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STATE OF WASHINGTON

# DEPARTMENT OF ECOLOGY

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July 31, 1998

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Mr. Marvin J. Furman
U.S. Department of Energy
P.O. Box 550, MSIN: HO-12
Richland, WA 99352

Dear Mr. Furman:

Re: Comments on "Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas B-BX-BY at the Hanford Site" February 1998 (PNNL-11826)

The Washington State Department of Ecology (Ecology) has initiated its review of the above document. The number of comments generated thus far has prompted Ecology to provide you with the enclosed list of completed comments. Ecology believes this transmittal will give the U.S. Department of Energy (USDOE) and its contractors sufficient direction to begin revising the document. As can be observed from the enclosed comments, substantial editing of this document is necessary. Additional comments may be forthcoming as Ecology completes its review.

Ecology will also provide comments on the remaining two Single-Shell Tank Groundwater Quality Assessments that USDOE has transmitted to Ecology. However, Ecology expects that many of the issues identified in the enclosed comments will also be applicable to these other documents.

If you have any questions, please contact me at (509) 736-3018, or Stan Leja at (509) 736-3046.

Sincerely,

Dr. Alex Stone, TWRS Project Manager
Nuclear Waste Program

AS:sb
Enclosure

cc: Maureen Hunemuller, USDOE
Bob Lober, USDOE
Mike Thompson, USDOE
Doug Sherwood, EPA
Janice Williams, FDH
Dave Myers, LMHC
Jim Bertch, MACTEC
Administrative Record: SST TSD S-2-4 and Vadose Zone Characterization
Stuart Harris, CTUIR
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July 30, 1998

**"Results of Phase I Groundwater Quality Assessment for Single-Shell Tank Waste Management Areas B-BX-BY at the Hanford Site" February 1998 (PNNL-11826)**

1. Page iii, Summary, 1st paragraph. The term "Phase I" has no regulatory basis. Delete the term and insert the applicable regulatory citation. Recommended wording is: "Pacific Northwest National Laboratory conducted a "first determination" groundwater quality assessment for the U.S. Department of Energy, Richland Operations Office, in accordance with 40 CFR 265.93(d)(4) by reference of WAC 173-303-400(3)."

2. Page iii, Summary, 1st paragraph. The last sentence of the paragraph should clearly reflect the regulatory status of the groundwater monitoring program. In addition, the applicable regulatory citations should be used. Recommended wording is: "This report documents the first determination evaluation of 40 CFR 265.93(d)(4) and describes the assessment monitoring program of 40 CFR 265.93(7)(i)."

3. Page iii, Summary, 2nd paragraph. As Washington Administrative Code (WAC) 173-303-040 defines "ancillary equipment," insert the words "equipment and" between the words "ancillary" and "waste systems" in the first sentence.

4. Page iii, Summary, 2nd paragraph. The second sentence should read "The unit is regulated under RCRA interim-status regulations (40 CFR, Subparts J and F, by reference of WAC 173-303-400(3)) and was placed in assessment groundwater monitoring (40 CFR 265.93(d)(4) after elevated conductivity in B-BX-BY WMA downgradient monitoring wells was confirmed pursuant to 40 CFR 265.93(d)(1)."

5. Page iii, Summary, 2nd paragraph. The third sentence indicates the rise in conductivity was initially observed in well 299-E33-32 in February 1996. Figure 1.3 of the assessment report indicates the rise in conductivity was initially observed in January 1995. If Figure 1.3 is interpreted correctly, revise the sentence to read: "A rise in conductivity of statistically significant difference was initially observed in this well in January 1995."

6. Page iii, Summary, 3rd paragraph. The term "Phase I" has no regulatory basis. Delete the term in the first sentence and insert the applicable regulatory citation. Recommended wording is: "During the indicator parameter monitoring program of 40 CFR 265.92, a rising trend of water quality parameters (sodium, sulfate, nitrate, and chloride) was observed in downgradient well 299-E33-41 beginning in January 1995. In the February 1997 sample for well 299-E33-41, elevated conductivity was also observed."

7. Page iii, Summary, 3rd paragraph. In the second sentence the words "increases in" is used to describe the groundwater monitoring data of downgradient well 299-E33-41. It is noted the increases can be described, for the most part, to have been consistent. Therefore, the word "increasing" would better describe the data.

8. Page iii, Summary, 3rd paragraph. Although technetium-99 is not regulated by RCRA as a listed waste, the contaminant is a constituent of the mixed waste. In addition, there are clearly toxicity attributes of the contaminant as well as associated drinking water standards. Delete the "non-RCRA co-contaminant" wording. Recommended wording is: "The concentration of technetium-99, a constituent of the mixed waste, also rose..."

9. Page iii, Summary, 3rd paragraph. Although the third sentence correctly describes the February 1997 sample observation for technetium-99, Figure 1.4 indicates technetium-99 also rose above the drinking water standard of 900 pCi/L for the February 1995 and August 1995 samples. Therefore, insert the identification of the February 1995 and August 1995 observances. Recommended wording for the third sentence of the paragraph is: "The concentration of technetium-99, a constituent of the mixed waste, also rose above the drinking water standard of 900 pCi/L for the February 1995 and August 1995 samples."

10. Page iii, Summary, 3rd paragraph. Identify that uranium concentrations in well 299-E33-41 have exceeded the 20 μg/L drinking water standard during the November 20, 1997, December 4, 1997, January 6, 1998, and February 4, 1998, sampling events.

11. Page iii, Summary, 4th paragraph. In the first sentence, the word "remobilized" is used. As a general comment for the entire document, the word is repeatedly used throughout. Due to the usage, Ecology requires a technical basis for the use of the word to be provided in the document as well as a definition. The word denotes a stoppage of the single-shell tank (SST) waste and/or waste constituents. If a satisfactory technical basis and definition cannot be provided, delete the use of the word throughout the document. A recommended word to be used in place of "remobilized" is "migrating."

12. Page iii, Summary, 4th paragraph. In the first sentence, insert the words "and/or waste constituents" between "tank waste" and "either."

13. Page iii, Summary, 5th paragraph. In the first sentence it is indicated that contamination observed at well 299-E33-41 "has only recently entered the groundwater as evidenced by the sudden sharp rise in anion and technetium-99 concentrations." According to Figures 1.3 and 1.4 (and HEIS data), the rise in anion and technetium-99 concentrations rose gradually beginning in January 1995 and suddenly in or around January 1997. Re-write the sentence to accurately

describe the observations. Recommended wording is: "The contamination observed at well 299-E33-41 has gradually (August 1992 through June 1993 and February 1995 through November 1996) and suddenly (February1997, August 1997, and November 1997) risen as evidenced by the measured anion and technetium-99 concentrations."

14. Page iii, Summary, 5th paragraph. The second sentence appears to be stating a risk-based opinion. As this is neither technically supported by nor the intent of the document, delete the sentence.

15. Page iii, Summary, 5th paragraph. Although the last sentence of this document will be deleted, the words "isolated event" to describe the contamination is noted with interest. If the words "isolated event" are used to describe the B-BX-BY WMA impacted groundwater in this report, a basis for usage of this word will be required. Considering the unit releases and indications of leaking tanks, as well as the data trends observed, the words "isolated event" do not appear to correctly describe the B-BX-BY WMA groundwater contamination.

16. Page iii, Summary, 6th paragraph. Re-write the sentence to state a fact or to describe an observation. Recommended wording is: "Rising trends of technetium-99 and nitrate in other groundwater monitoring wells downgradient to B-BX-BY WMA have been observed."

17. Page iii, Summary, 6th paragraph. The intent of the first determination requirement of 40 CFR 265.93(d) is to either confirm if the B-BX-BY WMA has impacted groundwater and continue determinations under 40 CFR 265.93(d)(7)(i) or to demonstrate the B-BX-BY WMA has not impacted groundwater and return to the indicator parameter monitoring program of 40 CFR 265.92.

    Ecology has reviewed the assessment report as well as other pertinent information/data (HEIS data) and has concluded that the first determination requirements of 40 CFR 265.93(d)(4-5) have been occurring from early 1995 to early 1998 and have been fulfilled. In addition, Ecology has concluded that the first determination has conclusively demonstrated in a technically feasible fashion that the B-BX-BY WMA has impacted groundwater.

    Therefore, the groundwater assessment monitoring program requirements of 40 CFR 265.93(d)(7)(i) are applicable and the determinations of 40 CFR 265.93(d)(4) must continue to be made. The summary is required to reflect completion of the first determination of 40 CFR 265.93(d)(4) and that further determinations will be made as required by 40 CFR 265.93(d)(7)(i).

    Delete the last two sentences of the sixth paragraph. Insert sentences or a new paragraph that reflects the regulatory determination of this notice. Recommended wording is: "The first determination requirements of 40 CFR 265.93(d)(4)

occurred from February 1995 to February 1998. It has been determined that the B-BX-BY WMA has impacted groundwater. Therefore, the indicator parameter monitoring program of 40 CFR 265.92 will not be resumed and the assessment monitoring program requirements of 40 CFR 265.93(d)(7)(i) will continue."

18. Page iii, Summary, 7th paragraph. Phase II of the assessment is identified but has no regulatory basis. Delete the term. Include a citation of 40 CFR 165.93(7)(i) in relation to future "determinations." Recommended wording is: "Further determinations of source(s), nature, and extent of groundwater contamination attributable to B-BX-BY WMA will be conducted pursuant to 40 CFR 265.93(7)(i) by reference of WAC 173-303-400(3)."

19. Page 1.1, Section 1.0, 1st paragraph. For clarity, change the word "facilities" to "tanks and ancillary equipment and waste systems."

20. Page 1.1, Section 1.0, 1st paragraph. Tank requirements are also applicable. In addition, the applicability through the Washington Administrative Code should also be identified/cited. Therefore, in the last sentence of the paragraph, the following text is recommended: "As such, these tanks are subject to interim-status regulations, Title 40, Code of Federal Regulations Part 265, Subparts F and J (40 CFR 265.92 and 265.196 [by reference of Washington Administrative Code {WAC} 173-303-400(3)]).

21. Page 1.1, Section 1.0, 2nd paragraph. In the first sentence and throughout the document, the term "Phase I" in relation to the "first determination" of 40 CFR 265.93(d) has no regulatory basis. For clarity, delete the term here and throughout the document.

22. Page 1.1, Section 1.0, 2nd paragraph. From the data included in the report, the first determination is concluded to have occurred from February 1995 to February 1998. Change "June 1996" to "February 1995" in the second sentence of the paragraph. Similarly, due to Ecology's review turn-around time, the additional pertinent information contained in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997 GJ-HAN-89), and additional monitoring data obtained from August 1997 to February 1998, change the end date of the assessment to February 1998.

23. Page 1.1, Section 1.0, 2nd paragraph. It is recommended that this paragraph also identify assessment requirements of 40 CFR 265.196(3). The following text is recommended to be inserted between the 1st and 2nd sentences of the paragraph: This document also contains the initial investigative results of release(s) from the RCRA SST system as required by 40 CFR 265.196(3) (by reference of WAC 173-303-400(3))."

24. Page 1.1, Section 1.0, 2nd paragraph. The following phrase is recommended to be inserted in the last sentence of the paragraph between the words "support" and "the": "and are considered part of."

25. Page 1.1, Section 1.1, 1st paragraph. Insert the following sentence between the 2nd and 3rd sentences: "Regulatorily, these wastes are defined in WAC 173-303-040 as 'mixed wastes'."

26. Page 1.1, Section 1.1, 2nd paragraph. The last sentence implies the interim status groundwater monitoring was occurring as "detection" monitoring. It should be noted that the interim status monitoring programs are typically referred to as "indicator parameter" or "assessment" monitoring. A monitoring program used for final status facilities prior to releases from the unit to the groundwater is called "detection" monitoring. Similarly, a monitoring program used for final status facilities after releases from the unit have occurred to the groundwater is called "compliance" monitoring. Therefore, it is recommended the words "detection-level" in the last sentence be changed to "indicator parameter."

27. Page 1.1, Section 1.1, 4th paragraph. Although technetium-99 is not regulated by RCRA as a listed waste, the contaminant is a constituent of the mixed waste. In addition, there are clearly toxicity attributes of the contaminant as well as associated drinking water standards. Lastly, it should be noted that 40 CFR 265.93(d)(4) clearly and repeatedly specifies that "hazardous waste constituents" (extent, rate, and concentration) shall be evaluated during assessment monitoring. Delete the "non-RCRA co-contaminant wording." Recommended wording is: "...increases, technetium-99, a constituent of the mixed waste, was observed..."

28. Page 1.1, Section 1.1, 4th paragraph. The second sentence implies that the first statistical difference of an indicator parameter (specific conductivity) occurred in February 1996 and was confirmed in June 1996 (4 months later) by "verification" sampling. Although not stated, it is assumed that the "verification" sampling was performed to satisfy requirements of 40 CFR 265.93(c)(2). The same sentence continues on to identify a statistical critical mean of 365.7 μmhos/cm. The following issues are related to this sentence:

    Figure 1.3 indicates specific conductivity was measured in well 299-E33-32 above the statistical critical mean value of 365.7 μmhos/cm in early 1995. HEIS data indicates the statistical critical mean value of 365.7 μmhos/cm was exceeded during the September 1993, February 1995, and February 1996 sampling events. It is also noted that the statistical critical mean value of 365.7 μmhos/cm was almost exceeded during the August 1995 sampling event. Given this scenario, the statistical increase verification of this indicator parameter as required by 40 CFR 265.93(c)(2) could have been performed as early as early 1993. Also given this scenario (as well as the collection of waste constituent concentration data from the

groundwater monitoring system), the first determination of 40 CFR 265.93(d)(4) can be considered to have been initiated as early as early 1995.

The assessment report does not contain an explanation or a derivation of the critical mean value of 365.7 μmhos/cm. The report must include all data used to derive the statistical mean as well as an explanation and/or equation which identifies how the specific conductivity measurements were averaged to obtain the critical mean value of 365.7 μmhos/cm. Note: If specific conductivity measurements from an upgradient well other than 299-E33-33 were used, justification must be provided. In addition, if data other than from 299-E33-33 were used, a statistical critical mean derivation using only 299-E33-33 data must also be submitted.

In conclusion, for purposes of satisfying the groundwater monitoring requirements of 40 CFR 265 (by reference of WAC 173-303-400(3)), Ecology has determined that the initiation of first determination monitoring of 40 CFR 265.93(d)(4) occurred in early 1995. As such, the statement of problem of Section 1.1 should be re-written to describe the earlier critical mean exceedences of specific conductivity.

29. Page 1.1, Section 1.1, 2nd paragraph. See the comment immediately preceding this one. Re-write the second half of the paragraph accordingly. In addition, delete from discussion the consideration of a false positive or identify it in relation to having already performed the first determination for over a year and justify the previous 5-6 sampling observations. It should be noted that a return to the indicator parameter monitoring program (40 CFR 265.93(d)(6)) was only an option after determining (40 CFR 265.93(d)(4-6)) that no hazardous waste or hazardous waste constituents from the B-BX-BY WMA had entered the groundwater.

30. Page 1.1, Section 1.1, 4th paragraph. Insert an identification that "Along with conductivity increases observed in early 1995, technetium-99, a constituent of the mixed waste, was observed above the 900 pCi/L Drinking Water Standard (DWS) for well 299-E33-41(Figure 1.4). Technetium-99 values rose from 232 pCi/L to 948 pCi/L (February 1995) and 1630 pCi/L (August 1995). For the next three quarterly sampling events, the value dropped to 889.6, 600.08, and 506 pCi/L (February 1996, August 1996, and November 1996 respectively) only to rise again in February 1997 to 5740 pCi/L. For the next quarterly sampling, the value again dropped to 523 pCi/L (May 1997) only to rise again in August 1997 to 12,000 pCi/L."

31. Page 1.5, Section 1.1, 2nd paragraph. The assessment monitoring program of 40 CFR 265.93 requires the evaluation of "hazardous waste or hazardous waste constituents." Specific conductivity represents an indicator parameter which was

monitored in the indicator parameter monitoring program of 40 CFR 265.92(b)((3). Technetium-99 represents a dangerous waste constituent that will be monitored during the assessment monitoring program. Therefore, the following text is recommended to replace the existing paragraph: "Although it was elevated conductivity in well 299-E33-32 that initially triggered the WMA into an assessment monitoring program, it is the presence, as well as elevated concentrations, of dangerous waste constituents (i.e., technetium-99, nitrate, sodium, chloride, sulfate, etc.) that require the WMA to remain in an assessment monitoring program."

32. Section 1.1. From the HEIS data, the following gross beta concentrations measured in well 299-E33-41 are noted: 667 (February '97), 1670 (May '97), 3790 (August '97), 780 (August '97), 1100 (October '97), and 2860 (November '97). The drinking water standard for gross beta is noted to be 50 pCi/L. The concentrations measured from July 25, 1991 to present have greatly exceeded the DWS. Include a trend plot of gross beta measurements for the B-BX-BY WMA RCRA groundwater monitoring network. Also include a discussion of the B-BX-BY WMA RCRA monitoring well network observations and trends. Clearly, the upgradient well 299-E33-33 gross beta measurements are well below drinking water standards while wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 are well above the DWS of 50 pCi/L. Similarly, it is clear that an increase of gross beta concentrations trend is observed in the downgradient wells. Lastly, this data would support the initiation of an assessment monitoring program as early as 1991.

33. Page 1.5, Section 1.2, 1st paragraph. The term "Phase I investigation" has no regulatory basis. Replace the term with "first determination."

34. Page 1.5, Section 1.2, 1st paragraph. Insert "and/or hazardous waste constituents" between the words "wastes" and "from" in the first sentence.

35. Page 1.5, Section 1.2, 1st paragraph. Recommended text for the 2nd sentence of the paragraph is as follows: "If, however, it is determined that dangerous waste and/or dangerous waste constituents from the WMA have entered the groundwater, then an assessment monitoring program must be implemented to define the rate of migration, the areal extent of the resultant groundwater plume, and the concentration of the hazardous constituents."

36. Page 1.5, Section 1.2, 2nd paragraph. Change the question to: "Have dangerous wastes and/or dangerous waste constituents from the WMA reached groundwater?"

37. Page 1.6, Section 1.3, 1st paragraph. The term "Phase I investigation" has no regulatory basis. Replace the term in the first sentence with "the first determination required by 40 CFR 265.93(d)(4-7)."

38. Page 1.6, Section 1.3, 1st paragraph. Include the term "and B-BX-BY unit-specific" between "site-" and "constituents" in the second sentence.

39. Page 1.6, Section 1.3, 1st paragraph. In the third sentence, delete "is a non-RCRA co-contaminant" and replace it with "represents a mixed waste constituent."

40. Page 1.6, Section 1.3, 1st paragraph. Delete the third sentence which begins "The elevated conductivity..." Insert the following: "The first determination required by 40 CFR 265.93(d)(4) was initiated in early 1995 after elevated conductivity was observed in well 299-E33-32 which triggered the B-BX-BY WMA assessment monitoring program."

41. Page 1.6, Section 1.3, 1st paragraph. Delete "continued monitoring" at the end of the fifth sentence and replace it with "further determinations under 40 CFR 265.93(d)(7)(i)."

42. Page 1.6, Section 1.4, 1st paragraph. Delete "Phase II investigation" and replace it with "further determinations of 40 CFR 265.93(d)(7)(i)."

43. Page 1.6, Section 1.4, 1st paragraph. As groundwater was observed to be contaminated in 1995 by technetium-99, delete the word "recent" in the fourth sentence.

44. Page 1.6, Section 2.0, 1st paragraph. The paragraph should be re-written to describe the first determination in the past tense. The following re-write is provided: "This assessment of groundwater quality has involved the development of a conceptual model integrating the characteristics of the hydrogeological system and the waste management unit setting. This model includes the general waste types, the geology, the hydrogeology, and the geochemistry of the vadose zone and the unconfined aquifer. Hence, the movement of B-BX-BY WMA contaminants into and through the vadose zone and the unconfined aquifer could be better understood and possibly predicted. Specifically, the purpose of the conceptual model is to explore the complexity and spatial relationships of four important parameters: the B-BX-BY WMA contamination source, the driving force, the migration pathway, and rate of contaminant migration/transport."

45. Section 2.0. Add a sub-section that describes the tank wastes of the B-BX-BY WMA. In particular, include a thorough description of wastes containing technetium-99, uranium, arsenic, chromium, nitrate, sodium, chloride, sulfate, etc.. It is noted that tank characterization reports are available for many of the tanks that describe the chemical make-up of the wastes. Due to the tank farm occurrences, tank leakers/re-leakers status, and proximity to well 299-E33-41, a tank-waste-specific discussion of the waste chemistry of tank 241-BX-102 is requested to be included.

46. Page 2.1, Section 2.1.1, 1st paragraph. For consistency with the rest of the document, change "hazardous and radioactive" to "mixed waste(s) and/or mixed waste constituent"

47. Page 2.3, Section 2.1.1, 2nd paragraph. A total leak volume for the three tank farms is provided as well as a leak volume for tank 241-BX-102. An identification of leak volumes for specific tanks must be added to this assessment report. In addition, it is also necessary to describe the source of the leak volume estimates and indicate the uncertainty associated with these numbers. Similarly, it is requested that respective information regarding spill volumes, dates, and locations for the three tank farms be added to this assessment report.

48. Page 2.3, Section 2.1.1, 5th paragraph. This paragraph provides a status of tank contents and references Hanlon 1996. It is requested that Hanlon 1998 be referenced and the waste volumes of Table E-3 (February 28, 1998) for the B, BX, and BY tank farms be included in the report. Data/information from Table E-6 to indicate which tanks are considered sound and which are considered assumed leakers is also requested to be included in this assessment report.

49. Page 2.3, Section 2.1.1, 7th paragraph. The first sentence needs to be re-written in perspective of capacity or some other relation. Although the B-BX-BY tank farms may now only contain approximately 860,000 gallons of drainable liquid, this amount still represents a large amount of liquid in relation to a release. Either delete the first sentence, re-write it using actual data, or re-write it in context with past release comparisons.

50. Page 2.3, Section 2.1.1, 7th paragraph. In the last sentence, the word "remobilized" is used. As a general comment for the entire document, the word is repeatedly used throughout. Due to the usage, Ecology requires a technical basis for the use of the word to be provided in the document as well as a definition. The word denotes a stoppage of the single-shell tank (SST) waste and/or waste constituents. If a satisfactory technical basis and definition cannot be provided, delete the use of the word throughout the document. The following is a recommended re-write: "These vadose zone plumes are potential sources of tank waste contamination that could either migrate or be migrating to negatively impact groundwater quality."

51. Page 2.4, Section 1.1.1, 2nd paragraph. "Non-tank leaks" are described in this section of the report. It should be noted that although the released waste described is from spillage rather than tank leakage, regulatorily, the released waste is associated with the management of the B-BX-BY tank farms and as such, constitutes a release from the B-BX-BY WMA. To better associate the releases with the tanks, change the title of this discussion from "Non-Tank Leaks" to "Tank Waste Spills."

52. Page 2.4, Section 1.1.1, 2nd paragraph. Delete the last sentence of the paragraph. The section is discussing tank waste spills rather than the potential driving forces of the spilled waste contamination.

53. Page 2.4, Section 1.1.1, 3rd paragraph. In the last sentence of the paragraph, change "could be" to "are."

54. Page 2.4, Section 1.1.1, 3rd paragraph. The term "residual plumes" is used. The meaning of this term is neither technically justified nor defined by the document. A recommended re-write of the last sentence of the paragraph is: "Given a sufficient driving force, any of these contaminated soils and/or soil zones could be or become a source for groundwater contamination."

55. Page 2.5, Section 2.2, paragraph from preceding page. As Ecology has determined the first determination is complete, change the wording to past tense. Recommended wording is: "Consequently, constituents' chemical signatures have been evaluated with other considerations, such as trend characteristics (see trend analyses discussion of Section 3)."

56. Page 2.5, Section 2.3, 1st paragraph. The first sentence states "pick up and remobilize a residual tank waste vadose zone plume." The remobilization of contaminants is neither technically justified nor defined by the document. Either provide the technical basis for use of the word "remobilize" or re-write the sentence. Recommended wording is: "...must be available to either increase mobilization or transport released tank waste contaminants."

57. Page 2.5, Section 2.3, 3rd paragraph. Re-write the words "escaped waste" in the first sentence. Recommended words are: "released tank waste contaminants."

58. Page 2.6, Section 2.4, 3rd paragraph. Although poorly sealed dry wells within the farm boundaries are described as a vertical pathway for rapid migration of contaminants, poorly sealed boreholes and/or wells in the vicinity of the B-BX-BY WMA are not identified or discussed. Although poorly sealed boreholes and/or wells located beyond the tank farm filled areas or boundaries are not likely to provide for as rapid migration, the vertical migration would still be relatively rapid. Therefore, include an identification of poorly sealed boreholes and/or wells in the vicinity of the B-BX-BY WMA as potential rapid vertical migration pathways.

59. Page 2.6, Section 2.4, 3rd paragraph. Although Figure 1.2 of this report identifies wells in the vicinity of B-BX-BY WMA, it does not identify or denote the quality of the seals of the "RCRA," "non-RCRA" and "Vadose Zone" wells. In addition, the quality of the seals does not appear to be discussed in Chapters 2 or 3. As poorly sealed wells may be considered a plausible rapid vertical migration

pathway, the assessment report must include a discussion of this issue. The discussion should identify all borings and/or wells in the vicinity of the B-BX-BY WMA, a description of the seals, and an evaluation or assessment of the quality of the seals.

60. Page 3.1, Section 3.0, 1st paragraph. As the first determination of 40 CFR 265.93(d) is complete, the text must be re-written in past tense to describe the findings. Recommended re-write of the first sentence of the first paragraph is: "In this chapter, various observations are made that are pertinent to determining the WMA B-BX-BY source(s) of contamination found in the groundwater." Note: the word "recently" is deleted in relation to when groundwater contamination was found as groundwater monitoring data support the "finding" occurred as early as '93 and definitively in early '95.

61. Page 3.1, Section 3.0, 2nd paragraph. As the first determination of 40 CFR 265.93(d) is complete, the text must be re-written in past tense to describe the findings. In addition, it is noted that the groundwater flow discussion of Section 3.2 supports the first determination conclusion that releases from the B-BX-BY WMA have negatively impacted groundwater quality. The discussion of Section 3.2 also emphasizes the importance of accurately measuring the groundwater flow direction (via surface water elevation measurements and evaluations) to support an accurate interpretation of the changing groundwater flow direction. A recommended re-write of the first and second sentences of the paragraph is as follows: "The section on stratigraphy is followed by a brief discussion of the groundwater flow. An accurate understanding of the recently changing flow direction in the vicinity of this WMA is needed in order to be able to properly interpret developing temporal and spatial patterns of groundwater contamination.

62. Page 3.1, Section 3.0, 3rd paragraph. Delete the word "recently."

63. Page 3.1, Section 3.0, 4th paragraph. Change the word "source" in the first sentence to "this first."

64. Page 3.1, Section 3.0, 4th paragraph. Re-write the second sentence in past tense in relation to the first determination conclusions reached. A recommended re-write is: "Along with the results are observations of constituent occurrences, constituent patterns and co-varying trends, which support the first determination conclusion associated with the contamination found at well 299-E33-41."

65. Page 3.1, Section 3.0, 5th paragraph. Re-write the sentence to use another word other than "remobilize." It is noted that until such time that contaminant transport (pathway and rate) through the unsaturated and/or saturated soil column is understood or confirmed, the word "remobilize" may inaccurately describe the observations. Recommended wording is: "These sources may have acted or contributed as a driving force to assist the waste and/or waste constituents in the

vertical pathway(s) to migrate through the vadose zone to well 299-E33-41 just prior to and during the drilling of this well."

66. Page 3.1, Section 3.0, 5th paragraph. Due to the lack of understanding associated with B-BX-BY WMA contamination in the vadose (i.e., the dynamics of contaminant transport), it is noted the last sentence of the fifth paragraph may incorrectly refer to "the vadose zone plume." Recommended re-wording is: "....in the vicinity of B-BX-BY WMA vadose zone contamination and well 299-E33-41."

67. Page 3.4, Section 3.2. Figure 3.3 provides hydrographs of five of the wells comprising the RCRA network. It is noted from Figure 3.3 that most of the groundwater surface elevations of the network were taken or collected at the same time. As the groundwater surface level is recently and gradually changing, groundwater "potentiometric" surface maps are required to be inserted as figures in this section. At a minimum, groundwater surface maps are requested for the following dates: July '91, November '91, April '92, August '92, March, '93 September '93, January/February '95, August '95, February '96, August '96, May '97, and November '97. In addition, it is noted that Figure 3.3 provides hydrographs for only 5 wells. Figure 1.2 identifies at least nine "RCRA monitoring wells." It is requested that the groundwater table elevation maps include the maximum number of data points. Although the majority of groundwater wells shown in Figure 1.2 are "non-RCRA monitoring wells," the groundwater surface elevation measurements collected should be considered for use in this report. Lastly, for well data not used for the potentiometric surface maps, include an identification and explanation of wells and/or data omitted from the maps.

68. Page 3.4, Section 3.2. It is requested that water table elevation maps similar to Figure 3.2 be included in this report for '91, '92, '93, '94, '95, and '96.

69. Page 3.4, Section 3.2. The second sentence of the fourth paragraph indicates the wells were surveyed "to eliminate any error associated with references to datum." Include the date of survey and the before and after riser surface elevations or whatever depth to water reference elevations were used. This information may be included as an appendix of the assessment report.

70. Page 3.4, Section 3.2. It is required that well design schematics be provided for the RCRA network (including wells E33-31, E33-32, E33-33, E33-41, and E33-42). This information may be provided in an appendix to the document.

71. Page 3.4, Section 3.2. Provide an explanation or identification (whichever is applicable) of why E33-43 is not being used as part of the network. Similarly, identify if E33-36 is being used as part of the network.

72. Page 3.4, Section 3.2, 5th paragraph. Due to the observed decline of the groundwater surface elevation/table, include an identification or description of well development histories associated with each network monitoring well. This information may be provided in an appendix to the document.

73. Page 3.4, Section 3.2, 5th paragraph. Delete the last sentence of the paragraph. A sentence similar to this one will be stated in Chapter 6.

74. Page 3.4, Section 3.2, 6th paragraph. Change the sentence to past tense and indicate that analyses have been performed. It is Ecology's conclusion that the first determination has been completed. In addition, it is Ecology's conclusion of the alternative flow directions and the applicable monitoring data provided in this assessment (and to be visually displayed by the B-BX-BY WMA local groundwater surface contour maps) that the source(s) of the groundwater contamination observed in wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 is(are) due to tank waste releases from the B-BX-BY WMA. Recommended re-wording for the sixth paragraph is: "Because there is uncertainty in both the recent past and future groundwater flow direction beneath the tank farms, the first determination analyses of the groundwater contamination data have considered possible alternative flow directions."

75. Page 3.6, Section 3.3, 1st full paragraph. Section 3.3 discusses regional contamination. The last sentence of the paragraph identifies a potential expectation regarding chromium. As this section is describing regional plumes, this sentence appears misplaced. Either delete the sentence or include discussions of contaminant transport rates (including geochemical reaction information [i.e., hexavalent versus trivalent chromium states]) of all contaminants identified in the section.

76. Page 3.6, Section 3.3, last sentence of the section. Include the basis of the statement. Identify that a concentration of technetium-99 has been measured at well 299-E33-41 at 12,000 pCi/L that represents an order of magnitude greater than the regional technetium-99 plume. Clearly identify that this observation cannot be attributed to the regional plume.

77. Page 3.6, Figure 3.3. The graph is hard to read due to the inclusion of numerous data points/measurements. It is indicated that "spurious data were removed." It is also indicated that the wells were recently surveyed to eliminate survey error in the elevations. Due to the importance of this information, the data should be included in an appendix to the report. Spurious data should also be included and flagged accordingly. In addition, the re-survey of the wells should be discussed. In particular, if the groundwater elevation data was "adjusted" after the re-survey, this information must be explained.

78. Page 3.6, Section 3.4, 1st paragraph. Insert the words "in and" between "region" and "around" in the first sentence.

79. Page 3.8, Section 3.4, 2nd paragraph. The first sentence indicates there are seven wells in the B-BX-BY WMA RCRA assessment monitoring network. As previously indicated in an above comment, the monitoring well network information is required to be included in the report. It is noted that the monitoring network wells are not clearly identified in the report. While Figure 1.2 is referenced, the figure appears to indicate nine RCRA monitoring wells. Upon reviewing the figure, it is assumed that wells 299-E33-33, 299-E33-36, 299-E33-41, 299-E33-43, 299-E33-32, 299-E33-42, and 299-E33-31 represent the seven B-BX-BY WMA assessment monitoring network wells. If this assumption is correct, it is noted the assessment report does not include discussions of wells 299-E33-43 and 299-E33-36. The assessment report must clearly identify the network and include discussion of all network wells.

80. Page 3.8, Section 3.4, 2nd paragraph. Re-write the last sentence in past tense. Recommended wording is: "Both were sampled for the first determination investigation."

81. Page 3.8, Section 3.4, 3rd paragraph. As indicated in a previous comment, Figure 1.2 identifies dozens of wells. It is not apparent which wells will be sampled for further determinations. Either identify the eight wells to be sampled in this section or in Chapter 6.0. It is recommended that this information be placed in Chapter 6.0.

82. Page 3.8, Section 3.4, 3rd paragraph. Insert the applicable regulatory citation in the sentence. Recommended wording is: "....eight others will be sampled for further determinations required by 40 CFR 265.93(d)(7)(i). These wells and their sampling frequency are identified in Chapter 6.0."

83. Page 3.8, Section 3.4.1. The sub-section does not appear to discuss or even reference the voluminous data and information contained in the "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89). As such, the sub-section is both grossly deficient and misleading. Similarly, the sub-section does not appear to discuss or even reference the voluminous data and information contained in the "Hanford Tank Farms Vadose Zone Draft for External Technical Review Only BX Tank Farm Report" (June 1998, GJO-98-40-TAR, GJO-HAN-19). At the very minimum, the data and information contained in the "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" must be referenced and summarized in this sub-section. In other words, Ecology requires an integration of the information. It is Ecology's conclusion that the information and data contained in the BX-102 tank summary data report irrefutably indicates a release(s) to the vadose zone near and/or from the BX-102 tank has(have) occurred in relation to

the management of the RCRA TSD B-BX-BY WMA and that the released waste and/or waste constituents have migrated.

84. Page 3.8, Section 3.4.1, 2nd paragraph. Identify if non-radioactive tank waste constituents were "looked for" or monitored during the drilling of well 299-E33-41.

85. Page 3.8, Section 3.4.1, 2nd and 3rd paragraphs. Identify which constituents are beta, alpha, or gamma emitters.

86. Page 3.8, Section 3.4.1, 4th paragraph. In an appendix to this assessment, include the log data and information about the discrepancy noted in the borehole package.

87. Page 3.9, Section 3.4.1, 5th paragraph. Figure 1.2 indicates crib 216 B-7b operated from 1946 to 1967. Include this information in the text. Recommended wording is: "The crib nearest to well 299-E33-41 is 216 B-7b that operated from 1946 to 1967."

88. Page 3.9, Section 3.4.1, 5th paragraph. The word "remobilized" implies a stoppage of tank waste constituents. As the vadose zone contaminant transport mechanics are not yet completely understood, use of the word "migrating" would better describe the 241-BX-102 tank leak contamination. Replace "remobilized" with "migrating."

89. Page 3.9, Section 3.4.1, 4th paragraph. Include a description of the "design" of drywell 299-E33-141 (in particular, identify if the well was installed in tank fill material).

90. Page 3.9, Section 3.4.1, 5th paragraph. Re-write the last sentence of the paragraph to remove reference to "Phase II" assessment. In addition, the sentence must reflect the completion of the first determination. Recommended wording is: "Further mapping of the vadose zone contamination in this area may help delineate the BX-102 tank leak from other B-BX-BY WMA tank leaks and/or spills."

91. Page 3.10, Section 3.4.2, 1st paragraph. Change the first sentence to reflect the first determination of 40 CFR 265.93(d)(4) is complete. Recommended wording is: "With exception of cyanide data, any data received after February 1998 will be evaluated in further determinations required by 40 CFR 265.93(d)(7)(i)."

92. Page 3.10, Section 3.4.2, 1st bullet. Re-write the bullet to identify that the well 299-E33-32 conductivity values exceeded the critical mean (of 365.7 μmhos/cm) during the September 14, 1993, February 7, 1995, and February 6, 1996 sampling events. Also indicate that the statistical critical mean value was almost exceeded

during the August '95 sampling event. Recommended re-wording: "Conductivity values exceeded the critical mean in February 1993 and elevated B-BX-BY WMA waste constituent concentration trends were observed as early as February 1993. Given the elevated specific conductivity and waste constituent observations, the confirmation of releases from the unit to groundwater could have begun as early as 1993.

93. Page 3.10, Section 3.4.2, 2nd Bullet. Re-write the bullet analyzing all of the HEIS specific conductivity data to describe conductivity trends in relation to well 299-E33-41 rather than statistical critical means of an entire network or area. It is noted that many of the specific conductivity measurements at well 299-E33-41 were well below the 200 Area plateau background value of 344 μmhos/cm until February 13, 1995.

94. Page 3.10, Section 3.4.2, 2nd Bullet. Delete the statement that "These changes were so transient that if the WMA had been monitored semiannually, neither of these high conductivity values would have been observed." Considering the HEIS data, it may be concluded that quarterly monitoring occurred due to the observation of contamination beginning in 1991. Due to the vadose zone information and the other groundwater information, the statement appears to take the observation out of context.

95. Page 3.10, Section 3.4.2, last paragraph. Change the wording in the second sentence to remove "remobilizing." Recommended wording is: "....possible consequences of further transporting of waste and/or waste constituents in the vadose zone."

96. Page 3.10, Section 3.4.2, last paragraph. The last sentence does not identify the occurrence and/or trends associated with waste constituents. While it is recognized that this section is only discussing conductivity trends, the wording of the statement is misleading. Change the last sentence to put the likelihood of the observation into perspective. Recommended wording is: "Alternatively, and without consideration of waste constituent trends, the gradual increase of specific conductivity could be caused by a return to ambient background conductivity. Due to the waste constituent observations, the likelihood of the trend being solely due to a return to ambient background conductivity is low."

97. Page 3.11, Section 3.4.2, 1st paragraph. Identify the highest measurement of technetium-99. Insert this identification between the fifth and sixth sentences.

98. Page 3.11, Section 3.4.2, 1st paragraph. Move the last sentence of the paragraph (regarding the drinking water standard) up and place it after the fourth sentence (which ends with "March 1991").

99. Page 3.11, Section 3.4.2, 1st paragraph. Include the observation that the highest technetium-99 measurement at well 299-E33-41 (12,000 pCi/L) represents an order of magnitude greater than the regional technetium-99 plume. Clearly identify that this observations can be attributed to neither the regional plume nor the nearby cribs.

100. Page 3.11, Section 3.4.2, 1st paragraph. Re-write the next to last sentence and identify the B-BX-BY WMA as the source of contamination observed at well 299-E33-41. Recommended wording is: "Clearly, the signature is distinct for well 299-E33-41, indicating a B-BX-BY WMA source."

101. Page 3.11, Section 3.4.2, 1st bullet. Change the word "strong" to "direct."

102. Page 3.12, Section 3.4.2, last paragraph. Insert "B-BX-BY WMA" between "indicating a" and "tank waste" in the last sentence.

103. Page 3.15, Section 3.4.2, 2nd paragraph. In the next to last sentence, replace "expanded assessment network" with "further determinations to be made pursuant to 40 CFR 265.93(d)(7)(i)."

104. Section 3.4.2. The section does not include a discussion of other indicator parameters (pH, TOX, and TOC) that are required to be monitored. Include a discussion(s) of these parameters in this section.

105. Page 3.16, Section 3.4.2, paragraph from preceding page. As Ecology considers this first determination assessment to have occurred from early '95 through February '98, include the uranium data collected since August '97. In particular, identify that uranium measurements in well 299-E33-41 are currently rising. For example, prior to the November 20, 1997 sampling event, uranium groundwater concentrations in this well had not been observed above the DWS of 20 pCi/L. From November 20, 1997 to May 4, 1998, uranium concentrations have been observed to occur above the DWS on every occasion (12 times).

106. Page 3.16, Section 3.4.2, paragraph from preceding page. The assessment report states that "...the occurrence of uranium (12 g/L ) in well 299-E33-41 is not completely understood....." Delete the sentence and include a discussion of the uranium contamination occurring in the vadose zone as described in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89). Clearly, the uranium observations in well 299-E33-41 are more than understandable, they may be expected to remain elevated until the plume (see Figure 7 of "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89)) has migrated beyond the well 299-E33-41 observation point.

107. Page 3.16, Section 3.4.2, paragraph from preceding page. The last sentence implies the future sampling will be done due to the increases observed in crib monitoring wells 299-E33-13, 299-E33-18, and 299-E33-38. Delete the sentence and identify in Chapter 6.0 that sampling of the B-BX-BY WMA RCRA TSD groundwater monitoring network for uranium will continue due to both the observations and the vadose zone contamination information.

108. Page 3.16, Section 3.4.2, 2nd paragraph. Cobalt-60 is discussed in relation to wells 299-E33-5 and 299-E33-13. Reference the applicable data and/or Figure 8 of "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89) and discuss the cobalt-60 and europium-154 vadose zone information. Again, by the exclusion of vadose zone contamination information, the text of the groundwater assessment report is at best incomplete.

109. Page 3.16, Section 3.4.2, 2nd paragraph. Cesium-137 is discussed in relation to observed contamination, but does not include or reference the information of in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89). Reference the applicable data and/or Figure 6 of in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89) and discuss the cesium-137 vadose zone information.

110. Page 3.16, Section 3.4.2. It is noted that Section 3.4.2 does not discuss additional sampling results. What appears to be 40 CFR 265 Appendix IX-like sampling has been noted in the HEIS data. Include a thorough discussion of the additional data. Lastly, include an explanation of why this sampling was performed. This discussion should include observations about arsenic, chromium, and gross beta concentrations. Also, specify drinking water standard exceedence observations in the RCRA well network.

111. Page 3.17, Section 3.5, 1st paragraph. Replace "remobilized waste" in the second sentence with "contributed to migration of the waste and/or waste constituents."

112. Page 3.17, Section 3.5, 1st paragraph. Replace "was remobilizing tank waste" in the last sentence with "contributed to contaminant transport of B-BX-BY WMA waste and/or waste constituents."

113. Page 3.17, Section 3.5. Include an identification of the non-tank leaks described in Section 2.1.1 as tank farm occurrences. Although it is not necessary to repeat all of the information from Section 2.1.1 (page 2.4), it is appropriate to add the 1951 waste spill between tanks 241-BX-102 and 241-BX-103 as a bullet in Section 3.5.

114. Page 3.17, Section 3.5. Hanlon's 1997 reports appear to use terminology of "leakers" and "re-leakers." Identify in this assessment report that B-BX-BY

WMA tanks are considered to be "leakers" and which ones are considered to be "re-leakers."

115. Page 4.1, Section 4.0. A general comment about the entire chapter is that it must be re-written to include the voluminous vadose zone information available. In addition, the modeling should be re-evaluated to incorporate/integrate the vadose zone information. Upon re-modeling, the current scenarios with the extensive crib vadose zone contamination should be clearly described as not being the likely cause of contamination and/or not a good fit for the data/information.

116. Page 4.1, Section 4.0, 1st sentence. Delete the word "recently" as technetium-99 was observed to be gradually rising beginning in November 1992.

117. Page 4.1, Section 4.0, 1st paragraph. "Phase II" in the third sentence has no regulatory meaning. Delete the phrase "Phase II of the assessment" and replace it with "further determinations required by 40CFR 265.93(d)(7)(i)."

118. Page 4.1, Section 4.0, 1st paragraph. It is stated that the upward trending contamination observations in wells along the west side of BX and BY Tank Farms are "not developed sufficiently to determine sources." It is Ecology's conclusion that the first determination of 40 CFR 265.93(d)(4) has occurred from early 1995 to February 1998. It is also Ecology's conclusion that the first determination period has been sufficient to conclusively determine that the contamination observed in downgradient monitoring wells is from the B-BX-BY WMA. Therefore, delete the words "sources and" in the 2nd sentence.

119. Page 4.1, Section 4.0, 2nd paragraph. Change the wording "initial assessment" to "first determination assessment."

120. Page 4.1, Section 4.0, 2nd paragraph. Insert the words "tank waste chemistry" between "observations of" and "vadose zone contamination" in the fourth sentence.

121. Page 4.1, Section 4.1, 2nd paragraph. The modeling described does not include the information available from the other RCRA network wells or from the vadose zone work performed in the tank farm and in particular from the vadose zone work performed for tank BX-102. Section 4.1 must be re-written to consider the information available through February 1998. Recommended wording for the second sentence is: "These specific scenarios are focused on information and assumptions related to the contamination and trends observed at wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 as well as vadose zone investigation information contained in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89).

122. Page 4.1, Section 4.1, 2nd paragraph. Delete the word "unbiased" in the last sentence of the paragraph. As there is ample information indicating that the B-BX-BY WMA is the source of the vadose zone and groundwater contamination, it is inappropriate to consider the process unbiased. To the contrary, by not considering appropriate (and available) vadose zone and groundwater information, bias is an inherent attribute of the process. The process bias may be an issue in determining which B-BX-BY WMA tank and/or spill is the particular source. An unbiased process may be particularly important if the vadose and/or groundwater information indicated a "non-leaker" tank is currently leaking.

123. Page 4.1, Section 4.1, 3rd paragraph. As the modeling approach will be changed by the use of different assumptions, change the sentence to reflect which assumptions (without limitations) are being applied to the consideration. Recommended re-wording is: "The following appropriate assumptions are placed on the conceptualized pictures for the B-BX-BY WMA releases:"

124. Page 4.1, Section 4.1, 1st bullet. As shown in the previous section, the groundwater chemistry, contamination and/or indications at wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 clearly indicate contamination and/or vadose/groundwater impact from the B-BX-BY WMA. Recommended re-wording is: "Models are for multiple-well occurrences and trends. As shown in the previous section, the groundwater and vadose zone signatures at groundwater wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 and at numerous BX tank farm boreholes appear to be uniquely similar."

125. Page 4.1, Section 4.1, 2nd bullet. According to Hanlon's February waste tank summary report, the B-BX-BY tanks contain 896,000 gallons of drainable liquid. In addition, tank farm occurrences have been documented. Recommended re-wording of the second bullet is: "Sources are B-BX-BY WMA waste, spills and/or leaks, and migrating vadose zone plumes. Because there is a total of approximately 900,000 gallons of drainable liquid waste left in certain tanks, there are at least 18 designated "leakers," and there are documented tank farm occurrences, migrating vadose zone plumes and the B-BX-BY WMA waste spills and/or leaks are identified as sources."

126. Page 4.1, Section 4.1, 3rd bullet. The chemistry and trend plots of wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42 give a unique signature not observed in crib or upgradient wells. Therefore, the recommended re-wording of the third bullet is: "The driving force for contaminant transport to groundwater is surface or near surface water and/or B-BX-BY WMA tank wastes. A water source may be natural precipitation as is supported by the observance of similar chemistry and trends in wells 299-E33-31, 299-E33-32, 299-E33-41, and 299-E33-42."

127. Page 4.2, Section 4.1, 1st bullet. Identify that infiltration studies for non-saturated gravity flow have not been performed for the upper section of the sediment package.

128. Page 4.2, Section 4.1, 2nd bullet. For purposes of this level of modeling, groundwater flow direction is sufficiently understood. In addition, there is a great deal of B-BX-BY WMA vadose zone monitoring data points available to use in relation to this model assumption. It should be noted that if vadose zone monitoring data points are available for the surrounding waste management units, the data may also be used in the model. Recommended re-wording is: "Contaminants migrate through the vadose zone and intersect monitoring wells. Although groundwater flow direction has recently been observed to be changing, the local groundwater flow direction in the vicinity of the downgradient monitoring wells combined with the vadose zone monitoring information are considered for the various scenarios.

129. Page 4.2, Section 4.1, 4th complete paragraph. Insert the following sentence between the last and next to last sentences: "Inclusion of the numerous vadose zone data qualitatively reduces the sudden, sharp increases seen in groundwater data by also considering a breakthrough curve for the vadose zone."

130. Page 4.2, Section 4.1, item number 1. Change the first bullet to identify " past and/or present tank leaks" rather than "tanks."

131. Page 4.2, Section 4.1, item number 1. Insert an additional bullet: "Vadose zone contamination from tank spills and/or releases."

132. Page 4.2, Section 4.1, new item (2A). Insert an additional item: "Distance from the borehole to the water source."

133. Page 4.3, Section 4.1, item number 7. Insert "and/or indicator parameter" between the words "chemical" and "trend."

134. Page 4.3, Section 4.1, item number 8. Insert "and/or indicator parameter" between the words "chemical" and "correlations."

135. Page 5.1, Section 5.0, 1st paragraph. Delete the term "Phase I" in the first sentence.

136. Page 5.1, Section 5.0, 1st paragraph. Change the word "decisions" to "determinations" in the first sentence.

137. Page 5.1, Section 5.0, 1st paragraph. Insert the following sentence between the first and second sentences: "The determination must be based upon the collection of additional samples and analysis/evaluation of the data."

138. Page 5.1, Section 5.0, 1st paragraph. Delete the phrase "and the results support this conclusion" in the second sentence.

139. Page 5.1, Section 5.0, 1st paragraph. Change the word "decision" to determination in the third sentence.

140. Page 5.1, Section 5.0, 1st paragraph. Re-write the last sentence of the paragraph and identify that it was concluded from the first determination, that the B-BX-BY WMA has negatively impacted groundwater. Recommended wording is: "It is concluded that spills and/or leaks from the current/past operation of the B-BX-BY WMA have resulted in groundwater contamination."

141. Page 5.1, Section 5.0, 1st bullet. Delete the word "recent" in the first sentence.

142. Page 5.1, Section 5.0, 1st bullet. Delete the word "remobilized" and insert the word "releases" between the words "waste" and "from" in the first sentence. Also, insert the identifier "B-BX-BY" in front of "WMA."

143. Page 5.1, Section 5.0, 1st bullet. Re-write the second sentence as: "The trend plot characteristics combined with the well's proximity to known tank farm occurrence locations and with documentation of local water driving forces indicate that the observed groundwater contamination may be attributed solely to tank waste releases from the B-BX-BY WMA."

144. Page 5.1, Section 5.0, 1st bullet. Insert the following sentence between the second and third sentences: "Data reported in February and August 1995 showed that the DWS of technetium-99 (900 pCi/L) was exceeded."

145. Page 5.1, Section 5.0, 1st bullet. Insert an identification/description of technetium-99 occurrences from August 1997 to February 1998.

146. Page 5.1, Section 5.0, 2nd bullet. Include an identification of the vadose zone information contained in "Hanford Tank Farms Vadose Zone Tank Summary Data Report for Tank BX-102" (September 1997, GJ-HAN-89).

147. Page 5.1, Section 5.0, 2nd bullet. Change the last sentence of the bullet to item number 6. Recommended wording is: "…. (70,000 gallons), the overflow/spill that occurred in 1951 of 30,000 to 90,000 gallons between tanks 241-BX-102 and 241-BX-103."

148. Page 5.1, Section 5.0, 2nd bullet. Include an identification of infiltration studies/experiments performed near the B-BX-BY WMA. Recommended wording is: "….BX-103, and infiltration studies conducted at the 200 East Area/105 A Mock Tank Site."

149. Page 5.1, Section 5.0, 2nd bullet. Change "this contamination is remobilized vadose waste" to "vadose zone contamination and/or waste constituents are migrating."

150. Page 5.1, Section 5.0, 2nd bullet. Change "may have" in the last sentence to "has very likely contributed and/or is contributing."

151. Page 5.1, Section 5.0, 3rd bullet. Change "may" in the first sentence to "are concluded to" and insert "B-BX-BY" between "the" and "WMA."

152. Page 5.1, Section 5.0, 3rd bullet. Insert the following sentence between the first and second sentences: "As evidenced by the trend analyses discussed in this report, the first determination conclusion is that the B-BX-BY WMA is the source of contamination.

153: Page 5.1, Section 5.0, 3rd bullet. While the situation may be dynamic, the data and data trend analyses leave no question as to the source of the contamination. Delete the third sentence.

154. Page 5.1, Section 5.0, 3rd bullet. Delete the last sentence of the bullet and replace it with the following sentence: "Further determinations of contaminant migration extent, transport rates and concentrations will continue to be made."

155. Page 5.1, Section 5.0, 3rd paragraph. Change the first sentence to read: "The contamination observed at well 299-E33-41 has entered the groundwater as evidenced by the gradual and/or sharp elevations of nitrate, chloride, sulfate, sodium, technetium-99, and uranium."

156. Page 5.1, Section 5.0, 3rd paragraph. As the extent of contamination is not yet determined and as the comparison between concentrations of waste constituents occurring in groundwater versus concentrations of waste constituents occurring in the B-BX-BY tanks is inappropriate, delete the second sentence of the paragraph.

157. Page 5.1, Section 5.0, 3rd paragraph. As the overall impact of the releases from the B-BX-BY WMA has not yet been determined and as the qualitative and the comparison to other contamination plumes is both pre-mature and inappropriate without this information, delete the third sentence of the paragraph.

158. Page 5.1, Section 5.0, 4th paragraph. Re-write the sentence to state: "The open issues noted above, and further assessment of the groundwater contamination attributable to B-BX-BY WMA will be addressed in the further determinations to be made as described in Chapter 6 of this document.

159. Page 6.1, Section 6.0, title. Change the title to: "Proposed Further Determination Actions."

160. Page 6.1, Section 6.0. Re-write the first and second sentences as: "The first determination of 40 CFR 265.93(d)(4-6) of the B-BX-BY WMA concluded that the WMA has negatively impacted groundwater quality and further determinations of the B-BX-BY WMA as required by 40 CFR 265.93(d)(7)(l) will be performed. The following actions will be performed."

161. Page 6.1, Section 6.0, item number 1. Re-write the item to identify the following: "Quarterly monitoring will continue for the following RCRA wells: 299-E33-31, 299-E33-32, 299-E33-33, 299-E33-41, and 299-E33-42. The monitoring will occur to a) measure contaminant concentrations, b) measure rate of contaminant transport, c) monitor the changing groundwater flow and, d) monitor the decreasing water table. The RCRA groundwater monitoring network will, at a minimum, monitor the following constituents and parameters: arsenic, calcium, cadmium, chloride, chromium, fluoride, iron, lead, nickel, nitrate, phosphate, phosphorous, potassium, silver, sodium, sulfate, sulfur, zinc, technetium-99, uranium, and gross beta."

162. Page 6.1, Section 6.0, item number 2. Re-write this item to identify and propose actions to evaluate the following contaminated vadose zone issues: 1) depth, concentration, and distribution measurements of the cesium-137 and the effect, if any, of borehole contamination around borehole 21-02-04, 2) determination of the depth extent of the uranium and whether the uranium identified just above the groundwater in borehole 299-E33-41 originated from the BX-102 tank leak, 3) seal borehole 21-27-11 to prevent future spread of contaminants, 4) non-gamma-emitting plume characterization, and 5) periodic borehole monitoring to identify short-term changes caused by a possible large moisture flux or a new tank leak and to identify the long-term changes resulting from steady-state migration of the radionuclides.

163. Page 6.1, Section 6.0, item number 3. Add the following to the third item: "This will be performed by collecting same-day water table elevations from the following wells: 299-E33-31, 299-E33-32, 299-E33-33, 299-E33-36, 299-E33-38, 299-E33-39, 299-E33-41, 299-E33-42, and 299-E33-43."

164. Page 6.1, Section 6.0. Include an indication that due to the recently changing groundwater flow direction, estimates of groundwater sampling capabilities associated with this network will be provided in each B-BX-BY WMA assessment report. This indication should be similar to the third sentence of the fifth paragraph in Section 3.2 (page 3.4) of this report.

165. Page 6.1, Section 6.0, item number 4. As the specific conductance will be measured as well as water table elevations, the information of item 4 is not

necessary in relation to the B-BX-BY WMA contamination further determinations. Delete the item.

166. Page 6.1, Section 6.0, last paragraph. Insert an identification that an annual report will be generated. Indicate that the annual report will describe the observations made during the previous year. Also, delete the first sentence of the last paragraph. This section should clearly identify the path forward.

167. Page 6.1, Section 6.0, last paragraph. Re-write the last sentence of the last paragraph to state the following: "Until this report and plan, which includes proposed actions for further determinations, is approved by the regulator, sampling will continue quarterly with monthly sampling as necessary."

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