UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

January 26, 1994

Reply To
Attn Of: HW-124

RECEIVED
FEB 02 1994
Environmental Restoration Division

Ms. Lisa Green, Deputy Director
Environmental Restoration Division
Department of Energy
Idaho Field Office
785 DOE Place
Idaho Falls, Idaho 83401-1562

Re: INEL WAG 7 Groundwater Pathway Draft Track 2 Summary Report

Dear Ms. Green:

In an April 1993 submittal you provided the Environmental Protection Agency (EPA) a draft Track 2 Summary Report for the groundwater pathway at WAG 7. EPA has reviewed the Report and has enclosed comments.

As I have discussed with DOE's WAG manager, the comments provided are primarily those of EPA's contractor. I have not reviewed the Summary Report, and the temporary leave of absence of EPA's WAG 7 manager has resulted in her inability to add her own review comments.

I apologize that it has taken this long to respond in written form to your April submittal. If you or your staff have any questions about the comments, or would like to schedule a meeting for comment resolution, please contact me at (206) 553-1743.

Sincerely,

Ed Jones, WAG 10 Manager
Federal Facility Section I

Enclosure

cc: D. Nygard, IDHW
D. Koch, IDHW
C. Strong, Geotech
J. Lyle, DOE
P. Cleary, DOE
M. Nearman, EPA

INTRODUCTION

EPA has reviewed the WAG 7 Groundwater Pathway Draft Track 2 Summary Report dated April 1993, for the Radioactive Waste Management Complex (RWMC) at Idaho National Engineering Laboratory (INEL) and the Transmittal of Groundwater Trend Analyses OU 7-06, WAG 7 (ERWM-ERD-079-93), dated August 12, 1993. In each review, general comments are followed by specific comments. Finally, a few comments on the data limitations and validation reports, which was used as a reference document, are attached.

DRAFT TRACK 2 SUMMARY REPORT

GENERAL COMMENTS

Overall, the WAG 7 Groundwater Pathway Track 2 Summary Report is good: the discussion of site geology and hydrogeology is superior. The reviewers feel that the authors understand and summarize well the complexities of fractured basalt. This kind of discussion should be used in the track 2 or remedial investigation/feasibility study reports from other waste area groups (WAGs), and if possible, the discussion in this report (Section 3) should be incorporated into other operable unit (OU) reports on the RWMC.

Deficiencies have been identified in pumping test analyses, discussion of groundwater flow (dike swarm hypothesis), and the trend analysis for carbon tetrachloride. These deficiencies are relatively minor. Recommendations for the pumping test analyses and the trend analysis using the least-square regression technique are presented in the following specific comments.

The report uses the Standard International metric unit system for length, thickness, weight, and area, although many hydrogeologic parameters are shown using English units of measure. The hydrogeological parameters should be presented using metric units with English units in parentheses for consistency. When figures use English unit, the corresponding discussions of the figure in text should use the same system with the alternative system in parentheses.

SPECIFIC COMMENTS

Section 1.0

Many of the references cited in this section (including Robertson and others 1974, Vigil 1989, and Mann and Knobel 1988) are not listed in the reference section (Section 7.0). Other references may be present but are given in a different form (such as Burgess 1992 versus Burgess and Higgs 1992 and Wood 1989 versus Wood and others 1989). All references should be listed clearly using one standard format.

Section 1.1, page 1, last paragraph, and page 3, first paragraph

The unit conversion calculation from hectares to acres and kilograms (kg) to pounds (lb) is incorrect. Values listed in these paragraphs should be checked and corrected accordingly.

Section 3.1, page 11, Figure 3

This figure should include the locations of deep coreholes C1 and C1A.

Section 3.1.2, page 12, Figure 4

This figure shows that the groundwater monitoring riser pipe (1-inch PVC piezometer) and groundwater pump were installed inside of a 6-inch-diameter casing. The diagram does not show the screened section of the 6-inch casing or the well completion outside the casing (i.e. the sand pack and grouting seal). This information should be shown in the figure.

Section 3.2, page 15, Figure 5

A scale should be included in this figure and the coreholes (C1 and C1A) should be added. The title of this figure should be changed to Location and Legend of Geologic Section A-A' at the RWMC. The current title is confusing.

Section 3.2, page 16, Figure 6

This is a useful and well presented geologic cross section. The following additions, however, would be helpful.

- The general direction of the cross section (add NW and SE above the letter A and A', respectively).
- Question marks at end of the three discontinuous interbeds (interbeds A-B, C2-C3, and E-F). The ends of these interbeds are the author's interpretation and are not yet proven by the borehole data.

Also, because this cross section uses English unit of measure for length and thickness, the discussion of the stratigraphy in the text should use the same units with metric units in parentheses, in contrast to the recommendation made earlier in the general comments. These changes will make the discussion easier to follow.

Section 3.2.1, page 17, Figure 7

A scale should be added to the figure or the figure should be specified as "not-to-scale."

Section 3.2.2, page 18, second paragraph

The text states that coreholes C1 and C1A are 10.4 meters (34 ft) apart. The figure on page 19 shows that the corehole are 34 inches apart. This discrepancy should be corrected.

Section 3.2.3, page 27, second and third paragraphs

Physical properties of interbed sediments appear to not have been fully characterized because of the difficulty of retrieving the samples. The report should indicate whether this is a remaining data gap or if the previous study by McElroy and Hubbell (1990) is adequate for vadose zone characterization and contaminant fate and transport modeling.

Section 3.4, pages 30 and 31

The pumping test analyses of "M" series wells are generally acceptable. However, the reviewers believe that the test data could be analyzed in more detail. Alternative interpretations should also be presented. These alternative interpretations using leaking-aquifer-without-storage and double-porosity models may result in more defensible transmissivity values since some of the drawdown responses, as well as the hydrogeological conceptual model for RWMC, indicate that these models are probably more appropriate. More detailed recommendations are presented in the following comments on Appendix D.

Section 3.4, page 31, Table 3

Some of the specific capacity and transmissivity values presented in this table are inconsistent with Table 1 in Appendix D. These values should be checked and discrepancies should be resolved.

Typographical errors that should be corrected include: (1) the unit for average transmissivity (last column) which should be changed to ft^2/day, and (2) the second transmissivity value calculated using Theis' method for USGS-88, which should be 1000 r instead of 1000 d.

Section 3.5, pages 31 through 48

The discussions of groundwater flow in this section are generally good, although some are difficult to follow. The well hydrographs lack details such as the time lag of water levels between wells (or the information is not clearly shown). Certain sections of the hydrographs should be expanded, especially information pertaining to the spreading recharge period and the dry-year period. The enlarged hydrographs will probably demonstrate more clearly the hydraulic communications among the wells, and water level responses to the spreading recharge area.

Section 3.5.1, pages 36, 37, and 38, Figures 18, 19, and 20

A north arrow and, water level measurements for the individual wells that are used to construct the contour maps should be added to these figures. Further, additional information is needed for Figure 20 to explain the values shown near the well names. These values do not appear to be the water level elevations and should be expanded in a legend. A typographical error was also found in Figure 20 for the "M" series wells; the letter S was misprinted as 5.

Section 3.5.2, page 40, Figure 21

A discharge unit should be added in this figure.

Section 3.5.3, page 44, Figure 23, and page 45, second paragraph

A hypothetical (vertical) dike swarm scenario is shown in the figure and discussed in the text. The effort to illustrate and describe the complex hydrogeological conditions at the RWMC using the observed water level and groundwater geochemical data is appreciated by the reviewers. The following comments represent the reviewers' assessment of the issue and are presented here for reference.

- The vertical dike swarm scenario should be renamed as the hydraulic barrier or isolated zone scenario which would be less specific in terms of what forms the barrier or isolated zone. The existence of continuous vertical dikes may never be proven unless extensive horizontal or angled coreholes are drilled.

- Water level steps shown in Figure 23 are difficult to prove. Because the fracture pattern of the basalt and hydraulic relationships among the fractured zones are so complex, there is a vertical hydraulic gradient at the RWMC. This vertical gradient, in conjunction with horizontal gradient changes caused by changes in horizontal hydraulic conductivity of transmissivity, make the flow system very complicated. The water level steps (sharp breaks or discontinuity of water levels) may or may not exist. Based on the water level contours shown in Figures 18 and 20, there is a groundwater level mound, not a plateau, to the south of RWMC.

Section 4.1.2, page 50

This text discusses background concentrations of several transuranic radionuclides. It should be emphasized that (1) all transuranic radionuclides are of anthropogenic (not natural) origin, and (2) although some transuranics and fission products are ubiquitous surface contaminants from nuclear tests and nuclear accidents, EPA would presume that such radionuclides in groundwater at INEL are the result of INEL activities. Therefore, these radionuclides cannot be attributed to background sources without sufficient supporting evidence. In the Agency's view, the question of the source for these contaminants is primarily relevant in terms of source control, and to cost allocations among the various tenants at INEL.

Section 4.3, Page 56, first paragraph

The text should state the order of the polynomials whose curve is one shown as the "best fit." This is particularly important because as the order of the polynomial approaches the number of data points (that is, as the degrees of freedom approach zero), the fit automatically improves. This information is necessary so that the validity of the suggested "best fit" can be evaluated. Also the text referring to Well 88 should be corrected to show that the linear regression curve is a first order polynomial.

The text states that the regression for Well 88 omitted the earliest result, 6.6 micrograms per liter (μg/L) "because of the extreme variances in the concentrations." Variance is a precisely defined statistical term but it appears that the phrase "extreme variances" is used to refer to outliers. The report should use some formal statistical procedure to deal with suspected outliers. Using American Society for Testing and Materials (ASTM) Method E-178 (Standard Practice for Dealing with Outlying Observations) and a probability of less than 0.001 value comes from the same normal distribution as the others. Therefore the exclusion is fully justifiable, although the justification in the report should be restated.

Section 4.3, Page 56, third paragraph

The report should extrapolate the curve (shown in Figure 30) for carbon tetrachloride concentrations in the RWMC production well to its maximum. The figure appears to show that concentrations in this well will reach 2.5 μg/L in about 1995. This is the CERCLA action level, half of the regulatory limit, the maximum contaminant level. The data on these contaminants should be carefully monitored. In an area with a similar climate (New Brighton, Minnesota), and similar contamination (tetrachloroethene and 1,1,1-trichloroethane), a granular activated carbon system in an insulated, heated pumphouse has functioned reliably for a decade.

Section 4.3, page 56, and Figures 26 through 30, pages 59 through 63

The trend analysis and the least-square regression fit are described in this section and shown in the figures. The discussion of the polynomial regression fit should be expanded. It appears that the sampling data from one of the wells (USGS Well 88) are analyzed using linear regression, while data from the other wells are analyzed with second-order or higher polynomial regressions. The report should present a regression equation for each least-square fit of the data. Also, statistical analysis should be used to confirm that the current polynomial regression significantly improves the curve fit over that obtained from the lower order of polynomial equations. The residual error or variance should also be presented for each curve fit.

Section 5.5, Table 9

This table is unclear. It should include adequate headings with units and (if necessary) footnotes. Finally, the results calculated for radionuclides (discussed in the text on page 66) should be included in the table.

Section 6.4, page 72

The proposal to use only groundwater data to establish a long-term target analyte list assumes that no new contaminants will break through to the groundwater. In view of the extremely wide variety of materials disposed of at the RWMC, this is not a safe assumption. The semiannual groundwater sampling includes general analyses at predetermined intervals (2 to 5 years). This will help identify any new contaminants, yet still be cost effective. Also, the RWMC production well should be analyzed frequently to insure that the observed contamination is being controlled at concentrations below the regulatory limits.

APPENDIXES

The appendixes need pagination so that any pages that may be missing or scrambled can be identified. Also, all appendixes except the simplest should have tables of contents to facilitate reader access.

Appendix B, Interbed Physical Properties Results

There is only one sediment sample (RIS05001PR) result reported by Daniel B. Stephens and Associates, Inc. The reported sample porosity is 42.22 (% Volume) (page 3 of the DBSA report). However, the following test results show that a saturated moisture content (under zero pressure head) is 46.69 (% Volume). There is no explanation for this in the report. This discrepancy should be checked with the lab contractor and corrected or explained.

Appendix C

The reviewers were unable to adequately review this appendix because the following deficiencies.

- The appendix includes most of the raw material for the data validation. However, data do not appear to be validated.
- Although these data are supposed to be validated, laboratory qualifiers (such as "*," "N," and "W") which are not standard validator's qualifiers are used frequently. The qualifiers are never defined at any rate.
- Sample RIS05801C1 is labeled "rinsate," but its metal concentrations are typical for INEL groundwater. The identity of this sample should be checked and other headings should be verified to ensure correct identification of the rinsate.

This appendix should be both complete (all four rounds) and organized.

Appendix D, Pumping Test Analysis

The pumping test analysis is generally acceptable, although a more detailed analysis may be needed for a better understanding of the aquifer hydraulic characteristics. Modification of the pumping test analysis should include:

- A conceptual model of the site hydrostratigraphy and hydrogeology (i.e., identification of aquifers, aquitards, or aquifer zones)
- A qualitative analysis of pumping test data, to identify the types of drawdown responses, deviation of the data from the typical type curves, leaky or nonleaking conditions, and possible boundary conditions.
- Alternative interpretation of the pumping test data. For example, if the RWMC monitoring wells are considered fully penetrating in the aquifer (zone) and the aquifer zone is considered as confined, the leaky aquifer without storage model (Hantash and Jacob 1955, and Jacob 1960) should be applied for data interpretation. In addition, for the small-scale pumping tests in the RWMC monitoring wells, a double-porosity model (Moerch 1984) should also be considered as an alternative approach. These two models have been identified as useful for small-scale pumping test analysis in a fractured basalt aquifer (Li 1991).

Appendix D, Table 1

Some of the values listed in this table are inconsistent with those in Table 3. In the text, some specific capacity values appear to be incorrect. This table should be checked for errors.

Appendix D, page 9, Figure 4

The pumping test data deviate from this type curve at early and later stages of the test. These deviations should be explained and discussed in the text. The rationale for use of intermediate-period test data should also be explained.

Appendix D, pages 10 and 11, Figures 5 and 6

The figures should indicate the time points that the pump was off. The plots show that the water levels in these two wells actually increased after an initial decline. The pumping discharge rate plots should be presented to allow evaluation of the reasons for these responses. Well construction, data logger and pressure transducer accuracy, and other factors should be considered for these response evaluations.

Appendix D, Section 3.2, pages 15 through 26

The multiple-well pumping test analysis should be modified based on the evaluation of the hydrogeologic conceptual model. Well USGS-88 is not completed in the same fractured zone as M4D. It may not be appropriate to consider the drawdown responses in USGS-88 to be the response of the pumped aquifer. In other words, USGS-88 may not directly connect hydraulically to the pumping well. The linkage between the observation well (USGS-88) and the pumping well may be the leakage through less permeable basalt flow zones. This interpretation may explain why the transmissivities calculated from the pumping well (M4D) and the observation well (USGS-88) differ by two or three orders of magnitude.

REFERENCES

Hantush, M.S. and Jacob, C.E. 1955. Nonsteady Radial Flow in an Infinite Leaky Aquifer Transactions of American Geophysical Union Vol. 36, pp 95-100.

Hantush, M.S. 1960. Modification of the Theory of Leaky Aquifers Journal of Geophysical Research Vol. 65, No. 11. pp 3713-3725.

Li, T. 1991. Hydrogeologic Characterization of a Multiple Aquifer Fractured Basalt System. Ph.D. Dissertation. University of Idaho. Moscow, Id. 303p.

Moench, A.F. 1984. Double-porosity Models for a Fissured Groundwater Reservoir with Fractured Skin Water Resource Research Vol. 20, No. 7, pp 831-846.

GROUNDWATER TREND ANALYSIS

GENERAL COMMENTS

The groundwater trend analysis report dated August 12, 1993, shows no significant trends for 11 identified contaminants of concern. The lack of a trend probably resulted from a lack of sampling data points. Only 3 data points (over 7 months) are reported in this trend analysis. In view of the data variability over the several years shown in the groundwater track 2 report, more data points are needed for adequate trend analyses.

The discussions of several contaminants of concern are inconsistent with the data tables and figures. These inconsistencies should be checked and corrected accordingly.

SPECIFIC COMMENTS

Page 3, second paragraph

The tritium analysis is inconsistent with the data listed in Table 1. The table shows that tritium has not been detected in well M6S (page 6). The discrepancy should be resolved.

Page 3, third paragraph

The text states that wells M1S, M10S, and M4D showed no chloroform in any of the samples analyzed. Table 1, however, shows that chloroform was detected in all three wells in at least one sample. This discrepancy should be checked and corrected accordingly.

Page 5, last paragraph

The last sentence of this paragraph states that nitrate concentrations for the 5/93 sampling event tend to be somewhat higher than those of the other two sampling rounds. This statement cannot be supported by the data. Table 1 on page 6 shows that the 5/93 sampling results for nitrate concentrations are actually *lower* than previous sampling results. The decrease of nitrate concentration is clear for several monitoring wells (i.e., from over 1,000 to about 600 $\mu g/L$). This statement and the data table should be checked and corrected accordingly.

DATE LIMITATION AND VALIDATION REPORTS

The following comments apply to the data limitations and validation (DL&V) reports submitted on April 12, 1993 and July 7, 1993. There were a few anomalies, noted below.

- **SDG RIS10101D4 (Volatile Organic Analyses)** Section 4.2 of the DL&V report says no field quality control blanks were analyzed. However, the time of collection on the chain-of-custody forms (included with another DL&V Report) shows that all samples with numbers beginning "RIS1080" are field blanks. These contain 24 to 40 μg/L of bromodichloromethane, indicating the use of chlorinated drinking water, rather than reagent water, for these blanks. Therefore, the traces of chloroform (less than 1 μg/L) in all other samples should be considered artifacts and the results changed to "1U."

- **SDG RIS15001C1 (Inorganic Analytes)** CTR Comment 2 (on field duplicates) qualifies iron results for the pair RIS15401C1/RIS15402C2. The reported concentrations were not detected at 5 μg/L and detected at 12.1 μg/L, respectively. The criterion is twice the contract-required detection limit, which is the same as the instrument detection limit, 5 μg/L, in this case. Therefore, this difference (12.1 minus 5 or less) is within the criterion (10), so no qualification is warranted.

- **SDG RIS15001D4 (Volatile Organic Analyses)** The blanks, both laboratory and field, seemed unusually messy, which may indicate lapses in technique. Also, the 21 μg/L of chloroform in the field blank suggest the use of chlorinated drinking water rather than reagent water.

- **SDG RIS150001ET (Semivolatile Organic Analyses)** Page 7 of this DL&V Report was missing from the review copy.