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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7601 W. Clearwater, Suite 102 • Kennewick, Washington 99336 • (509) 546-2990

October 1, 1993

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Mr. Steven H. Wisness
U. S. Department of Energy
Richland Field Office
P.O. Box 550
Richland, WA 99352

Dear Mr. Wisness:

Re: N Springs Expedited Response Action (ERA) Proposal, Draft A (DOE/RL-93-23) regulatory comments 39336

The Washington State Department of Ecology, as the lead regulatory agency, in cooperation with the United States Environmental Protection Agency, Region X Hanford Project Office, has reviewed the document and prepared the enclosed comments. Ecology finds the document lacking in sufficient detail as to support the implementation of the preferred alternative. We look forward to receiving a response to the comments by October 31, 1993, which addresses our concerns and provides a clear pathway to the selection and implementation of an alternative.

Should you or your staff have any questions concerning the enclosed comments, please contact me at (509) 736-3029.

Sincerely,

Phillip R. Staats

Phillip R. Staats
Unit Manager
Nuclear and Mixed Waste Management Program

PS:mf
Enclosure

cc: Mr. Brian Foley, DOE
Ms. Pam Innis, EPA
Administrative Record

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ECOLOGY COMMENTS
ON THE
N SPRINGS EXPEDITED RESPONSE ACTION PROPOSAL
DOE/RL-93-23 DRAFT A

General Comments:

The N Springs Expedited Response Action Proposal provides a comparison of treatment alternatives to be used in the abatement of contaminant flow from the 100 N area to the Columbia River. This outflow is and has been occurring through the N Springs seeps located north of the N Reactor.

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The efficiency of the alternatives discussed were evaluated using differing criteria and modelling programs. As an example, the pump and treat options used the Maximum Contaminant Level (MCL) of 8 pCi/L as a standard with the FLOWPATH model which provides a zone of capture, but does not indicate the Sr-90 flux to the river. The vertical barrier option was said to have achieved the goal of reducing 50% of the Sr-90 > 1000 pCi/L and used the PORFLO-3 model which produced a potentiometric graph indicating a Sr-90 reduction significantly similar to the no action alternative. The lack of consistent evaluation criteria and directly comparable data prevents the reader's ability to agree or disagree with the document's selected alternative.

1. Executive Summary, page 1, paragraph 4

   Deficiency: If the current MCL for Sr-90 is 8 pCi/L (40 CFR 141), with a proposed limit of 42 pCi/L (FR Vol.56, No.138, July 18, 1991) then why is 50% of the Sr-90 >1000 pCi/L being used as the performance standard by which the alternatives are evaluated?

   Recommendation: The criteria used to evaluate the alternatives should reflect longterm objectives and the eventual abatement of the contaminant level to a current or projected regulatory limit. Select and provide justification for a single performance standard to which all of the alternatives can be evaluated against.

2. Executive Summary, page 3, paragraph 2

   Deficiency: The N Springs proposal is currently being considered as an expedited response and should therefore be limited in scope to a one to two year time period as per section 104(b) of CERCLA.

   Recommendation: Re-evaluate the project after two years and determine the transitional needs of conversion to an IRM.

3. Executive Summary, page 3, paragraph 3

Deficiency: A reference is given for the PORFLO-3 model but not for the FLOWPATH model. The comparative table of capture zone efficiencies reflects a reduction of 100% of the Sr-90 >1000 pCi/L being achieved by the vertical barrier. This information is contradicted by figure 6-7, which presents an essentially identical result as the no action alternative shown in figure 6-1.

Recommendation: Include a reference for the FLOWPATH model. Revise the document to reflect the correct efficiency of the vertical barrier or expand the document to include a direct comparison of the no action alternative and the vertical barrier alternative.

4. Executive Summary, page 4, paragraph 2

Deficiency: Figure 1 is referenced, however, there is no figure 1 in this section of the document. Shouldn't this reference be to figure 7-1?

Recommendation: Correct this error.

5. Executive Summary, page 5, first bullet

Deficiency: The statement is made that the slurry wall offers complete reduction of the Sr-90 flux to the river for concentrations >1000 pCi/L at a reasonable cost. If the potentiometric graph presented in figure 6-7 is correct, then this statement is incorrect.

Recommendation: Revise the document appropriately.

6. Executive Summary, page 5, seventh bullet

Deficiency: The statement is made that the slurry wall alternative complies most fully with ARAR, while the no action, pump and treat, and hydraulic controls are uncertain.

Recommendation: Provide supporting information to substantiate this statement.

7. Section 1.0, page 1-1, paragraph 2

Deficiency: The strategy for the N Springs is to eliminate or substantially reduce, not restrict, the Sr-90 transport to the river.

Recommendation: Revise the statement accordingly.

8. Section 2.1.1, page 2-1

Deficiency: Figure 2-2 is referenced, which is a site map with landmarks that are not marked on the map.

Recommendation: Mark the figure with referenced landmarks (i.e., 100N and 600 area).

9. Section 2.1.5.1, page 2-3, paragraph 1

Deficiency: The Ringold is not divided into five units. According to Lindsey (1992), the Ringold contains five facies types and also contains five units (A through E), which represent the gravel facies. Also, the statement that only units A, C, and E are present is incorrect. Units B, LM, and UR are also present. The stratigraphy of the 100 N Area shown in Figure 2-3 also includes unit B.

Recommendation: Revise the document to correct these discrepancies.

10. Section 2.1.5.1, page 2-3, paragraph 3

Deficiency: The combination of the use of "Units 1-3" with the Lindsey (1992) definitions of the Ringold Formation is confusing. The Lindsey approach is based on the terminology used by Delaney, Lindsey, and Reidel (1991) in a document that was apparently intended to establish a "standardized text" for use at Hanford. A single approach to the definition of the geohydrologic units would be helpful.

Recommendation: Revise the document accordingly.

11. Section 2.1.6.1.1, page 2-5, paragraph 2

Deficiency: The statement is made with regard to the Ringold Confined Aquifer "B" that no hydraulic data are available for this confining unit, but the clay and silt are expected to restrict both horizontal and vertical flow in the 100 N Area (DOE/RL 1992b). This is a large assumption upon which to base the investment of an alternative which might prove useless.

Recommendation: Since the effectiveness of a vertical barrier is dependent upon the assumption that vertical and horizontal flow will be restricted, then its cost/benefit analysis should reflect the field investigation necessary to verify a confining layer does exist.

12. Section 2.1.6.1.2, page 2-5, paragraph 4

Deficiency: The statement about the correlation of water-level changes with river-level changes is not completely consistent with the paper referenced (Gilmore et al.,m 1991). The reference states that water levels are affected within 650 feet of the river by both seasonal highs and lows, while water levels 750 to 1000 feet from the river are affected only by seasonal highs, and water levels greater than 1000 feet from the river are unaffected by seasonal highs or lows.

Recommendation: The text should be revised to be consistent with the reference.

13. Section 2.1.6.1.2, page 2-6, paragraph 5

Deficiency: The estimated transmissivity range near the two LWDFs is given as 6,770 to 27,000. The reference (DOE/RL, 1991b) contains values ranging from 5,800 to 27,000 (there is no 6,770 value in Table 2-4 of the reference).

Recommendation: Revise the document to include the proper range.

14. Section 2.1.6.1.3, page 2-6, paragraph 1

Deficiency: Reference is made to the fact that perched water was encountered during the drilling of one well near 116-N-3 and that no other perched water was encountered during activities. The relevance of this encounter should be expanded.

Recommendation: Identify the location of all wells drilled during this campaign and provide an evaluation of the relevance of the perched water.

15. Section 2.1.6.1.3, page 2-6, paragraph 2

Deficiency: The vertical hydraulic conductivities determined by Connelly et al. (1991) are stated as being representative of the area surrounding the LWDF. This is true, but it should be pointed out that Connelly et al. also stated that their values applied only to the materials directly below the ponds and that these values are much lower than elsewhere in 100 N (due to clogging with fines?).

Recommendation: Revise the text to reflect the confining nature of the values presented in the reference.

16. Section 2.1.6.2, page 2-6, paragraph 2

Deficiency: The paragraph states that there are no Federal Emergency Management Agency floodplain maps for the Hanford Reach, while section

6.3.1, page 6-13, paragraph 2, states that slurry wall cannot be placed within 100 ft. of the Columbia River as it would be in the 100 year floodplain and thus trigger wetlands analysis. Which statement is correct, are there or are there not floodplain maps for the Hanford Reach?

Recommendation: Provide the applicable floodplain map for the Hanford Reach and revise the document accordingly.

17. Section 2.2.1.1, page 2-12, paragraph 3

Deficiency: Tritium is discussed as being a product of nuclear reaction which was discharged to the Liquid Waste Disposal Facilities (LWDF), however, it is not included on tables 2T-1, 2T-2, or 2T-3.

Recommendation: Please include a volume for the discharge of tritium on each of the above mentioned tables.

18. Section 2.2.1.1, page 2-12, paragraph 5

Deficiency: A reference is made to a National Pollutant Discharge Elimination System (NPDES) permit for the monitoring of discharges to the Columbia River via the N Springs. A copy of this permit is not included with the document.

Recommendation: Include a copy of the NPDES permit along with the most recent quarterly analysis.

19. Section 2.2.1.2, page 2-12, paragraph 3

Deficiency: The statement is made that discharges to the 1325-N facility ceased in 1991. Can the reader assume that both 1301-N and 1325-N are no longer needed in support of the N Reactor?

Recommendation: Please include a statement which clarifies the current status of each unit.

20. Section 2.2.3, page 2-14, paragraph 3

Deficiency: By comparing the Sr-90 contours in Figures 2-7 and 2-9, the conclusion is reached that Sr-90 remained steady near the 1301- N LWDF and N Springs from 1990 to 1993. Comparing contours can be misleading because the contours reflect a certain amount of interpretation. A better approach is to compare values at individual wells. Those wells nearest to 1301-N and N Springs are N-2, N-3, N-14, and N-67. Only two of these wells (N-3 and N-14) show values for both 1990 and 1993, and both indicate increases in Sr-90 (from 607 to 837 and 987 to 1210, respectively).

Recommendation: Include a statement clarifying the data and the fact that an increase in Sr-90 occurred in the above referenced wells.

21. Section 2.2.3, page 2-14, paragraph 4

Deficiency: It is stated that tritium concentrations near 1301-N LWDF have remained steady from 1990 to 1993. However, well N-3 is near 1301-N, and it experienced a decline from 1990 to 1993. It is also stated that tritium has declined near 1325-N and increased near N-41. However, N-41 is near 1325-N.

Recommendation: This paragraph should be clarified.

22. Section 2.2.3, page 2-14, paragraph 5

Deficiency: A sulfate plume is mentioned, but no detail is given. Examining the data in HEIS, it is apparent that a plume can be fairly easily defined (with maximum concentrations in excess of 500,000 ppb) and is now merging with the Sr-90 plume.

Recommendation: Include a plume map of the sulfate extent and a discussion of its possible interaction with the Sr-90 plume.

23. Section 2.2.3, page 2-15, paragraph 6

Deficiency: The text references Figure 2-11 for results of analyses of water samples collected from wells placed in adjacent springs and seeps that discharge to the river. No discussion of the results is included.

Recommendation: Provide a discussion of the results in terms of the relevant increase or decrease in the contaminant levels.

24. Figures 2-7 through 2-10, pages 2F-7 through 2F-10

Deficiency: Do the contours shown agree with the concentrations observed at the springs? Concentrations in the groundwater should be equal to or greater than those observed at the springs. Also, the locations of wells N-2, N-67, and N-59 on Figures 2-7 and 2-8 appear to be different than those on Figures 2-9 and 2-10.

Recommendation: Ensure that the figures reflect the data accurately and that the well locations are consistent.

25. Figure 2-8, page 2F-8

Deficiency: Well N-27 is shown on the figure, but no tritium value is given.

Recommendation: Provide a value for this location or remove the reference point from the figure.

26. Figure 2-9, page 2F-9

Deficiency: There are a large number of wells on the figure with no matching Sr-90 data. These only make the figure harder to read and give a misleading impression of a greater amount of data than is really present. Also, the contours should be labeled.

Recommendation: Provide a figure which indicates only those wells which have data available and label the contours appropriately.

27. Figure 2-9, page 2F-9

Deficiency: Well N-67 does not show a Sr-90 concentration for 1993.

Recommendation: Provide a concentration for this well on the figure.

28. Table 2-4, pages 2T-4a through 2T-4c

Deficiency: Error values are presented along with results of analyses for several radionuclides and uranium (chemical). The term "Error" in the last column of this table is not defined, but should be so that the purpose of the error values can be understood.

Recommendation: Provide a definition for the term "Error."

29. Section 3.1, page 3-1, paragraph 1

Deficiency: The statement is made that Co-60, while present at levels in groundwater samples below regulatory limits, needs to be considered in the design of any treatment system. Where in the document is Co-60 considered as a contaminant of potential concern which is addressed with a treatment system?

Recommendation: Include a section which addresses Co-60 with a treatment methodology.

30. Table 3-1, page 3T-1b

Deficiency: Table 3-1 should include the water quality criteria developed under Section 304 of the Clean Water Act as an ARAR.

Recommendation: Include the water quality criteria developed under Section 304 of the Clean Water Act as an ARAR.

31. Table 3-4, page 3T-4

Deficiency: This table should include as potential ARARs 40 CFR Parts 261 and 262, which require that anyone who generates a solid waste must determine whether that waste is hazardous.

Recommendation: Include 40 CFR Parts 261 and 262 as potential ARARs.

32. Table 3-7, page 3T-7

Deficiency: The federal location-specific ARARs table should include the floodplains and wetlands requirements of 40 CFR Part 6, Appendix A; 40 CFR part 230; and 33 CFR Parts 320-330.

Recommendation: Include the requirements of 40 CFR Part 6, Appendix A; 40 CFR part 230; and 33 CFR Parts 320-330.

33. Section 4-0, page 4-1

Deficiency: The version of the 100 Area Feasibility Study, Phases 1 and 2 (DOE/RL 1992a), has been significantly revised after regulatory comment and should not be referenced.

Recommendation: Either reference the new version of the FS, provided it is transmitted to the regulators, or delete the reference completely.

34. Table 4-1, page 4T-1b

Deficiency: Supported liquid membrane is identified as a technology in Table 4-1. Section 5 refers to this technology as selective liquid membrane.

Recommendation: The inconsistency should be corrected.

35. Section 5.2.2.5, page 5-4

Deficiency: Sedimentation sludge can be dewatered or solidified and then properly disposed.

Recommendation: The text should be changed to include solidification.

36. Section 5.2.3.2, page 5-5, paragraph 1

Deficiency: The pump and treat options discussed in this section include the disposal of effluent to the N Area and 200 Area, however, both options are dismissed as requiring a waiver of Milestone M-17.

Recommendation: The pump and treat options should be reevaluated to address not only Sr-90 but also the other contaminants of concern (re: section 3.1, page 3-1, paragraph 1). As an example, by using this option with BAT the Sr-90 could be effectively removed while controlling the flow of tritium to the Columbia River by placing the groundwater in a continuous treatment loop with the interim point being the 1325-N facility until such time as effective treatment technology could be employed to remove the tritium. This method also significantly reduces environmental and human exposure through a contained and controlled treatment of the contaminants. Reevaluate this option using 1325-N as the receiving point and provide potentiometric graphs which depict its effectiveness on the flow of contaminants to the river. Revise the cost/benefit analysis accordingly.

37. Section 5.2.3.3, page 5-5

Deficiency: Reinjection is considered as a treated water disposal option. In this option, injected water would flow through the aquifer and into the river without impacting clean vadose zone soil and contaminated plume movement. It appears that the treated water containing tritium would be injected into a clean aquifer at a location in the N Area, injected water does not allow sufficient travel time for tritium decay. Further, clean aquifer sediments may become contaminated with tritium through injected water.

Recommendation: The limitations of this option should be clearly identified based on professional judgement and modeling results.

38. Section 5.2.4.1, page 5-5

Deficiency: The uncertainties of applying the slurry wall in the Hanford formation are not discussed in this section.

Recommendation: Revise the text to reflect the uncertainties involved with installing this option in the geologic conditions which exist.

39. Section 5.2.6.3, page 5-8, paragraph 2

Deficiency: The statement is made that no performance data are available for this option.

Recommendation: One such reference is A Practical Manual for Planning and Designing Urban BVPs., Thomas R. Schuel; 1987, Metropolitan Washington Council for Governments, Washington, D.C.

40. Section 6.0, page 6-2, paragraph 3

Deficiency: The N Springs proposal is currently being considered as an expedited response action and is therefore limited to one to two years in scope under section 104(b) of CERCLA.

Recommendation: It may be appropriate to re-evaluate this project after two years and determine whether it should be considered an IRM.

41. Section 6.1.1, page 6-3, paragraph 2

Deficiency: It is stated that the Connelly model was calibrated to pre-disposal groundwater conditions (July 1965). The model (as described in the Connelly document) appears to have been calibrated by comparing arrival times of a non-sorbed radionuclide. Therefore, it was apparently not calibrated to pre-disposal conditions. The Connelly report also states that the calibration time was July 1969 (and states that 1301-N started being used in Late 1963). This document gives a 1964 starting date.

Recommendation: Revise the text to reflect the correct reference and dates.

42. Section 6.1.1, page 6-4, paragraph 2

Deficiency: It is stated that Sr-90 decreases from 6,200 pCi/L in 1990 to about 1,000 pCi/L in 2002. It is not clear as to where this decrease is taking place. At the Columbia River? If so, the Connelly report appears to show large areas of between 1,000 and 5,000 along the river as of 2005.

Recommendation: Provide clarification of the decrease if any, and its location.

43. Section 6.1.1, page 6-4, paragraph 2

Deficiency: It should be noted that the groundwater levels and Sr-90 concentrations on Figure 6-1 are as predicted by the modeling for 2002.

Recommendation: As stated above.

44. Section 6.1.1, page 6-4, paragraph 2

Deficiency: The Sr-90 concentrations predicted by the Connelly model should be compared to those actually observed for 1990 and 1993. How well was the model predicting at these points in time. It appears that the 1990 prediction is relatively good for the areas near the river, but shows large areas near the sources of >10,000 pCi/L while the measured concentrations show a maximum value of 8986 pCi/L and include values of <2,000 pCi/L in areas where the model indicates >5,000 pCi/L.

Recommendation: Use the concentrations available from 1990 and 1993 in the model and correct or explain any discrepancies between the measured concentrations and the model.

45. Section 6.1.1, page 6-4, paragraph 2

Deficiency: It should be stated that the Connelly model used the 1964 regional water-table to construct the constant-head boundaries of the model. These boundary conditions were used in all model runs (including the predictive runs). Have the values used (1964 conditions) been checked versus the newer water-level data? Are there any significant differences?

Recommendation: Include a statement in the text which addresses which water levels were used and whether the data has been compared with existing levels. Explain any differences in the levels which may be discovered.

46. Section 6.1.2, page 6-5, paragraph 1

Deficiency: The statement is made that the five well system was modeled using PORFLO-3, yet no potentiometric graph was included in the document.

Recommendation: Include a potentiometric graph for the five-well system so as to enable the reader an ability to directly compare the effectiveness of this treatment process with others described in the document.

47. Section 6.2.1.1.1, page 6-6, paragraph 4

Deficiency: No description is given of the boundaries used in the FLOWPATH modeling.

Recommendation: Provide the boundaries used in the FLOWPATH modeling.

48. Section 6.2.1.1.1, page 6-6, paragraph 4

Deficiency: It is stated that each well system was centered directly upgradient from the N Springs showing the highest levels of contamination (near well N-8T). This does not seem to be the case when Figures 6-3 and 6-4 are compared with Figure 2-2. It appears as if the downstream ends of the well systems are placed at N-8T.

Recommendation: Ensure that the figures are consistent with the text.

49. Section 6.2.1.1.2 and 6.2.1.1.3, page 6-6

Deficiency: The one year capture percentage is presented for the three-well and five-well systems, but the capture percentages for 2- and 5-year durations and for steady-state conditions are not reported. Since capture zones were calculated for 2- and 5-year durations and for steady-state conditions (Section 6.2.1.1.1), capture zone percentages for these conditions should also be presented so that the relative long-term effectiveness of each pumping case can be evaluated.

Recommendation: Include the capture zones for the 2- and 5-year durations as well as for the steady state condition.

50. Section 6.2.1.2.1, page 6-8, paragraph 3

Deficiency: The text states, "spent media and filter wastes are estimated to be about 8,000 cubic feet per year (ft^3/yr) . . . groundwater."

Recommendation: The basis for this estimate should be identified.

51. Section 6.2.1.2.2, page 6-9, paragraph 4

Deficiency: The reverse osmosis option is evaluated against the MCL standard of 8 pCi/L for Sr-90. Which standard are the alternatives being evaluated against, the MCL or 50% of the Sr-90 >1000 pCi/L?

Recommendation: Revise the criteria to which all of the treatment options are evaluated to reflect the current MCL of 8 pCi/L for Sr-90.

52. Section 6.2.1.2.2, page 6-9, paragraph 5

Deficiency: The evaporator-bottoms stream solids may be disposed of as low-level waste provided no hazardous wastes are contained within the solids.

Recommendation: Provide references that indicate no hazardous wastes are contained in this waste stream.

53. Section 6.2.1.3, page 6-9, paragraph 2

Deficiency: It is stated that the 1993 maximum Sr-90 is 80,000 pCi/L and is located just downgradient of 1325-N. In Figure 2-10, the maximum appears to be a value of 80,900 at N-14 (near the Columbia River), while the maximum value near 1325-N is 76,800 (at N-32).

Recommendation: Revise the text to reflect the information presented in the figures.

54. Section 6.3.1, page 6-13, paragraph 1

Deficiency: It is stated that the slurry wall causes a "reduction in groundwater gradient" behind it. This is somewhat misleading. The slurry wall redirects the flow, resulting in a decreased gradient perpendicular to the wall and an increased gradient parallel to the wall.

Recommendation: Revise the text to clearly indicate the expected gradient increase/decrease.

55. Section 6.3.1, page 6-13, paragraph 1

Deficiency: It should be stated that the slurry wall, by raising the water table behind the wall and redirecting flow parallel to the wall, will result in the possibility of remobilizing Sr-90 that is now in the vadose zone and in spreading Sr-90 to parts of the aquifer previously unaffected by the Sr-90 plume. Also, the rise in water table may result in more of the gravels of the Hanford formation becoming saturated. This could produce increased groundwater velocities (preferential pathways) which are not taken into consideration by the model (single hydraulic conductivity). This in turn could lead to faster movement of the Sr-90 plume.

Recommendation: Include a discussion in the text which addresses the resulting pressure gradients and their affect on the Sr-90 plume.

56. Section 6.3.1, page 6-13, paragraph 1

Deficiency: The Sr-90 flux to the river in 2002 is compared for the slurry wall and the no action scenario. It would be useful to also include the total Sr-90 fluxes to the river for the period up to 2002 for both scenarios.

Recommendation: Include the Sr-90 fluxes for each alternative for the period up to 2002.

57. Section 6.3.1.2, page 6-15, paragraph 2

Deficiency: The text states that the chief advantage to deep soil mixing is that it does not require removal of contaminated soil, thereby eliminating contaminated soil or water disposal problems. However, the slurry wall, constructed by mixing contaminated aquifer sediments with slurry materials, may become fully loaded with contaminants. This may not meet the criterion of providing ultimate long-term mitigation of threats to human health and the environment (EPA 1987) unless the slurry wall (with a volume of approximately 30,00 cubic yards) is removed and treated in the final remediation phase. The additional work and cost associated with remediating the contaminated slurry wall may also not meet the secondary ERA objective--that a removal action be compatible with remedial actions planned for the operable unit and contribute to the efficiency of the remedial action to be taken (page ES-1).

Recommendation: Include discussion in the text which addresses how the slurry meets the objective of providing long-term mitigation and how it will integrate with remedial actions planned for this operable unit.

58. Section 6.3.2, page 6-15

Deficiency: Table 6-19 is referred to as presenting a technical feasibility evaluation of a slurry wall installed by deep soil mixing. The table states that the source to receptor pathway is restricted; therefore the alternative complies with ARAR. This statement is unsupported by the document.

Recommendation: Provide a discussion and supporting evidence as to how this alternative meets ARAR.

59. Section 6.3.5, page 6-15

Deficiency: This statement refers the reader to Table 6-22, which summarizes the environmental impacts of installing a slurry wall. Table 6-22 states that 1) surface hydrology and quality will be improved as a result of restricting flow of contaminants into the river, and 2) groundwater hydrology in the N Area is altered.

Recommendation: Include a discussion of how surface hydrology and quality are improved by the installation of an in-ground slurry wall. The document states that the groundwater is altered as a result of installing the slurry wall however, there is no discussion of the increased hydraulic gradient which will occur in front of the wall as well as the potential of a decreased gradient or river influx behind the wall. There also exists the likelihood that an increased gradient in front of the wall will simply cause the groundwater to flow around. Have the impacts of increased/decreased pressure gradients been evaluated and planned for with this option and if so what are the impacts to groundwater flow?

60. Section 6.4.1, page 6-16, paragraphs 3 and 5

Deficiency: This option was assessed using the FLOWPATH model which resulted in an approximate 50% reduction of Sr-90 >1000 pCi/L into the Columbia River; however, it is stated as not to having met ARAR. The slurry wall which also achieved 50% reduction of Sr-90 >1000 pCi/L is stated as having met ARAR (re: section 6.3.1, page 6-13). A consistent standard is important in determining the most effective alternative. Although hydraulic control does not involve treatment its physical effects on other contaminants should be included. No potentiometric graph for this option is included.

Recommendation: Choose a single standard to which all alternatives can be evaluated. Please include a discussion of the effects of this option on other contaminants of concern, particularly tritium. Include a potentiometric graph of the effectiveness of this option.

61. Figure 6-7, page 6F-7

Deficiency: The simulated water levels are highly constrained by the constant-head boundaries used in the model. The actual response of the system might be such that the rise in water levels is not sufficient to move water around the upstream end of the wall (all flow would be around the downstream end). This would result in a greater gradient in the downstream direction and therefore greater velocities, which would mean a faster rate of movement of the Sr-90 plume to the river.

Recommendation: Has this scenario been evaluated with respect to the slurry wall alternative? Include a discussion of this possibility.

62. Table 6-6, page 6T-6a

Deficiency: The 200 Area crib disposal option, includes construction of a long pipeline that will be vulnerable to earthquakes.

Recommendation: If earthquake effects are considered for this alternative, they should be considered for every alternative, or the reasoning for not considering them should be included.

63. Section 7.1.1.1, page 7-1, paragraph 1

Deficiency: This section states that the vertical barrier offers the greatest potential for meeting the 8 pCi/L for Sr-90 and would be most effective for reducing the Sr-90 flux to the river. The text also states that the five-well pump-and-treat system has the second best flux reduction potential compared with the slurry wall alternative. This statement is based on the one-year capture percentage for the five-well system. The flux reduction of the pump-and -treat system, however, may be greater than the slurry wall alternative in subsequent years. Hence, the five-well pump-and-treat system may be as effective as the slurry wall in reducing the Sr-90 flux to the river for long term effectiveness.

Recommendation: The statement that the five-well pump-and-treat system has the second best flux reduction potential compared with the slurry wall alternative should therefore be justified by additional modeling results.

64. Section 7.1.1.1, page 7-1, paragraph 2

Deficiency: The gradient has not been reduced, the flow direction has been altered.

Recommendation: Revise the text to reflect the above.

65. Section 7.1.1.8, page 7-2

Deficiency: It is stated that the slurry wall is least affected by uncertainties in the hydrogeologic setting. This may not be true. It may be extremely sensitive to the geometry of the system (if the Ringold 1 and Ringold 2a contact is very irregular, e.g. deep erosion of the 2a prior to deposition of 1, then extreme difficulty could occur in installing the barrier).

Recommendation: Has this possibility been evaluated with respect to installing the slurry wall?

66. Section 8.0, page 8-1, first bullet

Deficiency: The text states that the slurry wall offers complete reduction of the Sr-90 flux to the river of concentrations greater than 1,000 pCi/L, but there is no discussion of the reduction of Sr-90 flux to the river of concentrations less than 1,000 pCi/L.

Recommendation: Include a discussion of the fate of Sr-90 below 1,000 pCi/L using this alternative.

67. Section 8.0, page 8-1, sixth bullet

Deficiency: There is no "stagnation zone" in Figure 6-7, the wall only redirects the flow.

Recommendation: Revise the text to reflect the information provided in the figure.

68. Appendix A, page A-11

Deficiency: The unit cost for installation of extraction wells ($1,526.80/ft) appears to be exorbitant. Itemized costs for boring, materials, and installation should be estimated to support the reported unit cost for extraction wells.

Recommendation: Include an itemized cost for the installation of the extraction wells.

69. Appendix A, page A-14

Deficiency: The cost for ion exchange (IX) package installation is not reported at all, and the component IX pilot test is not included in the table.

Recommendation: These discrepancies should be corrected.

70. Appendix A, page A16

Deficiency: The cost estimate for a pump-and-treat system with reverse osmosis for the three-well system is summarized, but there is no cost estimate table (similar to the one shown for the five-well system [page A-17]).

Recommendation: A cost estimate table should be included for the three-well system.

71. Appendix A, page A-30

Deficiency: The installation cost for 6-inch diameter, 104-feet deep extraction well is reported as $1,526.80 per foot (page A-11) for the pump-and-treat alternative, whereas the cost for an 8-inch diameter, 114-feet deep extraction well is reported as $571 per foot for the hydraulic control alternative. Although construction and material specifications for extraction wells are essentially the same for both alternatives, except for the larger (8-inch diameter) well in the hydraulic control alternative, the unit cost of the extraction well for the hydraulic control alternative is approximately 60 percent lower than the unit cost of the extraction well for the pump-and-treat alternative.

Recommendation: This discrepancy should be explained.

72. Appendix A, page A-27

Deficiency: Operation and maintenance costs for the slurry wall alternative are reported to be zero. Once a slurry wall has been installed, it should be monitored to assure that it is performing as designed. If the monitoring program finds that the wall is not containing or isolating contaminants, the integrity of the wall should be restored. Water quality monitoring will be the most important indicator of wall performance; the wall will either contain and isolate waste materials, or constituents will continued to migrate. Water quality monitoring systems usually consist of multiple wells installed at suitable locations up and downgradient of a wall. Water from these wells can be sampled and analyzed to determine the effectiveness of the alternative.

Recommendation: The basis for not including a monitoring program should be explained.