions of dry material and waste feed by recycling baghouse (V33) dust back to the mixer? What are typical rates of baghouse dust production?

48. 4-10 What chemical will be used as the fluidizer? What is the function of the fluidizer?

49. 4-10 What chemical will be used as the set regulator? What is the function of the set regulator?

50. 4-10 What is the function of the air deentrainer?

51. 4-10 It should be noted that tributylphosphate is a dangerous material and that a spill or discharge of this material, or material with which this has been mixed, will be considered a dangerous waste. (173-303-101)

52. 4-10 R05 is the only fluidizer-metering pump, therefore, the sentence beginning with "Fluidizer-metering pumps R05, R06, and R07..." should be amended to read "Metering pumps R05, R06, and R07...".

53. 4-10 Describe the scenario when each of the three additives might be used.

54. 4-11 What decontamination fluids will be utilized?

55. 4-11 When flushing process piping and equipment, how is it known that all the grout slurry has been purged? If flushing does not commence before the slurry sets in this equipment, what is the disposition of the equipment?

56. 4-11 What is the destiny of decontamination fluids for each part of the system which may potentially be flushed?

57. 4-12 It should be noted that sodium hydroxide is a dangerous material and that a spill or discharge of this material, or material with which this has been mixed, will be considered a dangerous waste. (173-303-101)

58. 4-13 Provide a more specific description and analysis of the chemically resistant paint.

59. 4-16 The LCT, along with any other tank at the GTF which will contain dangerous waste must meet tank regulations irregardless of the duration they will store such waste. The application must include a list of these tanks along with their age and required certifications. (WAC 173-303-283 and -640)

60. 4-16 Is the only means to return LCT waste to the double-shell tank farms via the transfer pipe? If this is the only route, then does the possibility exist that grout operations will have to be discontinued if the LCT is filled with wastes which are unacceptable for reprocessing directly into the grout mixer?

61. 4-20 The last paragraph on this page is misleading. Ecology may require secondary containment on any or all of the tanks, irregardless of the presence or absence of listed wastes. Section 4.2.3.4.4 should be deleted. (173-303-640(4)(a)(i))

62. 4-24 Although the GTF will not store dangerous waste for over 90 days, an area must be designated for temporary storage until shipment away from the facility occurs. Indicate where this area will be located. (173-303-200)

63. 4-25 Definitive information on the leak detection cable should be provided.

64. 4-27 Will excavation for the first four vaults still be completed by FY 1989? If not, please amend this date.

65. 4-28 What is the thickness of the grout cap layer to be placed over the cover blocks?

66. 4-30 The waste/liner compatibility test data was not provided in April 1989. Please amend this date.

67. 4-30 The vault design report was not submitted in April 1989. Please amend this date.

68. 4-30 A discussion should be presented on the effects of 90 degree centigrade temperatures on liner materials. What is the expected duration that the liners will be subjected to such temperatures? If the duration exceeds 120 days, EPA Test Method 9090 should be run for a duration more closely depicting the disposal scenario. (173-303-665(2)(a))

69. 4-31 What length of time will the vault be subjected to hydrostatic testing?

70. 4-36 In addition to the described leachate detection/collection and removal system described here, the design must include a vadose zone monitoring system around each vault. This system is required to prove the ability of 1) the vault to retain the grout slurry and 2) the diffusion layer to channel leachate into the catch basin. This requirement may be suspended in future vaults pending results. (173-303-283)

71. 4-37 What is the composition of the "expected leachate"?

72. 4-41 The run-on/run-off control system was not submitted in April 1989. Please amend this date.

73. 4-47 The design of the relocatable vault exhauster was not submitted in April 1989. Please amend this date.

74. 5-22 After considering the first three paragraphs on this page, shouldn't the primary emphasis be to determine the differences in conductivities between these lithologies and what these hydraulic conductivities may actually be, or at least their ranges?

75. 5-23 New data from Dr. Gee (PNL) reported in 1987 and 1989 indicate recharge rates as high as 10 cm/yr on bare surface areas. These references should be considered in this discussion.

76. 5-25 What are the effects of the enlargement of B Pond and the decommissioning of U and Gable Mountain Ponds?

77. 5-29 Is there more recent information than that contained in Graham 1981 or Graham et al. 1984?

78. 5-39 See comment #75.

79. 5-42 The Elephant Mountain aquifer will discharge to the unconfined aquifer in this area as long as the heads in the confined aquifer are greater than the water table elevation. This fact should be noted.

80. 5-49 This page repeats part of page 5-42 and 5-51. Please delete this page.

81. 5-49 Should the reference in paragraph 6 be Figure 5-10 instead of Figure 5-13?

82. 5-49 Your reference to Graham et al. 1984 says that the discharge to the unconfined aquifer occurs near West Lake. Since the time that this report was prepared, B Pond has been enlarged and water levels are higher near B Pond. Discharge is possibly occurring from the unconfined to the confined aquifer near the 200 East Area and from the confined to the unconfined aquifer adjacent to West Lake as stated. Please discuss this possibility.

83. 5-51 The unit of ft^2/day is transmissivity, not hydraulic conductivity. Graham's tables are also listed as transmissivity, however, in m^2/day. Please correct.

84. 5-53 An outline of the GTF or waste management area should be indicated on Figure 5-22.

85. 5-62 The text must indicate the fact that "T" represents transmissivity and "b" represents the thickness of the aquifer. Please amend.

86. 5-64 Typo. Paragraph 3. "nearly" should be "nearby".

87. 5-64 An explanation for the high coliform bacteria counts in 1986 should be provided.

88. 5-66 The point of compliance may change as B Pond is decommissioned. The groundwater flow direction should change resulting in the upgradient wells becoming downgradient wells if natural groundwater flow is to the Columbia River from the 200 Areas. This fact should be taken into account in your discussions regarding point of compliance.

89. 5-69 Initial detection monitoring wells at the point of compliance may be required in the present upgradient position before postclosure occurs, if B Pond is decommissioned before postclosure activities begin. This fact should be noted.

90. 5-70 What effect will dilution have on this well? Will samples collected from this screened interval be equivalent to those collected from other upgradient wells?

91. 5-72 Has the model used to determine well locations been run using hypothetical conditions likely to be present when B Pond is decommissioned? If not, why not?

92. 6-2 See comment #40.

93. 6-2 See comment #33.

94. 6-3 A description of the LDCRS was not submitted in April 1989. Please amend this date.

95. 6-3 The control system design was not submitted in April 1989. Please amend this date.

96. 6-5 See comment #40.

97. 6-9 The reproduction of hazardous waste labels in Figure 6-1 has rendered one of the labels illegible. This page must be reproduced in a manner which allows the readability of all signs.

98. 6-13 The vault construction inspection plan was not submitted in April 1989. Please amend this date.

99. 7-1 The contingency plan should include a list of all equipment which contains potentially dangerous materials, both wastes and products, and remedial actions to be taken in the event of their discharge to the environment.

100. 7-19 The DOE-RL report should also include actions already taken to mitigate the situation. Please add this requirement. (173-303-145(3))

101. 7-20 WAC 173-303-082 is not applicable for spill notification. WAC 173-303-145 should be appropriately addressed in this section.

102. 7-21 Typo. "Tech- niques" should be "techniques".

103. 7-25 To avoid confusion with the 2727-S Nonradioactive Dangerous Waste Storage Facility, Building 616 should be added to the description of where containers should be delivered.

104. 7-26 See comment #103.

105. 7-26 Should liquids be detected in the LCDRS, it is not appropriate to return this liquid to the vault because the integrity of the vault is unknown. The leachate should be delivered to and held in some other storage vessel until the vault has been assessed. (173-303-650(5))

106. 7-29 See comment #103.

107. 8-14 Which of these courses, or which combination of courses, satisfies OSHA requirements requiring 40 hours of training for hazardous waste workers? (29 CFR 1910)

108. 9-1 The second sentence of the first paragraph should be amended from "...disposal of wastes designated as dangerous wastes will begin." to "...disposal of wastes designated as mixed wastes will begin.".

109. 9-1 The last sentence in the first paragraph should be amended from "...long-term containment of the dangerous constituents ..." to "...long-term containment of the dangerous and radioactive constituents...".

110. 9-2 Typo. "Federally" should be "federally" and "Federal" should be "federal".

111. 9-5 It is insufficient to only state that drinking water and withdrawal wells are not located within a three mile radius. What is the distance to the nearest such well, irregardless of groundwater gradients? Will this distance change after institutional control ends? This should be a consideration in pathway analysis.

112. 9-7 Drinking water standards, as per your reference, are given as chloride and fluoride. Table 9-2 lists these standards as chlorine and fluorine. Please amend.

113. 9-7 The MCL for fluorine presented here does not match the limit in the reference. Provide the source of your limit.

114. 9-7 It is not clear what units are applicable to the last column of Table 9-2. Are these numbers concentrations or dimensionless fractions? Please clarify.

115. 9-6 Comment #111. also pertains to the distance from the vaults to the nearest natural surface water.

116. 9-9 Should the word "clean" in the last paragraph on this page be amended to "cleaning"?

117. 10-3 Which evaporator is used to reduce decontamination solutions? If this evaporator is not located at the GTF, this should be stated. How are decontamination solutions transported to the evaporator?

118. 11-1 The format of closure/postclosure plans has been discussed with Ms. Carol Geier (WHC). In an effort to boilerplate dangerous waste documents, these discussions, and comments on previously submitted closure plans, should be taken into account when developing this closure/postclosure plan. The

GTF closure plan should be developed to at least the level of detail in the 183-H Basin closure plan.

119. 11-1 The engineering report was not submitted in April 1989. Please amend this date.

120 11-2 An additional closure performance standard should be added to provide concurrence with Mr. Troy Wade's (DOE-HQ) statement regarding closure of USDOE facilities. This statement addresses USDOE commitment to close its federal facilities in a manner which promotes maximum reclamation of the land.

121. 11-4 If in-ground components of the TGE cannot be decontaminated, will they be removed for dangerous waste disposal or does the possibility exist that parts of the TGE will be closed as a landfill?

122. 11-4 The sampling and analysis plans to be used for all closure activities must be included as part of this permit application. (173-303-610(3)(a))

123. 11-4 The closure plan should designate the locations where concrete, steel and soil background samples will be taken. (173-303-610(3)(a))

124. 11-4 A set number of vaults are to be constructed as per Action Plan milestone M-01-00. The discussion should reflect the requirements of this milestone.

125. 11-5 Disposal of double-shell tank wastes is no longer scheduled to begin in 1990. Please amend this date.

126. 11-9 The sampling of flushed solvents may not be adequate to determine the extent of contamination, if any, remaining in system piping. Describe this process in more detail to justify the use of this procedure. (173-303-610(3)(a))

127. 11-9 The "appropriate disposal facility" must be identified and justified. (173-303-610(3)(a))

128. 11-9 What constituents will be analyzed to prove the success of decontamination? (173-303-610(3)(a))

129. 11-10 The closure cover design was not submitted in April 1989. Please amend this date.

130. 11-11 What is the angle of repose for the GTF's grout mixture?

131. 11-12 The term "coefficient of permeability" should be replaced with "hydraulic conductivity".

132. 11-17 The desiccation effects upon a clay layer in a semi-arid environment should be discussed.

133. 11-17 The last line on this page is repeated on page 11-18 and should therefore be deleted.

134. 11-29 If the operational scheduling as described in this section exceeds the requirements of WAC 173-303-610, a request for extension, with justification, must be submitted to our office for approval. (173-303-610(4))

135. 11-29 Congressional approval of funding is not an adequate reason for the delay of treatment and closure activities. This factor must be deleted throughout the text.

136. 11-39 The Hanford Reservation is composed of a number of deeds. The required notification should address the plurality of deeds. Each deed affected by the GTF should be annotated. (173-303-610(10))

137. 12-6 The first sentence in Section 12.3 is incorrect. The Hanford Site <u>does</u> ship dangerous wastes offsite. Please amend this section accordingly.

138. 12-7 If a discrepancy is unresolved after 15 days, the Department of Ecology must also be notified. (173-303-370(4))

139. 12-11 The DOE-RL report should also include actions already taken to mitigate the situation. (173-303-145(3))

140. 12-12 See comment #101.

141. 12-13 See comment #136.

142. 3C-1 See comment #29.

143. 3C-2 GTF design and operations have changed significantly since this model was run. Therefore, the assumptions and parameters used should be reevaluated and the program rerun.

144. 4G-i This information was not provided in April 1989. Please amend this date.

145. 4H-3 Figure 4H-2 is missing. Please provide this figure.

146. 4I-i This information was not provided in April 1989. Please amend this date.

147. 4J-i This information was not provided in April 1989. Please amend this date.

148. 5A2-4 How recent are these procedures? Is there a newer method available to analyze for nitrates other than the phenyldisulfonic method?

149. 5B3-2 The water level in this well is averaged over 30 feet of screen. It is not satisfactory to compare these water levels to those of other wells with lesser screened intervals. Please address this issue.

150. 5B3-9 The use of military time precludes the need for AM and PM designations. Please correct.

151. 5B3-9 What was the discharge rate after 400 minutes? Did this discharge rate change drastically?

152. 5B3-14 The date of pumping as listed in Figure 5B-3.4 should be from August 31 to September 1, 1987 and not 1978. Please correct.

153. 5B3-14 It appears there is a possibility of delayed yield. A discussion of partial penetration effects should be included in the appendix text.

154. 5C1-8 Typo. "Well 299-E25-3<u>2</u> is a single completion well." should be "Well 299-E25-3<u>3</u> is a single completion well."

155. 5C1-13 The statement "The water is not turbid." is relative. What criteria is used to determine whether the water is turbid?

156. 5C1-14 Organic sampling will be conducted in the future. Therefore, wells must be constructed of materials agreeable to organic sampling.

157. 5C2-2 The assumptions are not very realistic assuming a conservative approach. Are you trying to match conditions to the model, when the model should match the conditions?

158. 5C2-3 There is a general breakdown in editing and checking the text in this section. The exponents are improperly written. Please correct.

159. 5C2-17 Units for the "Waste Concentration" column must be provided.

160. 5D1-1 If your sampling pumps are dedicated piston and submersible pumps, why do you use equipment for bladder pumps?

161. 5D1-4 Which wells have bladder pumps?

162. 5D1-8 The accuracy should be listed as "+/- 0.01 ft" not just to "+ 0.01 ft".

163. 5D1-9 The first line repeats the last line of page 5D1-8. Please delete.

164. 5D1-9 Steel tape method procedures should be repeated until two tape measurements agree within +/- 0.02 feet. In addition, the serial number or other identifying number of the measuring device should be recorded.

165. 5D1-12 The serial number or other identifying number of the conductivity meter should be recorded every time it is used.

166. 5D1-13 Typo. "Jingle" should be "Single". "calibration" should be "calibrated".

167. 5D1-14 Typo. "braking" should be "breaking".

168. 5D1-17 Is U.S. Testing Co. the only laboratory planned to be used for analyzing these samples?

169. 5D1-22 Typo. "TcO4-" should be "TcO_4^-" and "HNO^3" should be "HNO_3".

170. 5D2-5 The summation signs were left off of the equations. Please amend.

171. 5D2-8 The first two lines of the page are repeats of the last two lines of the previous page. Please delete.

172. 5D3-8 The conservative approach would be to control the false negatives rather than the false positives. It is more conservative to err on the side of the false positives. The statistical methods should be changed to accommodate this fact.

173. 8E-1 See comment #107.

174. 11A-i This information was not provided in April 1989. Please amend this date.

175. The QA/QC documentation will be required for all sampling and analysis activities. Please include a QA/QC plan.

ATTACHMENT 2
NOD Comments for the Grout Treatment Facility

1. Deficiency: Appendix 1, Section 4.4.4.2
The concrete composition for vault construction is not specified.

Recommendations:

This section should specify Type II cement with tricalcium aluminate (C_3Al) as indicated in Appendix 4E. This section should also specify concrete composition.

Air entrainment of 6 percent (more or less) should be considered in the concrete mix design to increase durability and moisture resistance. The proper amount should be verified through proper testing.

All aggregate used in the concrete should be alkali resistant. The following tests should be completed for aggregates to verify alkali resistance and chemical stability:

* o ASTM C 227 (mortar bar test)
* o ASTM C 289 (quick chemical test)
* o ASTM C 586 (rock cylinder test)
* (ASTM C 150 - 84)

2. Deficiency: Appendix 4E

The specification for concrete composition is incomplete.

Recommendation:
The concrete composition for vault construction should be specified completely as shown in Appendix 1, Section 4.4.4.2.

3. Deficiency: Appendix 4E

The test report is not adequate. No basis is presented for using a simulated double-shell tank solution as a test solution rather than free liquid after grout reaction with actual waste material. 40 CFR 270.21(b)(1) and 264.301(a)(1)(i) require that liner-waste compatibility testing demonstrate that liner strength and performance are still adequate after exposure to waste leachates and to the waste.

Recommendations:

The concrete and reinforcing steel should be testing for compatibility with actual grouted waste and free liquid after the grout reacts with the mixed waste. After the grout reaction, free liquid will probably constitute the highest salt solution in contact with the concrete.

Compatibility tests should demonstrate that the concrete and reinforcing steel are not adversely affected by exposure to test samples under maximum design load and with maximum expected temperature, including heat generated by hydration of the grout matrix. Compatibility tests should include a margin of safety for the maximum expected temperature in case 90°C is exceeded during hydration or afterward.

The impacts of surface drying and wetting of concrete and reinforcing steel should be evaluated.

The effects of the introduction of chemical impurities into the grout matrix from the addition of fly ash, blast furnace slag, or clays should be evaluated. These effects will be taken into account with test solutions consisting of free liquid after grout reaction.

Total organic carbon was not addressed in previous compatibility tests. The actual waste solution contains 3g/liter of total organic carbon and a number of inorganic constituents. Test solutions consisting of free liquid after grout reaction will take into account the effects of these constituents.

4. Deficiency: Appendix 1, Section 4.4.2.7

The compatibility of grouted waste and free liquid after the grout reaction with the proposed asphalt liner have not been addressed. The Part B indicates that these tests are ongoing, and results of these tests will be presented in the revised Part B at a later date.

Recommendations:

Compatibility tests for the proposed asphalt liner should be completed in accordance with 40 CFR 270.21(b)(1) and 264.301(a)(1)(i).

The asphalt liner (at a specified thickness) on a concrete surface should be tested for compatibility with the grouted

waste and free liquid after the grout reacts with the mixed waste. Any effects of total organic carbon and inorganic constituents should be addressed in the test results.

Compatibility tests should demonstrate that the asphalt liner on concrete is not adversely affected by exposure to test samples under maximum and minimum hydraulic design conditions and with maximum expected temperature, including heat generated by hydration of the grout matrix. Compatibility tests should include a margin of safety for the maximum expected temperature in case 90°C is exceeded during hydration or afterward.

Compatibility tests should demonstrate that the asphalt liner on concrete is not adversely affected by abrasion, which is expected to occur along the interior walls of the vault as the grout is flowing into and filling the vault. These tests should be conducted at the maximum expected temperature of the grouted waste, including some margin of safety greater than 90°C.

Commercially available asphalt materials used for surface protection include at least two different products. Review of the properties of these two products indicates that both will soften and flow in the range of 85 to 120°C and would not be suitable for use under a design condition of 90 to 100°C. It may be possible that chemical additives can be added to the asphalt to prevent softening and flowing from occurring at maximum design temperatures.

Alternatives to the asphalt liner should be investigated. Alternate materials such as HDPE may be viable options for the interior of the disposal vault. Alternate lining systems will require careful consideration and pilot testing to overcome potential problems. One such potential problem is the high viscosity of the grout flow which could cause tearing of the liner system. Expansion and contraction of the liner material with a change in temperature is also a potential problem. In the case of HDPE which has a high coefficient of expansion, a change in temperature from 0°C to 100°C will expand the material 1 ft. in 100 ft. An HDPE liner or other synthetic liner will require an anchor system for support along the 34-ft. high vertical walls of the vault. In some cases, a batten anchor system can be used to anchor liner material to concrete. The batten anchor system consists of a series of stainless steel strips and bolts with neoprene washers. Compatibility testing of alternate liners with the grout-waste matrix and free liquid after grout reaction will be necessary. Pilot testing of the anchor system to a vertical concrete wall

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with grout flow at maximum design temperature should also be performed to guard against possible tearing of the liner material.

5. Deficiency: Appendix 1, Section 4.4.3.1.2

This section, which describes the leachate detection and collection and removal system does not clearly describe the HDPE and secondary liner system.

Recommendation:

The revised Part B application should provide greater detail regarding the lower liner system. The information available does not clearly describe how the HDPE liner will be protected from high point loading imposed by the gravel drainage media. A number of options should be considered to minimize point loading. For example, a layer of abraded rock smaller in size than the gravel drainage media could be placed on top of the HDPE liner to reduce point loading. A geotextile cushion fabric under the HDPE would also reduce point loading. All gravel materials used for the lower liner system must be sized to prevent plugging of the 4-in. perforated collection pipe.

6. Deficiency: Appendix 4H

The flexible membrane liner-waste compatibility test report is inadequate. No basis is presented for using a simulated double-shell tank solution as a test solution rather than free liquid after the grout reaction with the mixed waste material. 40 CFR 270.21(b)(1) and 264.301(a)(1)(i) require that liner-waste compatibility tests demonstrate that liner strength and performance are still adequate after exposure to waste leachates.

Test solutions used has a greater concentration of inorganic salts than the actual double-shell tank solution. The test solutions also had no concentration of total organic carbon. However, the actual double-shell tank solution has 3g/liter of total organic carbon. Therefore, the data base is not adequate for evaluating of the suitability of this liner material.

The effects of radiation exposure on the liner as reported is incomplete. Test results of the effects of radiation exposure on the liner were reported only on the dimensional measurements.

The test report did not summarize or discuss the test results and conclusions as to the suitability of the synthetic liner.

Recommendations:

The 60-mil HDPE liner should be tested for compatibility with free liquid after grout reaction with actual mixed waste.

EPA Method 9090 compatibility test for wastes and membrane liners should be used in completing the tests. The test results should also address the effects of radiation pertaining to visual, tensile, and hardness aspects of the liner.

Compatibility tests should demonstrate that the 60-mil HDPE liner is not adversely affected by exposure to test samples under maximum design load and actual design conditions and with maximum expected temperature including heat generated by hydration of the grout matrix. Compatibility tests should include a margin of safety for the maximum expected temperature in case 90°C is exceeded during hydration or afterward.

The effects of the introduction of chemical impurities into the grout matrix from the addition of fly ash, blast furnace slag, or clays should be evaluated. These effects will be taken into account with test solutions consisting of free liquid after grout reaction.

7. Deficiency: Appendix 1, Section 4.4.3.5

This section on systems compatibility is not clear or complete concerning corrosion resistance of carbon steel components of the LDCRS system. Results of compatibility tests for carbon steel with this waste environment have not been provided.

Recommendations:

Carbon steel materials should be tested for compatibility with free liquid after grout reaction with actual mixed waste. The Chemical Engineering Handbook indicates that the usefulness of carbon steel in solutions containing NaOH, $NaNo_3$, or NaCl is limited due to expected corrosion rates.

With an NaOH solution greater than 50 percent, and with a temperature of 200°F, the expected corrosion rate is greater than 0.05 in. per year. With an NaOH solution less than 50 percent and with a temperature of 200°F, the expected corrosion rate is less than 0.02 in. per year. Proper test data should be provided to verify the stability of carbon steel in this environment.

Alternative materials to carbon steel should be considered for the leachate collection sump, pipe riser and connecting piping. Stainless steel and other materials should be considered and compatibility test data should be provided to verify its stability in this waste environment.

Corrosion protection for the LDCRS system should be verified. A cathodic protection system will require period maintenance that may be very difficult to perform and may not be adequate by itself for a long period of time. Protective coating materials should be considered. A section of the pipe riser above the high liquid level of the sump will also be subject to a degree of both interior and exterior corrosion. Test data should be provided to verify the adequacy of all coating materials specified.

8. Regulations for landfills require that two or more liners and leachate collection systems be provided; one above the upper liner and one between such liners. If this double liner arrangement is not used then an alternate design must be employed that is at least as effective as the double liner arrangement. The liner system being designed for the grout waste disposal vaults includes an upper and lower liner but provides only one leachate collection system which is located between the liners. Should leachate leak through the vault walls or floor it will be contained and removed above the lower liner. However, the disposal system does not provide a backup leachate containment and collection system should the first one fail.

Using a buried concrete vault and catch basin as a disposal system for a grouted waste is a sound approach, and it is apparent that a substantial effort has gone into the conceptual design of the disposal system. At this time, however, the EPA has some concerns whether the current system meets the alternative design criteria stated in the regulations. Based on the information provided in the Part B permit application, an area of utmost concern and uncertainty is the asphalt liner on the inside surface of the vault. As pointed out in this report, a number of potential problems need to be addressed for any type of liner installed on the inside surface of the vault. The potential for free liquid inside the vault during the filling and curing periods is high. Also, filling of the vault could occur in stages due to disruption of grout mixing equipment, pumps, or piping. This could contribute to an increased amount of free liquid inside the vault. The behavior of a grouted waste can be complex and sometimes unpredictable for a waste mixture containing a substantial amount of organic constituents. This could

also contribute to an increased amount of free liquid inside the vault.

Instead of trying to meet the alternative design criteria, another option would be to install another concrete catch basin and leachate collection system just below the catch basin presently being designed. This would fulfill the double liner requirement of the regulations.