16945

COMMENT RESPONSE TO DOCUMENT REVIEW: TECHNICAL MEMORANDUM; REVISED FIELD SAMPLING PLAN AND DATA QUALITY OBJECTIVES, THE WEST SPRAY FIELD (IHSS 168) OPERABLE UNIT 11, ROCKY FLATS PLANT

MAJOR CONCERNS

1. The document does not clearly present the changes made to the original field program. These technical memorandums are recommendations to the public and guidance to field personnel. As this technical memorandum's purpose is to revise the original work plan, then each revision should be clearly identified. Tables and figures should be provided that clearly show the original sampling plan, and the changes to that program. To insure that sampling activities are done correctly, the direction to the field personnel who implement the sampling actions must be clear.

   Response:
   Attached to this memo is a chart, comparing the field program from the original Work Plan and the revised field program as stated in the Technical Memorandum (TM). This will be incorporated into the TM as Table 4-2 (attached). Revision #1 has been added to the title and the date has been added to the bottom of the cover sheet.

GENERAL COMMENTS

1. The document includes a discussion of selection of contaminants of concern (COC's). At the other operable units this process has been provided under a separate technical memorandum, which specifically discusses COC selection. The inclusion of COC selection in this document appears to be to support the discussion on limiting the analytical suite. To be consistent with the other operable unit investigations, the recommendation that the COC portion be presented as separate technical memorandum, and then referenced is made.

   Response:
   The Contaminants of Concern (COC) development is a background comparison process intended to maximize the use of existing data to focus the investigation. According to the Interagency Agreement (IAG), COC determination for risk assessment purposes must be developed in a separate TM. Because the COC determination process is not being used for risk assessment purposes in this TM, it is not necessary or cost and schedule effective to develop a separate document for COC selection.

2. The possibility that Uranium contamination is the result of off-site activities appears important enough to justify a confirmatory sampling program. Uranium is driving risk calculations, or is above regulatory limits at this or other operable units than confirming that the levels are the result of up-gradient sources would be important.

   Response:
   A confirmatory sampling program for Uranium contamination due to upgradient sources is not currently in the scope for Operable Unit 11 investigations. The primary objective of this sampling program is to first determine if uranium concentrations at OU 11 present a

significant risk regardless of source. Any subsequent evaluations for remediation would address the source issue. However, plans are underway for an upgradient monitoring well system to be installed by EG&G's geosciences group. These wells will be sampled for analytical suites that include COCs delineated in the OU 11 FSP.

SPECIFIC COMMENTS

1. "Executive Summary", p. ES-1, third paragraph; Please clarify if the risk assessment for Phase II will present a comprehensive assessment of risk, i.e. the risk associated with exposure to contaminants in the surface soils, groundwater, and surface water should be considered in total, as well as separately.

   Response:
   The third sentence in paragraph 1 on page ES-2 has been changed to;

   "These combined activities have been focused to provide an investigation that will allow an early comprehensive assessment of risk and will eventually provide a study for public presentation several years in advance of the original Interagency Agreement (IAG) schedule."

2. Section 1.1, p. 1-1, fourth paragraph: It would be easier to estimate the volume of water applied to the Areas if the measure was in gallons rather than inches.

   Response:
   The volume of water was estimated in inches because rainfall is measured in inches. However, the last sentence in paragraph 4 on page 1-1 has been changed to;

   "Because liquid from both ponds were applied to Area 1, the maximum total application could have been as much as 190 inches per unit area for all four years of operation (approximately 66,000,000 gallons)."

3. Section 1.1: p. 1-3, second paragraph: Nitrate is the only potential contaminant listed in the memorandum for the liquid from Pond 207-B Center. All of the potential contaminants should be listed as was done for the North pond in the paragraph above. If nitrate really was the only potential contaminant, explicitly state that in the text.

   Response:
   A table listing analytical results from a historical study on Solar Evaporation Pond water was added as Table 1-1 (attached) and the first and second paragraphs on page 1-3 have been deleted and the following was inserted;

   "Water from Solar Evaporation Ponds 207-B North and Center was analyzed from 1984 to 1988 for select constituents. The analytical results from this study are summarized in Table 1-1 (U. S. DOE, 1992). Organic compounds are not included on this table as the only detect was methylene chloride, which is a common laboratory contaminant (used as an organic extraction solvent in the preparation of organic sample analyses) and was also found in blanks from the same analysis. The information from Table 1-1 was used as supplemental guidance for Potential Contaminant of

Concern determination.

4. Section 2.1, p. 2-2, third paragraph: If possible provide an overlay of the 1993 survey with the 1989 results. This would provide visual support to the arguments made in the text.

Response:
The results to the 1989 survey are not in the GIS system as they were not prepared by EG&G Rocky Flats. Potential milestone impacts from this effort do not support completion of this task at this time. However, the OU 11 1993 study area will be outlined on Figure 2-1 (results of the 1989 study) so that results from the 1989 study can be compared to the 1993 study.

5. Section 2.2, p. 2-5, second paragraph: Lead and mercury are inorganic parameters. Please clarify why they are listed separately.

Response:
The sentence that lists lead and mercury has been changed to;

"Thirty-six samples were collected and analyzed for constituents known to have been in the applied liquid including select metals, radionuclides, and nitrate/nitrite."

6. Section 2.2, p. 2-5, fourth paragraph: The second sentence is confusing. A better definition and description with is link to the OU-11 sit should be made. It is unclear whether Layer 1 was the upper two feet of soil or if the Rock Creek samples were at the same level stratigraphically as the upper two feet of soil at this site. Layers 1, 2, and 3 should be defined.

Response:
The paragraph has been clarified and changed to;

"The 1988 samples were taken from test pits exposing the upper five feet of soil. Data from layer 1, the upper two feet of soil, was compared to Rock Creek background data (surface-soil from zero to six inches). Data from soil layers 2 and 3 were combined as they are from three to five feet below the surface and thus are Rocky Flats Alluvium (RFA) materials. Soil layers 2 and 3 were compared with background data from the RFA in the Geochemical Characterization Report (EG&G 1992b). All analytical data are summarized in Appendix C of this TM."

7. Section 2.2, p. 2-7, second paragraph: The two references quoted in this paragraph as providing standards for uranium and plutonium need additional support.

a. The status of the 1988 closure plan for OU-11 should be briefly discussed, i.e. does the document have validity from the regulators. Also the acceptance of the risk based levels calculated for OU-3 should be discussed, and these levels compared to the OU-11 values.

b. The last sentence suggests that Uranium source areas may be mining activities up-

gradient from OU-11. The sampling plan should attempt to verify this conclusion, i.e. this should be incorporated into the data quality objectives. The reference for the supporting argument is to Appendix B, which does not discuss this issue. (Is the reference supposed to be APpendix A?) If off-site sources for Uranium can be confirmed then potential problems in the Woman and Walnut Creek drainages, as well as some interesting values in the Rock Creek background set, may be explained.

Response:

a. The 1988 Closure Plan for OU 11 became the 1992 Work Plan, which is conditionally approved. Verbiage to that effect has been added to this paragraph. The risk-based soil levels for OU 3 have been approved by the regulatory agencies in the OU 3 Area of Concern document (referenced in the TM). Letter number 8HWM-FF dated Sept. 20, 1993 from the EPA to the DOE documents agency approval of the OU 3 document. The appropriate sentence has been rewritten as follows;

"Risk-based soil reference levels for plutonium have been established and approved by the regulatory agencies for OU 3 (Offsite Areas) as 3.5 pCi/g for residential areas and 100 pCi/g for recreational areas based on excess cancer risk of 1×10^{-6} (U. S. DOE, 1993).

b. The Appendix reference has been changed to Appendix A, which is the appropriate appendix. The explanation in Appendix A should be sufficient for an explanation of off-site sources of uranium at OU 11, and off-site sampling for another uranium source is outside the scope of this effort.

8. Section 2.2, p. 2-7, third paragraph: The rational for additional sampling is not fully explained and explored. Limited soil sampling, with a complete Quality Control program may be sufficient to verify this historical data. If verification of the results of the 1986, and 1988 sampling would assist in supporting the conclusions of the study, then limited sampling could be conducted to verify this data set. If the historical data set is not vital to the program then the recommended sampling should not be conducted.

Response:

The proposed sampling activities will fill in data gaps that exist in the interval of subsurface soil between five feet and groundwater as well as any perched water that may be encountered in this zone. Existing data from the 1986 and 1988 programs do not provide information to characterize this zone. Additional data are necessary. This is clarified in the TM by adding an introductory paragraph to the section as follows;

"Two historic soil sampling programs were conducted at the WSF to determine if immediate removal actions were necessary. The sampling programs took place in 1986 and 1988. Soils were analyzed for contamination to a depth of five feet. The programs determined that immediate remedial actions were not necessary. Results from these two studies provide useful information for focusing the OU 11 field sampling program. No previous investigation of soils below five feet has been conducted."

9. Section 2.2, p. 2-8, bullets: First bullet - Please clarify the cleanup guidance standards i.e., are the standards state-wide or based on other sites or areas at RFP.

Second bullet - Please add that an additional reason that the volatile concentrations are inconclusive is that there is a lack of quality assurance and quality control (QA/QC) samples from the earlier sampling and data validation could not be performed.

Response:
First bullet - The words "cleanup guidance standards" were changed to "closure performance standards from the 1988 OU 11 Closure Plan."

Second bullet - This paragraph has been changed to;

"Concentrations of volatile organic compounds are inconclusive because of laboratory blank contamination, the lack of QA/QC samples from the earlier sampling effort, and data validation not being performed. However due to the method of waste water application, VOC's would have volatilized if they were ever present in solar pond water."

10. Section 2.3, p. 2-9, third paragraph: The "upper hydrostratigraphic unit" term referred to in the paragraph needs to be defined in the document. The site conceptual model, Figure 3-1, dies not identify this unit. THis nomenclature was not used in the "Draft Final Work Plan. Phase I RFI/RI Work Plan for Operable Unit 11" dated December 10, 1991. While Technical Memorandum do not need to be a stand alone document, the information presented in the memorandum should be consistent with the original work plan or changes should be clearly stated and sufficiently referenced and supported. If interpretations have been modified then enough information should be presented to support the new interpretation.

Response:
The upper hydrostratigraphic unit has been labelled on figure 3-1. Furthermore, the paragraph has been rewritten;

"Groundwater monitoring at the WSF began routinely in 1986 and is being conducted to provide data for assessment of level, extent, and migration characteristics of contamination in the unconfined "aquifer", commonly referred to as the upper hydrostratigraphic unit (Rockwell International, Inc., 1987). (The term aquifer is avoided because this hydrostratigraphic unit does not transmit significant quantities of water.) Groundwater flow in the upper..."

11. Section 2-3, p. 2-10, third paragraph: The first sentence lists 3 contaminants that may have been due to site activities. However, the paragraph above lists a number of inorganic compounds that were "significantly" higher in down gradient monitoring wells. Please clarify why these were not included in the closing discussion.

Response:
The purpose of this section was to summarize current groundwater monitoring activities, including contamination. This was not clear in the original TM, thus the last four paragraphs have been rewritten as follows;

Groundwater quality in the upper hydrostratigraphic unit in downgradient wells was compared with that in the upgradient wells and with background groundwater quality (Section 4.2) and is summarized below:

- The only volatile organic compound detected in groundwater was xylene, and that was only detected in one sample from the fourth quarter of 1992 at a concentration of 10 µg/l.
- The only radionuclides detected at activities exceeding sitewide background levels were americium, plutonium, and tritium.
- Plutonium activity was above the sitewide background value in groundwater from only one well during one quarter.
- Concentrations of uranium-233, 234 were detected in five downgradient wells but were within the upper tolerance limits of background values.
- Calcium, chloride, fluoride, silicon, and sodium were measured at greater concentrations in the downgradient monitoring wells; sulfate, nitrate/nitrite, magnesium and total suspended solids all were measured at higher concentrations in upgradient monitoring well number 5186.

Information concerning contamination values for groundwater at OU 11 is detailed in Appendix C, Contaminants of Concern Tables. Section 4.2, Contaminants of Concern, provides a discussion and evaluation of groundwater contamination.

12. Section 3.1.3, p. 3-4, third paragraph: A more inclusive discussion of the groundwater sampling program and its results should be made. This gap of information makes it difficult to agree with the objective of searching for a perched water table, for the primary purpose for preparing this technical memorandum.

Response:

The paragraph has been rewritten as follows;

"The upper portion of the upper hydrostratigraphic unit has not been investigated thoroughly. The media of concern that received the most attention historically were shallow soils, surface soils, and the saturated zone (the lower portion of the upper hydrostratigraphic unit). Relatively little attention has been given to potential perched water zones resulting from spray application. This perched system is thought to exist for two reasons;

1. Continuously screened wells (those screened *through* the entire upper hydrostratigraphic unit) generally show higher levels of particular contaminants than those screened only in the lower portion of the upper hydrostratigraphic unit.

2. Shallow water zones were encountered during past drilling operations.

Perched water zones would have a greater potential of retaining contamination than the lower portion of the upper hydrostratigraphic unit due to the proximity of spraying operations. Therefore, the potential for a perched water system to exist and accumulate contaminants will be

investigated."

13. Section 3.1.3, p. 3-6, first paragraph: Please provide the supporting information that wells screened in both the unsaturated and saturated zones have elevated nitrate levels. A figure showing the boring log information with a corresponding chart showing nitrate levels over time would be very useful to support the discussion.

Response:
To support this conclusion, a figure showing nitrate levels over time for all monitoring wells in the OU 11 network has been included as figure 3-2 and appropriate reference to that figure has been made within the text.

14. Figure 3-2, p. 3-9: Please modify figure to show decision logic on threat, and proceeding to response action or normal Corrective Measures Study/Feasibility Study. Interim Measures/Interim Remedial Action (IM/IRA) should only be implemented in response to an immediate threat to human health and the environment.

Response:
As required by EPA, an IM/IRA, rather than a CMS will present the evaluation and assessment of what remedial actions, if any, need to be taken. Assuming the likely scenario that no further action is required, the CMS supporting CAD/ROD will simply reference the IM/IRA.

15. Section 3.2.2, p. 3-11, first bullet: Please clarify if this step has already been conducted. Based on the Executive Summary it was review of historical information that resulted in the preparation of this memorandum.

Response:
The fourth and fifth sentences in the paragraph have been changed on as follows;

"The surficial soil analyses were conducted in 1986 and 1988. This historical information was reviewed and statistically evaluated against background values and risk parameters."

16. Section 3.2.3, p. 3-12, Table 3-2: Key points on the table need to be corrected. Point 3 in the 1st row, 2nd column should not have an associated analytical level because nothing is to be analyzed. It is a decision making point only. The analytical levels in the 2nd row also don't match the activity presented. Both of the activities are evaluating previous work and will not require field screening or lab analyses.

Response
The appropriate changes have been made and the table is attached.

17. Figure 4-1, p. 4-2: Please clarify or reference procedures as to what occurs within the Quality Assurance Testing of data step. Specifically define what occurs if data do not pass screen.

Also detection frequency should not be used as a screen for Contaminant of Concern selection. If 100 samples are collected and nine are contaminated within a small area this methodology would result in not considering that "hot spot".

Response

a. The paragraph has been changed to;

"The method of evaluation is graphically represented in Figure 4-1. For each media of concern, the appropriate analytical suite is identified based upon process knowledge and historical and current data available. The data is then put through QA testing to delete data determined to be duplicate or rejected data points so that statistical tests can be performed with appropriate data sets. After a battery of statistical tests (listed and described later in this section), the results are compared to background concentrations at RFP as presented in the Background Geochemical Characterization Report (EG&G, 1992b). In addition, analytes that are essential nutrients are not considered further in the PCOC list. Those analytes still remaining are compared to most likely ARARs or PRGs, whichever is available and the most conservative. The analytes that are remain after the tests are determined to be PCOCs."

b. Detection frequency was removed from the PCOC selection process.

18. Section 4.2, p. 4-4, second and third paragraphs: The discussion on the statistical tests to be performed needs to be clarified. Apparently only the Gehan test is considered necessary at the site. However, several other tests are going to be conducted, and if the results from those additional tests differ from the Gehan test, the results of those tests will be used to modify the sampling program. This approach can cause sampling difficulties. Different statistical tests require different input parameters. Key parameters, such as sample size, could drastically effect the results of the tests. The recommendation that the tests be compared and if modification of the sampling program is required, this modification be done now rather than later is made.

Response:

The additional tests were performed and in some cases provided a different interpretation of the results than the Gehan test. A complete discussion of the additional tests and results is now provided in Section 4.2 and Appendix D (attached). The text that describes the statistical interpretations has been changed to;

Background Comparison

"A nonparametric statistical comparison (one that does not require assumptions about specific distribution) was performed between the existing OU 11 data and background data obtained from the Background Geochemical Characterization Report (EG&G, 1992b). This was done for the purpose of statistically determining whether the OU 11 data significantly exceed background data at the 95 percent confidence level. (The significance level for determining if the null hypothesis

should be rejected is 5 percent.) The Gehan test was used, and comparisons were made without data replacement.

During the interagency meeting held on September 29, 1993, EG&G and DOE proposed a modified Gilbert methodology (EG&G 1993c) for performing OU versus background comparisons to generate a single list of PCOCs to be used for all facets of the OU study. Use of this proposed method, informally referred to as the "Strawman" approach, received verbal approval from representatives of both CDH and EPA following the meeting. It should be noted, however, that official endorsement of the method by the Agencies has not yet been finalized. In performing this analysis of potential contaminants in OU 11, EG&G has attempted to apply the method in order to comply with the verbal agreement with the Agencies. In reviewing this approach, the Statistical Applications Group (SA) from EG&G indicated that some of the battery of statistical tests discussed in Dr. Gilbert's report (i.e., quantile test, slippage test, t-test) may not offer much, if any advantage over the Gehan test alone. Statistician Dr. Kenny Crump made a similar evaluation at the request of EG&G and concluded that the Gehan test alone is generally sufficient for determining PCOCs (Crump, 1993). Since the September meeting, these three tests were applied to the OU 11 data for the purpose of confirming the conclusion. The slippage test identified only four additional compounds as being statistically elevated over background (See Section 4.2.2). Other statistical tests applied (quantile, t-test) did not identify additional potential contaminants based on background comparison. Results from the full complement of tests are provided in Appendix D of this TM.

Also agreed to at the September 29 meeting was the application of the 99/99 upper tolerance limit (UTL) as a "hot-measurement" test (i.e., for identifying potential hot spots). UTLs are calculated from background data and are intended to estimate an upper bound on background levels of analytes. All data from OU 11 were compared to the corresponding UTLs to identify the number of exceedances, if any, of the UTLs. These results are also shown in Appendix D. The analytes already retained as PCOCs were identified as exceedances as expected. Several other UTL exceedances were also observed; however, most individual analytes had only one exceedance. For example, the UTL evaluation of alluvial groundwater resulted in 10 metals each having one exceedance. Limited exceedances of the UTLs are expected for any data sets representative of a population. A cursory evaluation of temporal or spatial trends was performed for those 10 metals. It was observed that all but one of the exceeded values came from the same groundwater sample on the same date from the same well. The well, number 5086, is located at the southwestern boundary of OU 11, upgradient from the spray activities. The likelihood of environmental impact at this location from the spray field activities is low because of the upgradient proximity. All other concentrations of these metals observed at this well both before and after the date on which the anomalies were analyzed did not exceed the 99/99 UTL. These exceedances therefore are considered outliers and the metals are not retained as PCOCs for this reason alone. The well will continue to be monitored as part of the RCRA Groundwater Monitoring Program to provide more data for further evaluation.

The next step in this process is to evaluate, via spatial and temporal analysis, any compounds for which exceedances of the UTL were identified. However, this evaluation was not completed for this TM for two reasons. First, no method for this evaluation has been proposed by the regulatory agencies, and time/cost considerations prohibit development of such methods for this screening analysis. Without the spatial/temporal analysis, the UTL test has no utility as a hot-measurement test and, therefore, it is not used in this analysis. Second, the proposed field activities (see Section 4.3) include soil and groundwater analyses to complete the media evaluations. The implementation of the proposed activities is independent of the results of the UTL analysis for OU

11, yet will provide additional sample data which will refine the interpretation of the UTL evaluation. However, due to the nature of the historical treatment of waste at OU 11, no "hot spots" are anticipated. Water from the solar ponds was uniformly sprayed over the spray areas of the West Spray Field, thus the potential contamination should also be rather uniformly distributed across the OU.

19. Section 4.2.3, p. 4-10, second paragraph: Based on this analysis there is no support for more drilling and sampling. The reasoning driving this drilling program should be made unmistakably apparent. If the presence of Preliminary Contaminants of Concern(PCOCs) is the driver for the drilling program and if PCOCs for all media were eliminated, then the reason for the drilling program is unclear. Nitrate was mentioned in an earlier section as a COC, but doesn't appear in the PCOC list.

Response:
The drilling program is being driven by the need to fill in data gaps as well as further characterize the PCOCs as determined by the PCOC evaluation. Data have not yet been obtained for the unsaturated zone of the subsurface from between five feet and groundwater; therefore a PCOC evaluation could not be performed on for those subsurface soils to close out this potential pathway. Similarly, no perched water has been isolated for sampling so a data gap exists in that medium. These data gaps also drive the drilling program. the results of the additional statistical tests indicated that some PCOCs should remain in the media evaluated. These PCOCs are among the analytes that are also considered necessary for sampling media where data gaps exist. The paragraph was changed as follows;

"Because PCOCs were determined from monitoring wells designed to evaluate contamination in bedrock groundwater, the list of PCOCs for that medium is appropriate. However, the current conceptual model includes the presence of perched water within the subsurface soil. Data have not yet been obtained for the area of the subsurface from between five feet and groundwater, thus a PCOC evaluation could not be performed for that area. Similarly, no perched water has been isolated for sampling. If perched water is encountered during the proposed drilling program, wells will be installed and samples will be analyzed to determine if contamination exists in the perched zone."

For the question concerning nitrate: Because nitrate was expected to be an analyte of concern due to the effluent source, it was monitored in the environment since the mid 1980s. It was not until this recent PCOC evaluation that nitrate was determined not to pose a health risk at the levels detected.

20. Section 4.3.1, p. 4-15: Reference site selection should attempt to utilize sites already sampled for other OUs reducing scope and cost.

Response:
The West Spray Field is located further west than any other OU. Surrounding areas have not been sampled for Ecological parameters. Results from a sitewide sampling program

were coordinated with this project and will be incorporated into the final ecological assessment if the assessment is completed in time and if the data is applicable.

21. Section 4.3.2, p. 4-20, second paragraph: The estimate of how many samples will be collected for all parameters should be stated.

Response:
The first paragraph on page 4-20 has been removed as it does not lend clarity to the TM. The last three sentences in the remaining paragraph on page 4-20 have been changed to;

"A sitewide Ecological Evaluation will quantify the nitrate distribution in surficial soils (66 soil scrapes) and the impact of potential contamination on surface water. Subsurface soils will be sampled via core samples from the proposed boreholes and will be analyzed for TAL metals, radionuclides and nitrate/nitrite. A total of approximately 120 samples from 6 boreholes will be taken for this study."

22. Section 4.3.3.1, p. 4-21, third paragraph: Justification for the statement that the levels of nitrate are below risk based levels should be provided.

Response:
The paragraph has been changed to;

"The screened intervals of the wells in the current monitoring system are either too deep to monitor perched conditions, or the wells are screened through the entire thickness of the Rocky Flats Alluvium. Three wells with extensive screened intervals are 4986, 5186, and B410789. Nitrate/nitrite has been detected in all three wells at concentrations ranging from approximately 3 to 8 mg/l during the past several years. Concentrations were reported for nitrate/nitrite. These concentrations do not constitute a concern in terms of nitrate and nitrite groundwater quality standards (10 mg/L, EPA 1993); however, they may represent a dilution of shallow groundwater contamination with deeper groundwater from the saturated zone."

23. Section 4.3.3.1, p. 4-22, third paragraph: Subsurface geology should be utilized as one of the primary criteria for locating wells. The relationship of surface topography to perched water zones would appear to be problematical at best. Cross-sections and three dimensional fence diagrams could be utilized as preliminary siting instruments. As new boreholes are completed, the diagrams can be modified to reflect the new data and aid in site selection, i.e. the observational approach.

Response:
As stated in the DQO section, part of the purpose of the RFI/RI investigation is to characterize shallow subsurface lithologies. Not enough data exists to develop cross-sections and fence with certainty. It is likely, however, that if the borehole data from the OU 11 RFI/RI Investigation verifies the seismic data and provides more complete geologic data, cross sections and fence diagrams will be generated for the RFI/RI Report.

24. Section 4.3.3.1, p. 4-23, Figure 4-2: Groundwater flow direction for the water table aquifer should be available from already existing well information. Please include an arrow showing the general flow direction.

Response:
Regional groundwater flow in the water table aquifer is west to east. However, this flow direction probably has little impact on the occurrence of perched water conditions. Flow in the vadose zone is influenced by a strong vertical gradient as represented by arrows on the conceptual site model in section 3. Groundwater flow directions in the water table aquifer are not shown as this has no obvious relationship to the occurrence of perched water conditions. Groundwater flow directions in the water table aquifer would be shown if we were characterizing that portion of the hydrostratigraphic system, but this is not the case.

25. Section 4.3.2, p. 4-26, second paragraph: The drilling procedures discuss using sonic drilling to collecting soil samples in a split spoon. Typically, sonic drill rigs employ a split core sampler that is 5 ft. long. The typical split spoon is 2 ft. long. Sample frequency should be checked to assure that it is compatible with the chosen drilling method. For example, if samples for water content are to be collected every 2 ft., this means that at least 2 samples from a 5 ft split barrel will be necessary (as opposed to one per split spoon).

Response:
It is important to leave the option open to utilize the best sampling technology for subsurface conditions, which cannot be determined until fieldwork begins. Sampling will be composited every two feet, even if the sonic core barrel is five feet long. References to split spoon sampling have been removed and the last two sentences in paragraph 1 on page 4-27 have been changed to;

"Boreholes will be sampled in accordance with OP GT.02, Drilling and Sampling Using Hollow-Stem Auger Techniques or in accordance with a Document Modification Request (DMR) for a split core sampler used with a sonic drilling rig, depending upon the most appropriate technology as determined by subsurface conditions. Boreholes will be lithologically logged in accordance with OP GT.01, Logging Alluvial and Bedrock Material. During drilling operations, the cuttings will be ..."

26. Section 4.3.3.2, p. 4-27, first paragraph: Please clarify the status of the boreholes upon completion and how the monitoring wells are to be drilled. The middle of this paragraph states that after a boring is advanced to bedrock, it will be abandoned. The boreholes were to have monitoring wells instalied in them.

Response:
The paragraph has been rewritten as follows;

"Prior to drilling, approval for construction activities will have been obtained in accordance with OP GT.24 and drill sites will have been cleared in accordance with GT.10. Well locations will have been numbered and identified with stakes. During site preparation, an exclusion zone will be established according to the Site-Specific Health and Safety Plan, and the drill rig will be set up.

The objective of well installation is to monitor groundwater quality in potentially contaminated perched mounds. The monitoring network in the saturated zone is complete, and no new wells will be constructed to monitor this portion of the uppermost hydrostratigraphic unit. The total depth of each well will be determined by the EG&G project manager. Holes will be drilled to penetrate a perched saturated zone (if encountered) and the underlying aquitard. If a perched groundwater table is encountered, a monitoring well will be installed in accordance with this TM. If a perched groundwater table is not encountered, the boring will be advanced to the saturated zone. At that time the EG&G project manager will determine if the borehole should be abandoned in accordance with GT.05 or drilled to the alluvial/bedrock contact for the purpose of acquiring additional lithologic data in support of the OU 11 data acquisition plan. Since OU 11 subsurface lithologic data is incomplete, boreholes may be advanced to penetrate the entire RFA. After a boring has been advanced to penetrate bedrock..."

27. Section 4.3.3.2, p. 4-27, second paragraph: The goal of the sampling program needs to be clearly stated. COmposite soil samples are discussed in this paragraph. If the intent of the sampling program is to confirm or deny contamination at given depths across the site, compositing the samples will meet this goal. However, if the goal is to quantify extent of contamination, compositing samples will not meet this goal because if the composite sample for a given depth shows contamination, it will be impossible to trace with boring(s) contributed the contamination. Discrete sampling, would have to be accomplished to quantify the specific extent and magnitude of contamination. If it is the intent of the sampling program to collect enough information to develop a final action for this site, a different sampling strategy could be recommended. Collecting discrete samples instead of compositing samples and increasing the sampling interval from every 2 ft to 5 ft in order to reduce the number of samples per boring may more practically be implemented.

Response:

The proposed sampling plan of collecting two-foot composite samples is consistent with the sampling practices employed in other site-specific evaluations, for example OU 1, OU 2, and OU 15. Apparently there is a concern that "composite samples" refers to combined samples from several individual boreholes. This is not the case. So that the sampling intent is clear, the introduction to the paragraph has been rewritten as follows;

"For the purpose of defining extent of contamination, soil samples will be collected from ground surface to the saturated zone. At each boring location, discrete two-foot composite samples for chemical analyses will be collected from ground surface to a depth of 30 feet...

28. Section 4.3.3.2, p. 4-28, fourth paragraph: The sampling well design should be improved. The bore hole should extend at least 5 ft below the screened interval to accommodate the bentonite seal placed below the screened zone. The bentonite should be placed in a manner so that it does not get hung-up in the screened zone during emplacement. Bentonite can alter the pH of formation water. At least 2 ft of sandpack should extend below and above the screened interval to assure that the bentonite doesn't expand into the screened zone.

Response:
The paragraph has been rewritten as follows;

"Bentonite seals will be installed above and below the filter pack, with the bottom seal designed such that the perched mound and underlying aquitard are sealed from the lower portion of the hydrostratigraphic unit. A seal will consist of a layer of bentonite pellets that is at least three feet thick when measured immediately after placement, without allowance for swelling. The annular space between the well casing and the borehole will be grouted from the top of the bentonite seal to the ground surface. Each borehole will extend to a total depth of at least five feet below the screened interval to accommodate the lower bentonite seal. The bentonite should be placed in a manner so that it does not get hung-up in the screened interval during emplacement, as bentonite can alter the pH of the formation water. At least two feet of sandpack should extend below and above the screened interval to assure that the bentonite doesn't expand into the screened zone."

29. Section p. 4-29, sixth paragraph: For analytical parameters the order of collection in cases of low water volume should be presented.

Response:
The analytical sampling priority was established in Section 4.2.3, which is now referenced in the paragraph. If field parameters are the concern, SOP 5-21000-OPS, GW.6 indicates that field parameters will be measured after analytical samples are collected if the well is de-watered.

30. Section 5.1, p. 5-1, fourth paragraph: Distilled water should not be used as source water. Deionized water should be chosen instead. The distilling process removes organics but not metals. The deionizing process removes organics and metals.

Response:
The word "distilled" was removed from the paragraph.

31. Section 5.1, p. 5-2, Table 5-1: Source water blanks should be collected an analyzed for the same parameters as the site samples. Source water includes any site or facility tap water used in the investigation as well as deionized water. Samples should be collected at a rate of one per source per field shift.

Response:
The table has been changed to include "Source Water Blanks" as an activity and "1 sample per source" as the frequency.

TABLE 4-2
JUSTIFICATION FOR MODIFICATIONS TO THE ORIGINAL FSP

ORIGINAL FSP	MODIFIED FSP	JUSTIFICATION FOR MODIFICATION
Review new data	Continue to review all data	All site data need to be reviewed in conjunction with OU11. Some data need to be re-reviewed with consideration of new data.
Radiation Survey	High Purity Germanium Survey	Soil sampling from 1986 and 1988 does not indicate radiological contamination in the surface soils. While the 1986 program did not target areas suspected of being most highly contaminated, the 1988 program did. Plutonium was detected at activities higher than the background but significantly lower than the accepted action guideline levels. The data collected to date do not indicate the presence of hotspots. Nonetheless, an HPGe survey was performed at OU11 in September 1993 and did not identify any anomalous surface radiation.
Review existing and ongoing geological studies	Review all data	All site data need to be reviewed in conjunction with OU11.
Surficial soil sampling for NO_3, TAL metals, and inorganics; 75 samples	Soil sampling during drilling of proposed boreholes	Soil samples will be collected during the drilling of six proposed boreholes. The boreholes will be drilled to obtain additional information regarding subsurface conditions; however, sampling will begin near the surface to enable a complete profile of the core. The near-surface samples will provide additional information regarding the characterization of surface soil even though existing data do not suggest OU 11 activities have had adverse impacts on surface soil.

TABLE 4-2
JUSTIFICATION FOR MODIFICATIONS TO THE ORIGINAL FSP

ORIGINAL FSP	MODIFIED FSP	JUSTIFICATION FOR MODIFICATION
Test pit samples; 48 samples	-	The preliminary understanding of the site does not suggest the need of a spatially wide-spread data collection program. Samples from surface to a depth a five feet were taken in the 1988 test pit program; however, there is limited knowledge of the soil from a depth of five feet to bedrock. Chemical and physical analyses will be performed on recovered core from the proposed boreholes from the surface to the bottom of the hole to help fill in this data gap.
Borehole samples	Borehole samples; ~120 samples	Six boreholes are proposed to provide additional site data and fill in data gaps. Both physical and chemical analyses will be performed on core samples. Two-foot composite samples will be collected from the surface to a depth of 30 feet; six-foot composite samples will be collected from a depth of 30 feet to groundwater.
Sediment Samples; 16 samples	-	The 1988 program did not indicate significantly greater concentrations of constituents in the areas suspected to have received the greatest impact of spraying activities than the 1986 program which did not target sampling areas. Therefore, greater concentrations are not anticipated in surface water channels. The proposed Ecological Evaluation will address issues regarding surface water.
-	Perched water samples	If perched water is encountered during the drilling of the six boreholes, monitoring wells will be installed to enable the collection of perched water samples. Samples will be analyzed for TAL metals, radionuclides, and nitrate in addition to field parameters (pH, specific conductance, temperature, dissolved oxygen, and barometric pressure).

TABLE 4-3
SUMMARY OF PROPOSED FIELD SAMPLING ACTIVITIES AT OPERABLE UNIT 11

ACTIVITY	PURPOSE	METHOD	ANALYTICAL PARAMETERS	SAMPLING FREQUENCY	TOTAL NUMBER OF SAMPLES
GROUNDWATER SAMPLES					
Analytical Sampling	To determine if contamination exists in OU 11 groundwater due to historical spraying activities.	Laboratory Analysis	TAL Metals Plutonium, Americium Uranium 233/234, 235, 238 Nitrate	Six groundwater monitoring wells are proposed for OU 11.	24 annual samples (four quarterly samples of six groundwater monitoring wells)
Water quality	To detect abnormal conditions in groundwater.	Field analysis methods	pH Specific conductance Temperature Dissolved Oxygen Barometric pressure	Six groundwater monitoring wells are proposed for OU 11..	24 annual samples (four quarterly samples of six groundwater monitoring wells)
HIGH PURITY GERMANIUM SURVEY	Surface soil radiation data and Health & Safety screening.	Truck mounted HPGe gamma survey at 10 meters above ground level.	Plutonium 239 Americium 241 Potassium Cesium Uranium 235,238 Radium Thorium	HPGe surveyed 62 locations distributed evenly over the three historical spray areas.	62 survey stations
SUBSURFACE SOIL SAMPLING					
Boreholes	To provide subsurface geologic, lithologic and analytical data.	Sonic drilling will be employed, and core samples will be collected in a split spoon sampler or by using the core barrel method.	TAL Metals Plutonium, Americium Uranium 233/234, 235, 238 Nitrate	Two-foot composite samples will be collected from the surface to a depth of approximately 30 feet; six foot samples will be taken from a depth of approximately 30 feet to groundwater.	Approximately 120 samples.
Water content	To determine if perched water zones exist above bedrock layer.	Field measurement methods and subsequent laboratory analysis using "Speedy Soil Moisture Tester" or gravimetric methods.	Percentage Measurement	Samples for water content measurements will be collected every two feet.	Approximately 120 samples.

Table 1-1
SUMMARY OF LIQUID SAMPLING RESULTS FOR THE
SOLAR EVAPORATION PONDS

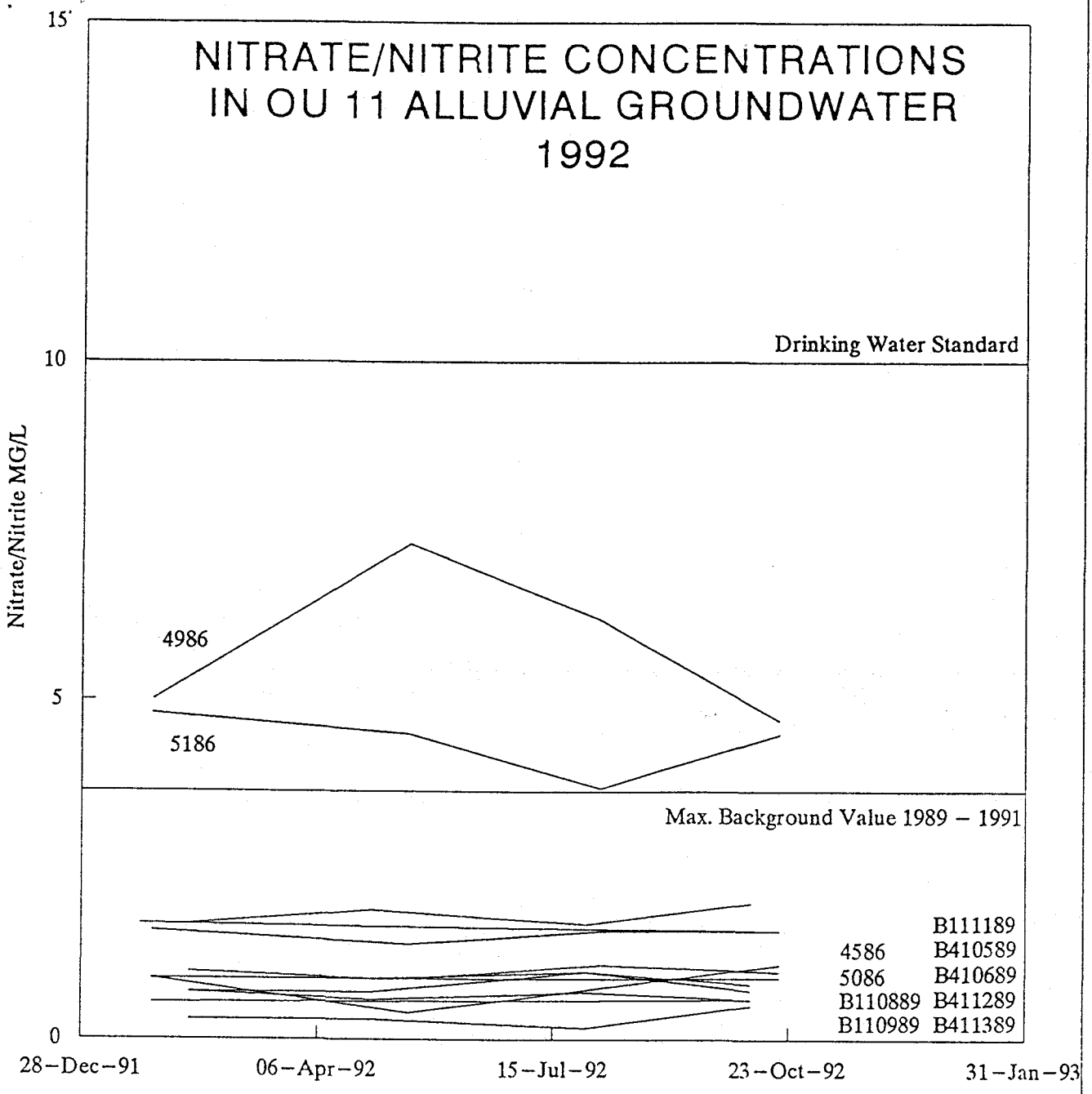
COMPOUND	UNITS	207 B NORTH	207 B CENTER
		1984-1988 Range	1984-1988 Range
ANIONS			
Ammonia	ppm	N/A	N/A
Bicarbonate	ppm	N/A	N/A
Carbonate	ppm	N/A	N/A
Chloride	ppm	N/A	N/A
Cyanide, Total	ppm	N/A	N/A
Fluoride	ppm	N/A	N/A
Nitrate, N	ppm	212-1367	ND-1220
Nitrite	ppm	N/A	N/A
Phosphate, Ortho	ppm	N/A	N/A
Phosphate, Total	ppm	N/A	N/A
Sulfate	ppm	N/A	N/A
Sulfide	ppm	N/A	N/A
TKN-N	ppm	N/A	N/A
RADIONUCLIDES			
Americium-241	pCi/l	ND	NA
Plutonium-239	pCi/l	ND	NA
Uranium-234	pCi/l	50-53	NA
Uranium-235	pCi/l	NA	NA
Uranium-238	pCi/l	31-33	NA
Uranium	pCi/l	NA	NA
Tritium	pCi/l	1200-1300	NA
METALS			
Aluminum	ppm	ND-1.00	ND-2.00
Antimony	ppm	ND	ND
Arsenic	ppm	ND	ND
Barium	ppm	ND-0.22	ND
Beryllium	ppm	ND-0.06	ND
Bismuth	ppm	ND	ND
Boron	ppm	0.09-0.31	0.071-0.67
Cadmium	ppm	ND-0.01	ND-0.01
Calcium	ppm	20-290	2.9-95
Cerium	ppm	ND	ND
Cesium	ppm	ND	ND-0.35
Cobalt	ppm	ND	ND

NA = Not Analyzed
ND = Not Detected (below detection limits)

Table 1-1
SUMMARY OF LIQUID SAMPLING RESULTS FOR THE
SOLAR EVAPORATION PONDS

COMPOUND	UNITS	207 B NORTH	207 B CENTER
		1984-1988 Range	1984-1988 Range
Chromium, Total	ppm	ND	ND
Chromium, Hexavalent	ppm	NA	NA
Copper	ppm	ND	ND-0.037
Germanium	ppm	ND	ND
Iron	ppm	ND-0.29	ND-0.2
Lead	ppm	ND-0.004	ND-0.002
Lithium	ppm	0.37-6	0.052-3.5
Magnesium	ppm	66-120	3.9-91
Manganese	ppm	ND-0.015	ND-0.022
Mercury	ppm	ND	ND
Molybdenum	ppm	ND-0.0069	0.004-0.037
Nickel	ppm	ND-0.05	ND-0.016
Niobium	ppm	ND	ND
Phosphorous	ppm	ND	ND-0.2
Potassium	ppm	56-120	30-110
Rubidium	ppm	ND	ND
Selenium	ppm	ND-0.024	ND-0.019
Silicon	ppm	ND-5.6	1.4-5.5
Silver	ppm	ND-0.082	ND-0.015
Sodium	ppm	363-820	67-800
Strontium	ppm	0.14-3.5	0.14-0.52
Tantalum	ppm	ND	ND
Tellurium	ppm	ND	ND
Thallium	ppm	ND	ND
Thorium	ppm	ND	ND
Tin	ppm	ND	ND
Titanium	ppm	ND	ND
Tungsten	ppm	ND	ND
Vanadium	ppm	ND	ND-0.0081
Zirconium	ppm	ND	ND-0.004
Zinc	ppm	ND-0.022	ND-0.041

NA = Not Analyzed
ND = Not Detected (below detection limits)



Note: Wells 4986 and 5186 are screened the length of the well; other wells are screened at the bottom of the alluvium.

FIGURE 3–2

OU 11
HYDROLOGIC DATA

TECHNICAL MEMORANDUM
Revised Field Sampling Plan

Table 3-2
OBJECTIVES AND ACTIVITIES OF THE REVISED FIELD SAMPLING PLAN

Objective	Field/Analytical Activity	Analytical Level*	Data Use
Determine if Contamination Exists in the Vadose Zone	1) Collect and analyze soil samples from borehole core	I & II - Field IV & V - Analytical	Site characterization Risk assessment Field Decisions
	2) Install monitoring wells targeting suspected areas of perched groundwater	I & II - Field IV & V - Analytical	
	3) Determine total drilling depth with the use of a field moisture measuring instrument	II - Field	
Evaluate Current Radiological Screening of Surface and Subsurface Soils	1) Obtain recent HPGe Survey data & evaluate against 1989 aerial survey	II - Field	Site characterization Risk assessment Health and Safety
	2) Statistically evaluate 1986 and 1988 surface and subsurface soil investigation results		
Assess Current Ecological Conditions	1) Compare current conditions to background	Not Applicable	Site characterization Risk assessment
	2) Determine the absence or presence of adverse impacts to the ecology.		

* Level I - Field analysis with portable instruments
Level II - Field analysis with mobile lab or more sophisticated equipment than Level I
Level III - Analyses performed in an off-site lab
Level IV - Contract Lab Program (CLP) routine analytical services
Level V - Analysis by non-standard methods

Table 5-1
Field QA/QC Sample Collection Frequency

Activity	Frequency
Field Duplicate[1]	1 in 10
Field Preservation Blanks	1 sample per shipping container (or a minimum of 1 per 20 samples)
Equipment Rinsate Blank	1 in 20 or 1 per day [2]
Triplicate Samples (benthic samples) [3]	For each sampling site
Source Water Blanks	1 sample per source

1. For samples to be analyzed for inorganics.
2. One equipment rinsate blank in twenty samples or one per day, whichever is more frequent, for each specific sample matrix being collected when non-dedicated equipment is being used.
3. For samples collected for tissue analysis.