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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

May 4, 2009

Mr. David Scruggs, Chief
Environmental Restoration Program
49 CES/CEVR
550 Tabosa Ave.
Holloman AFB, NM 88330-8458

SUBJECT: NOTICE OF DISAPPROVAL: BASEWIDE BACKGROUND STUDY REPORT, JANUARY 2009
HOLLOMAN AIR FORCE BASE, NM, EPA ID# NM6572124422
HWB-HAFB-09-004

Dear Mr. Scruggs:

The New Mexico Environment Department (NMED) has reviewed the subject Report, which was submitted to provide background levels for non-organic constituents in soil and groundwater at the U. S. Department of Defense's (Permittee's) Holloman Air Force Base. NMED has determined that the Report cannot be approved at this time, as revisions are necessary. The following are the deficiencies the Permittee is required to address before the NMED can take action on the Report:

1. **General Comment**

Section 4 of the Background Study Report is difficult for the reader to follow in that the activities completed and their order is not clearly articulated or otherwise explained. To correct this problem, the Permittee must revise the introduction to this section to include a summary of the steps taken to generate the statistical descriptors of background conditions such as listed in Tables 4-11 through 4-16, including the Upper Tolerance Limits (UTLs).

Despite these problems, NMED gleans that the following steps were implemented by the Permittee, in the following order:

i. Raw data were summarized in Tables 3-1 through 3-6 for soils and Tables 3-7 and 3-8 for groundwater.
ii. Statistical descriptors were prepared using the raw data (no outliers were indentified and excluded at this point). A normality test was conducted on the raw data. The results of these efforts are summarized in Tables 4-1 through 4-5.
iii. The data were transformed into their natural logarithms (including, oddly, some data that were found to be normally distributed in step ii. above). Outliers were determined and removed from the data sets. The outliers removed are listed in Tables 4-6 through 4-10.
iv. Statistical descriptors were prepared using the reduced data (outliers removed) after the data were transformed to their natural logarithms. A second normality test was done on the transformed data. If the transformed data was found to be normal for a constituent/media, and a certain percentage of detects were available in the data set, a UTL was calculated. Otherwise, a UTL was assigned by other means. The results of these efforts are summarized in Tables 4-11 through 4-15.
v. Composite soil UTLs were generated by taking the average of the UTLs for the three soil types (surface, subsurface, and saturated subsurface soil) and were reported in Table 4-16.

In addition to the revisions to Section 4, in its response to this NOD, the Permittee must indicate if the steps (i.-v.) listed above are an accurate summary of those actually taken by the Permittee to establish background conditions for each constituent. If the steps are not an accurate summary, the Permittee shall indicate any corrections needed to produce an accurate summary.

2. <u>Page 4-1, Section 4-1, 2nd Paragraph, 2nd and 3rd Sentences</u>

The text states "Current and historical sampling data, as well as lithological data, was reviewed in order to select wells that have consistently had organic concentrations less than 5 parts per billion (ppb) and wells constructed within the same hydrostratigraphic unit. Based on communication with NMED, monitoring wells with minor organic contamination could be used as part of this study, provide there is no impact to metals concentrations".

The Permittee was informed by NMED staff that trace amounts (e.g. 5 ppb) of organics would not be expected to adversely affect background conditions for metals. However, groundwater samples obtained at some wells included in the study do not appear to be representative of background conditions due to high levels of nitrate, detectable levels of ammonia, and high levels of dissolved iron and manganese (the latter three are

representative of reducing conditions which can affect the concentration of metals in groundwater.)

The Permittee must evaluate the data sets for filtered and unfiltered metals in the areas containing the highest levels of ammonia, nitrite, dissolved iron, and dissolved manganese to assess whether the concentrations of metals in groundwater have been affected by reducing conditions. This area appears to be south and east of wells MW-BG-04, MW-58-03, TDS-MW03, and TDS-MW04. The Permittee shall furnish information to the NMED concerning the method used to evaluate the impact. If the concentrations of any metals have been significantly affected, the Permittee shall denote the affected metals and the areas on a map.

3. **Page 4-2, Section 4.2, All**

This section of the Report presents a discussion of how the number of samples to be collected (sample size) was determined. The Permittee must use the same method to determine whether the appropriate number of samples was actually collected for each constituent, using the corresponding sample standard deviation calculated for each constituent in the background study. A summary of the results for each constituent for each media shall be incorporated into a new table showing the sample size needed and the actual number of samples obtained. This requirement does not apply to situations where all or most of a data set for a constituent/media consists of data points with values that are below the level of detection.

4. **Page 4-3, Section 4-3, All**

This section does not discuss combining the three soil types even though the section is entitled "Combining Data Sets". Only in Section 5.3 is the reader informed that the Permittee believes that the three soil types are representative of a single population for each soil constituent, and that Composite Soil UTLs have been calculated. See comment #16. The Permittee shall add a paragraph in Section 4.3 that indicates that Section 5.3 also discusses the combining of the three soil types that were evaluated by the Background Study.

5. **Page 4-4, Sections 4.4.1 and 4.4.2, All; and Tables 4-11 through 4-15**

The Permittee assigned the constituents/media listed in Table 1 below a UTL equivalent to twice their method detection limit (DL) or minimum detectable activity (MDA) because their data sets contained only a few or no detections.

Table 1. Data Sets Containing Few or No Detectible Quantities

Media	Constituents
Surface Soil	Sb, Ag, Tl, Se, C-14
Subsurface Soil	Sb, Ag, Tl, Se, C-14
Saturated Subsurface Soil	Sb, Ag, Tl, Se, C-14
Groundwater (Unfiltered)	Sb, Be, Hg, Pb, Ag, Tl, Sn, C-14, Pb-210,Th-232
Groundwater (Filtered)	Sb, Be, Hg, Pb, Ag, Tl, Sn

Sb = Antimony; Ag = Silver; Tl = Thallium; Se = Selenium; C-14 = Carbon-14; Be = Beryllium; Hg = Mercury; Pb = Lead; Sn = Tin; Pb-210 = Lead-210; Th-232 = Thorium-232

Background levels should be established to include 95% of the naturally-occurring concentration/activity levels of a given constituent. This means that the upper 5% of the naturally-occurring concentrations/activity levels, for which individual values have only a very low probability of occurrence, *are purposely excluded* in order to construct useful and practical screening levels for differentiating between background and contaminated conditions.

With the exception of UTLs for Sb, Be, Tl, and Pb in groundwater (unfiltered and filtered), UTLs for the constituents/media listed in Table 1 above should be set equivalent to 1 times the corresponding DLs or MDAs, as appropriate. The last paragraph of Section 4.4.2, as well as any other text in the Background Study Report related to this issue, must be revised to reflect this change. The Permittee must either revise the UTLs for the constituents/media listed in Table 1 above in the aforementioned manner, or provide additional information to support the currently proposed UTLs which are currently set at two times DLs or MDAs. Given that most constituents in soil have combined data sets with more than 100 data points without a single detection at one times a DL (or MDA), it will be difficult to argue that an UTL of two times a DL (or MDA) is reasonable.

The UTLs for Sb, Be, and Pb in groundwater (unfiltered and filtered) exceed their respective federal or state water quality standard because the DLs for some samples are too high. See comment #7.

The UTLs for Tl in groundwater (unfiltered and filtered samples) exceed their respective federal water quality standard because the DLs for all samples are too high (see comment #7). Consequently, the Tl data are problematic for establishing accurate and reliable background conditions. Given that Tl is unlikely to be a constituent of concern at HAFB, NMED will not require the Permittee at this time to repeat the sampling for establishing the background conditions for Tl in groundwater. However, if Tl should ever become a constituent of concern for groundwater at HAFB, NMED reserves the right to require the Permittee to repeat the sampling of groundwater for the purpose of establishing more

reliable and accurate background levels of Tl at HAFB. In the meantime, the Permittee shall set the UTLs for Tl for filtered and unfiltered groundwater equivalent to the lowest DL of the data set.

6. **Page 4-4, Section 4.4.2, All and Tables 4-11 through 4-15**

The following UTLs for groundwater constituents are rejected for the reasons indicated (Table 2):

Table 2. Rejected UTLs

Constituent	Reason for Rejection
Al	DL too high for some samples.
Sb	DL too high for some samples.
As	DL too high for some samples.
Pb	DL too high for some samples.
Be	DL too high for some samples.
Fe	UTL appears to be too high. Possible error in calculating UTL.
Tl	DL too high for all samples.
Nitrate	Two populations evident (see Table 3).

Al = Aluminum; Sb = Antimony; As = Arsenic; Pb = Lead; Be = Beryllium; Fe = Iron; Tl = Thallium

With regard to Al, Sb, As, and Be, background statistics should be calculated after removing the non-detect data associated with the highest DL in the corresponding data set for each constituent.

The background statistics for Tl in groundwater cannot be accurately and reliably established, as the DLs for all samples are too high (see comment #5).

The background statistics for nitrate in groundwater must be re-calculated after breaking the data set into two populations. See comment #7.

7. **Page 4-4, Section 4.4.2, All and Tables 4-11 through 4-15**

The following groundwater constituents (Table 3) appear to have at least two populations based on probability plots and concentration maps. The Permittee shall evaluate the data sets for these constituents and determine whether multiple populations exist. Background statistics must be calculated separately for each population. The boundary of each population for each constituent must be shown on a map.

Table 3. Groundwater Constituents with Two Populations

Constituent	Remarks
Chloride	Higher levels in southeast corner. Break ~ 10,000 mg/L. Probably normally distributed.
Nitrate	Plume centered on MW-37-06, Break ~ 10 mg/L.
Ammonia	Plume in southeast corner. Break ~ 2 mg/L
Calcium	Higher levels southwest corner. Break ~ 800,000 ug/L
Total Uranium	Higher levels to south. Break ~ 40 ug/L
Cadmium	Break ~ 1 ug/L
Mercury	Higher levels in southeast corner. Break ~ 0.027 ug/L (= DL)
Potassium	Higher levels to south and west. Break ~ 40,000 ug/L
Nitrite	Plume in southeast corner. Break ~ 0.015 mg/L.
Fe	Higher levels in southeast corner. Break ~ 110 ug/L
Mn	Higher levels in southeast corner. Break ~ 30 ug/L

Fe = Iron; Mn = Manganese

8. Page 4-5, Section 4.4.2, 2nd Full Paragraph, All

Explain in the response to this NOD how the ProUCL code generates an Upper Tolerance Limit (UTL) in cases where 50-90% of the data in a given data set are non-detects. The Permittee shall also revise the fifth paragraph of Section 4.4.2 to include this information.

9. Page 4-6, Section 4.4.3, 1st Full Paragraph, 2nd and Last Sentences

The second and last sentences in this paragraph are confusing. Although they seem to imply that a single normality test was applied, the second sentence indicates that the normality test was done after Grubb's test, but the last sentence says that the normality test was done before Grubb's test.

It is possible that the normality tests were done both before and after Grubb's test was applied to a given data set (see comment #1). The Permittee must revise this paragraph to clarify when the normality testing was done and for what reason.

10. Page 4-6, Section 4.4.4.1, All

The Permittee shall indicate in this section what data were used to generate the histograms (raw data, reduced data, or both). At a minimum, the histograms must be constructed using raw data (outliers included) so that they may be evaluated for the presence of outliers. See comment #21. If the Permittee also desires to generate the histograms using reduced data, these histograms must be placed into a separate and new appendix to the report.

11. Page 4-7, Section 4.4.4.2, All

The Permittee must revise this section to indicate what data were used to generate the box and whisker plots (raw data, reduced data, or both). At a minimum, the box and whisker plots must be constructed using reduced data (outliers excluded). See also comment #22. If the Permittee also desires to generate the plots using raw data, these plots must be placed into a separate and new appendix to the report.

12. **Page 4-7, Section 4.4.4.3, All**

The Permittee must revise this Section to indicate what data were used to generate the probability plots (raw and reduced data). Probability plots must be prepared using both raw and reduced data, and the plots placed into separate appendices to the report. The probability plots must be constructed using the combined data sets for soil constituents where the soil constituents are representative of one population.

13. Page 4-8, Section 4.4.4.4, 1st Paragraph and Appendix G

Although the existence of the Piper diagram is mentioned in Section 4.4.4.4, the Permittee did not interpret the diagram. In addition, the Permittees must provide the calculations used to construct the Piper diagram. Reduced data (outliers removed) must be used to construct the Piper diagram. The Permittee shall revise Section 4.4.4.4 to indicate that reduced data were used to construct the Piper diagram.

The Piper diagram suggests that there may be some mixing of sodium-chloride and sodium-sulfate ground waters at HAFB. The Permittee must interpret the diagram, taking into account well locations, and determine whether there are any areas exhibiting distinct hydro-chemical characteristics, particularly with respect to chloride and sulfate concentrations. If any such areas are present, the Permittee must show such areas on a map and evaluate them as potentially exhibiting multiple groundwater populations.

14. Page 4-8, Section 4.4.4.4, 2nd Paragraph and Appendix H

To maximize the usefulness of the Stiff diagrams, the Permittee must plot these diagrams on a map of HAFB at the corresponding well locations where the water samples were collected. Additionally, the Permittees must interpret the map by evaluating the general shapes of the Stiff diagrams. Any areas at HAFB that have discrete hydro-chemical characteristics must be indicated on the map and evaluated as potentially exhibiting multiple groundwater populations. The Stiff diagrams must be constructed using reduced data (outliers removed).

15. Page 4-8, Section 4.4.4.5, All

The Permittee must revise this Section to indicate what data were used to generate the isoconcentration maps (raw data, reduced data, or both). At a minimum, the isoconcentration maps must be prepared using reduced data. The data shall be posted on the maps at the locations where the samples were collected. The isoconcentration maps must be constructed using the combined data sets for soil constituents where the soil constituents are representative of one population. In addition, this section states that an isoconcentration map for mercury in groundwater was not included. Because mercury was detected twice, such a map must be included in the NOD response.

16. Page 5-1, Section 5.3, All

This section presents a discussion that the three soil types sampled (surface soil, subsurface soil, and saturated subsurface soil) have similar textures (silty sands and clays), and for the various constituents of concern, similar (order of magnitude) concentrations/activity levels and similar patterns and distributions of concentrations/activity levels as shown on the concentration maps (isoconcentration maps) included in Figures 4-1 through 4-120. NMED has a few concerns related to this matter.

Similar patterns and distributions on concentration maps should not be expected for a given constituent if the data are representative of random variations of the same population. The claim that geochemical trends are of the same order of magnitude is not supported in the text in any detail and certainly not on a constituent by constituent basis. Because the assertion of a single population for each constituent (in soil) has not adequately supported, the Composite Soil UTLs presented in Table 4-16 are in question.

One appropriate way to assess this issue is to place side by side on the same graphic illustration the box and whisker plots for a given constituent for all three soil types. If the three data sets truly represent the same population for the constituent, the distributions of the data as shown on the box and whisker plots should be similar. In particular, the medians should occupy similar locations within the boxes, and there should be considerable overlap between the first and third quartiles among the three boxes. If the data sets of a given constituent are found to be similar, then statistical descriptors must be prepared using the combined data sets for the constituent rather than simply averaging the UTLs for the three soil types.

The Permittee must revise Section 5.3 with information that adequately supports the Permittee's assertion that the three soil types are actually representative of one underlying population for each of the constituents. The Permittee must do this by the method suggested above or, if sufficiently justified in the NOD response, by some other valid method.

17. Page 5-2, Section 5.4, All

Section 5.4, including its subsections, must be revised after resolving the UTLs for the constituents/media listed in Tables 1, 2 and 3 of this NOD.

18. Tables 4-6 through 4-10

The Permittee must revise these tables to show the specific means by which outliers were detected for each constituent/media.

19. Tables 4-11 through 4-15

The Permittee must revise each table and report all statistical descriptors in the data's original form, not in the data's logarithm-transformed values. The Permittee shall indicate whether the statistical descriptors, including the UTLs, were calculated using the reduced data sets (outliers were excluded from the calculations). Distributions indicated as "normal" should be labeled as "lognormal" if, in fact, the log-transformed data follow a normal distribution. The Permittee shall also add the corresponding maximum DL or MDA, as appropriate, to the tables for each constituent. The tables shall be prepared to reflect the combined data sets for soil (see comment #16).

20. Table 4-16

See comment #16 concerning single populations for soil constituents and revise the Table accordingly.

21. Appendix D

Many of the histograms in this Appendix are meaningless because the intervals that correlate to the plotted frequencies are not indicated on the graphs. In some cases where they are noted on a given graph, the widths of the intervals are not constant which makes it more difficult to interpret the graphs. Also, the 3-dimensional perspective of the histograms impairs readability and interpretation of the graphs. The Permittees must revise the histograms to specify the intervals on the horizontal axis of each histogram. The width of the intervals must be kept constant. A flat, rather than 3-dimensional perspective, is required so that the histograms can be more easily read and interpreted.

A legend or description must be provided at the beginning of the Appendix explaining what appears to be a probability density function curve that is shown on each histogram. If these curves are meant to represent normal probability density functions, the Permittee must indicate this fact and whether they are generated using the mean and standard deviation of the same data set used to generate the histogram.

Given the Permittee's assertion that the chemical and radiological constituents evaluated for surface, subsurface, and saturated subsurface soil are representative of a single

population for each constituent, the Permittee must construct the revised histogram for each constituent using the combined data sets (raw data) for the three soil types.

22. **Appendix E**

The Permittee must provide a legend explaining the box and whisker plots at the beginning of the Appendix. See also comment #11.

23. NMED has noted that the hydrochemistry of the groundwater at well MW-BG-04 often is quite different from that at nearby well MW-04-01(for example, see concentration maps for chloride, nitrate, sulfate, alkalinity, potassium, nitrite, and aluminum). Propose an explanation why the hydrochemistry of well MW-BG-04 is so different from that of the MW-04-01.

24. NMED staff have noted that a number of constituents have lower concentrations in an area bounded roughly by wells TDS-MW03, MW24-01,SS61-MW11, MW-58-03, MW-37-06, and MW-38-01. This same area also stands out when Stiff diagrams are plotted on a map of HAFB. Although most constituents have lower concentrations in this area, the one notable exception is nitrate; maximum nitrate concentrations are found in this area. The cause of these conditions does not appear to be random chance. Propose an explanation for the unusual hydrochemistry in this area.

25. **Figures 1-3 and 2-2**

Figure 1-3 shows monitoring well MW-23-03 in the southwest corner of the map. Figure 2-2 shows this same well as MW-23-04. This monitoring well should be shown as MW-22-03 on both figures. Figure 2-2 also shows monitoring well MW-41-04 in the northern portion of the map. This monitoring well should be shown as MW-41-03. In addition, Figure 2-2 does not show monitoring wells TDS-MW01 nor MW-BG-04. These wells must be shown. The Permittee is required to revise both of these figures accordingly.

26. **Figures 4-14, 4-43 and 4-72**

The legend for these figures indicates that mercury concentrations are shown as mg/kg. The concentrations are actually shown as µg/kg. The Permittee is required to revise these figures accordingly.

The Permittee must respond to this NOD within sixty (60) calendar days of receipt of this notice. The response must be in the form of a revised Background Study Report that incorporates all the responses to the above NOD in two hard copies indicating added information underlined, and deleted information in strikeouts. Further, in order to expedite review of the responses, provide a matrix of the comments and HAFB responses.

If you have any questions regarding this matter or if you would like to discuss the comments prior to your response, please contact David Strasser of my staff at (505) 222-9526.

Sincerely,

James P. Bearzi
Chief
Hazardous Waste Bureau

cc: J. Kieling, NMED HWB
W. Moats, NMED HWB
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