NEW MEXICO ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

RYAN FLYNN
Cabinet Secretary-Designate

BUTCH TONGATE
Deputy Secretary

THOMAS SKIBITSKI
Acting Director
Resource Protection Division

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

May 8, 2013

Radel Bunker-Farrah
Chief, Environmental Office
National Aeronautics and Space Administration
White Sands Test Facility
P.O. Box 20
Las Cruces, NM 88004-0020

Attention of: RE-E13-013

RE: NOTICE OF DISAPPROVAL
200 AREA INVESTIGATION - PHASE I STATUS REPORT
NATIONAL AERONAUTICS SPACE ADMINISTRATION (NASA)
JOHNSON SPACE CENTER
WHITE SANDS TEST FACILITY
DOÑA ANA COUNTY, NEW MEXICO
EPA ID #NM08800019434
HWB-NASA-13-002

Dear Ms. Bunker-Farrah:

The New Mexico Environment Department (NMED) has received NASA's (Permittee) *200 Area Investigation - Phase I Status Report* (Phase I IR) dated January 2013 and received January 31, 2013. NMED has completed its review of the document, issues this Notice of Disapproval (NOD) and provides the following comments.

Comments:

1. **Electromagnetic Induction Anomaly Mapping:**

Since the equipment used (GEM-2) collects two sets of data (in-phase and quadrature) at three different frequencies (5 kHz, 10 kHz and 20 kHz), the simple plotting of one data set at one frequency may be an underuse of collected data. The data must be further evaluated.

Include a map of the conductivity values that are not affected by ferrous metal (i.e., separate out the areas where there is a quadrature anomaly without an in-phase anomaly) which may point towards lithologic or moisture variations.

Assuming the alluvium has a different conductivity than the bedrock (which appears to be the case, based on the electrical resistivity data), use the three different frequencies to develop a depth to bedrock estimate (a mini-sounding) along the profiles in the area of shallower bedrock, looking for bedrock lows or channels in the shallow bedrock zone, determining the outline where bedrock drops off below the depth of penetration, and refine the "0" contour on the WSTF Alluvial Thickness Map (Figure 2.1 in the main report text).

Use the electromagnetic (EM) data as a check on the electrical resistivity characterization (ERC) data. Plot along each profile line the conductivity value obtained by the EM method at an appropriate depth (based on the frequency chosen) and a similar plot of the electrical resistivity (converted to conductivity, or convert the EM data to resistivity) obtained by the ERC survey at a similar depth. The two shapes should appear similar and the two values should be similar.

Indicate whether or not data is missing from Line L (page 2-8, Figure 2-6 of Appendix B), or indicate that the scale is such that no data can be identified. Follow the requirements of this comment by making necessary revisions to the 200 Area Investigation - Phase I Status Report. Revision of the Phase II IWP should not be necessary to respond to this comment since performance of additional field work is not anticipated.

2. **Seismic Refraction Survey:**

It may be inappropriate to use seismic software that assumes that a "...layer velocity was constant and that the layer extended throughout the modeled section." The WSTF Bedrock Lithologies map (Figure 2.3 of the main text) implies a number of the profile lines might cross two different bedrock lithologies, which could have different final velocities. Also, more fractured and less fractured zones in the same lithology would be expected to have different final velocities. Provide comments on whether or not this is the case at NASA WSTF.

Appendix B, Figure 4-3, Example of layer assignments (Line A), clearly shows two layers. However, they appear to be at velocities of about 1,500 feet per second (fps) for layer 1 and 4,000 fps for layer 2, with no rock velocities apparent. Appendix B, Figure 5-1, Lines A and B with Interpretation, shows an interpreted depth to rock across all of Line A and Appendix

B, Table 4-3, Layer velocities from seismic inversions, lists 3,280 fps for layer 1 velocity and 15,419 fps for layer 2 velocity. Explain the discrepancy.

The last line of Appendix B, pages 6-1 and 6-2 states: "Additionally, the method was unable to map grabens identified by the resistivity due to the relatively narrow width compared to the resolution of the method." Many of the interpreted grabens are 100 plus feet wide, which is sufficiently wide for the seismic method to resolve, and in fact, the seismic method may resolve smaller features than the resistivity method.

Follow the requirements of this comment by making necessary revisions to the 200 Area Investigation - Phase I Status Report. Revision of the Phase II IWP should not be necessary to respond to this comment since performance of additional field work is not anticipated.

3. **Comparison of Old and New Top of Bedrock Maps, Alluvial Thickness Map and Geophysical Lines:**

Based on a comparison of Appendix B, Figure 2-2, Model for the Top of Bedrock Elevation Map (Conceptual), Prior to Geophysical Acquisition, with Figure 3.1, 200 and 600 Area Bedrock Elevations with Geophysical Input, there is little change between the two. A comparison of these maps with Appendix B, Figures 5-1 through 5-9 indicates many areas of disagreement between the bedrock contours, the seismic results and the electrical resistivity results, as if the geophysical data had little effect on the newer contour map. Along each profile, plot the interpreted top of rock based upon the seismic interpretation, the electrical resistivity interpretation and the values obtained from the contours on the top of rock maps and provide comments on various discrepancies, such as why in some areas the contours agree with the seismic interpretation over the electrical resistivity interpretation, in some areas the contours agree with the electrical resistivity interpretation over the seismic interpretation, and in some areas the contours do not agree with either. The 200-D graben, as shown on the structural features drawing, appears to affect the 200 and 600 Area Bedrock Elevations with Geophysical Input map while lines F, G, H, and I, for example, show rock at some depth while the alluvial thickness map shows the areas as bedrock outcrop. Review the data and revise the 200 Area Investigation - Phase I Status Report as appropriate.

Include on each profile the depth to top of rock (if available) from borings, and the "0" contour line from the WSTF Alluvial Thickness Map, Figure 2.1.

The Plan Map with Interpreted Structural Features, Figure 5-10 of Appendix B implies structural features that should be seen in the bedrock outcrop area (based on the "0" line in the Alluvial Thickness map). Indicate whether this occurs at NASA WSTF. NMED understands that fracture mapping had taken place decades ago in the area of bedrock outcrop to the east of the 200 Area. Explain whether these interpreted features were mapped and if their orientations are consistent with current mapped orientations.

Appendix B, page 2-4, last paragraph in Section 2.1 states "These new interpretations are not included in the map shown in Figure 2-2, but were used in the annotation and interpretation of geophysical data in Section 5." Indicate also whether or not they were used in Figure 3.1

of the main report.

Follow the requirements of this comment by making necessary revisions to the 200 Area Investigation - Phase I Status Report. Revision of the Phase II IWP should not be necessary to respond to this comment since performance of additional field work is not anticipated.

4. **Geophysical Logs:**

There is mention in the report of existing geophysical logs. Utilize any available conductivity/resistivity logs to corroborate resistivity values interpreted from the electrical resistivity survey. If available, they must be included in the report. If not, identify available borings in which induction logs can be performed and propose to conduct induction logging in the Recommendations portion of the revised Phase I Status Report.

Include any sonic logs to corroborate bedrock velocities from the seismic survey in the report.

If there are any nearby open hole bedrock wells for which sonic logs can be conducted for velocity information, or camera or acoustic velocity logs that can be conducted for fracture density and orientation, propose the additional work in the Recommendations portion of the revised Phase I Status Report.

Follow the requirements of this comment by making necessary revisions to the 200 Area Investigation - Phase I Status Report.

5. **Geophysics:**

If vertical water-filled fractures were a target of the study, consider conducting a very low frequency electromagnetic (VLF-EM) survey. Revise the 200 Area Investigation - Phase I Status Report, if appropriate, to respond to this comment. Otherwise, provide appropriate clarification responses in the response to comments that will accompany the revised Phase 1 Status Report.

6. **Sections 1.4, Previous Investigations, pages 2 and 3 and Section 1.4.1, Geophysical Survey, page 3:**

NMED Comment: Although both sections of the report indicate that previous geophysical investigative work was conducted in the mid- to late 1980s and 1990s, the 200 Area Investigation - Phase I Status Report does not indicate how and whether any of the previous work was relevant to the report's current content and conclusions. For example, explain whether the previous information is included in the analysis or is used as a reality check against current information and whether these previous surveys coincide with, extend, disagree, conflict, or enhance the more recently generated information.

7. **Section 2.2.1, Rational and Background for Geophysics, seventh paragraph, page 6:**

NMED Comment: The discussion about faulting in this paragraph is somewhat confusing. A statement such as "This northeast trending feature is located parallel to and approximately 1,400 ft (426.70 m) northwest of Apollo Boulevard. It is referred to in this report as the 200 West Fault. The 200 West Fault corresponds to a fault identified in Maciejewski (1996) that is located in the same approximate position with the same strike and dip direction. It does not correspond to the formerly identified fault with the same name (200 West Fault, Maciejewski [1996]) that represents a linear structure with the same strike and dip, but runs in a location approximately coincident with Apollo Boulevard." is followed by the statement "The nature of the 200 West Fault is also undetermined."

This information seems to conflict with the information presented on Figure 3.1 (*200 and 600 Area Bedrock Elevations with Geophysical Input*) where the Permittee clearly illustrates the renaming of the 200 West Fault (as referred to by Maciejewski) to the Apollo Boulevard Fault location and moving the former 200 West Fault approximately 1,350 feet northwest of Apollo Boulevard. The figure title indicates some degree of geophysical input, which would seem to imply that some type of determination concerning the 200 West fault was made.

Revise the 200 Area Investigation - Phase I Status Report, if appropriate to respond to this comment. Otherwise, provide clarification responses in the response to comments that will accompany the revised Phase 1 Status Report.

8. **Section 6.0 Recommendations, page 24 and Figure 6.1, Proposed Locations for Additional 200 Area Closure Investigation Phase II Soil Borings, fifth bulleted item, page following page 44:**

NMED Comment: In comparing the location of proposed Boring 200-SB-10 to the alluvial thickness map (Figure 2.1, *WSTF Alluvial Thickness Map*) it appears that the proposed location is in an area of the site where bedrock is at or very near the surface. Although the text in Section 6.0 refers to a proposal to install five additional soil borings, Figure 4.2 (*General Construction for an MSVM Well*) depicts the proposed construction of a multiport soil vapor monitoring well. If the bedrock is at or near the ground surface, the proposed location will not be appropriate for subsequent construction of a MSVM well. Review the apparent depth to bedrock at the proposed MSVM well location and revise the map, if appropriate. If the depth to bedrock is in fact at or very close to ground surface, revise the proposed location of Boring 200-SB-10.

9. **Table 3.1 Summary of Gore Module Analytical Results for Anomalous VOCs**

The title of this table does not seem to reflect the contents of the table. As presented in the Phase I Status Report, the table contains mass concentration data summaries for trichloroethene (TCE), tetrachloroethene (PCE), two Freon compounds (Freons 11 and 113) and total petroleum hydrocarbons (TPH). With the exception of TPH, the table summarizes data on common site contaminants of concern (COCs) and NMED does not consider the compounds to be anomalous

volatile organic compounds (VOCs). Generally, petroleum contamination at the site is limited to the southeastern portion of NASA WSTF (and outside the coverage area for this study) in the vicinity of monitoring wells WB-2 and WB-3. Data from those multi-port wells indicates the presence of diesel range organic compounds (DRO) in selected well ports. Correct the figure title as appropriate and fix the typographical error (analtyical) if the word remains part of the figure title in the revised Phase I Status Report.

10. TCE Hotspot at Area of Interest (AOI) III:

NMED suspects that the TCE hotspot at AOI III is related to the NE – SW trending trough in the bedrock where contaminants are focused and transported (interflow) along the trough and towards the southwest. This would be occurring above the water table. The Apollo Blvd Fault (ABF) strikes obliquely to this trough but may have some influence on contaminant flow near the 200-D graben, which is coincidental with the core of the TCE groundwater plume.

Provide a response to this comment, as appropriate, in the response to comments that will accompany the revised Phase 1 Status Report.

11. Existence of an Additional AOI:

The Phase I passive soil gas survey results indicate that an additional AOI is located northeast of AOI IV where a Freon 11 anomaly (or "hotspot") was found. One additional boring targeting this AOI must be proposed in the Recommendations portion of the revised Phase I IR. Revision of the Phase II IWP should be delayed pending receipt and review of NMED's comments on the revised Phase I Status Report.

12. Additional Soil Boring Near Plugged and Abandoned (P&A) Well/Boring 200-East:

The Phase I passive soil gas survey and geophysical results indicate that the 200-D graben (also known as AOI II) may play a significant role in VOC migration through the vadose zone to groundwater and/or may act as a contaminant "sink" with respect to being positioned near the core or centroid of the VOC groundwater plume. In order to assess the potential for VOC transport (e.g., interflow) to groundwater in this area, propose to install one additional boring on the northeast up-thrown horst block. The boring must be drilled approximately 200 feet south of P&A Well/Boring 200-East. Include the additional proposed boring in the revised Recommendations portion of the Phase I Status Report. Revision of the Phase II IWP should be delayed pending receipt and review of NMED's comments on the revised Phase I Status Report.

13. Biasing Proposed Soil Boring 200-SB-12:

When drilling 200-SB-12, make an attempt to target structure #1 as delineated in geophysical line F near station F111. Biasing the borehole location to this feature will refine the subsurface distribution and transport pathway of Freon-113 (and TCE) in the vadose zone

with respect to the Freon-113 surface anomaly. Provide a response to this comment as appropriate in the response to comments that will accompany the revised Phase 1 Status Report.

14. Additional Soil Boring Near Geophysical Station 210:

Propose to install one additional boring near geophysical station F210 in order to assess potential VOC contamination in the vadose zone north of AOI II along the north-northwestern edge of the soil-vapor survey grid boundary. Station F210 is located at a small arroyo coincidental with a subsurface low-resistively vertical feature that appears to trend and widen towards geophysical line I.

Include the proposed additional boring in the Recommendations portion of the revised Phase I Status Report. Revision of the Phase II IWP should be delayed pending receipt and review of NMED's comments on the revised Phase I Status Report.

15. Burn Pits/Fire Training Areas Discussed in the June 2012 200 Area Historical Information Summary (HIS):

The 200 Area HIS identified several on-site areas that have been historically used for disposal of waste solvents and other combustible materials for training activities associated with fire suppression. Examples include the 200 Area Main Burn Pit (Solid Waste Management Unit [SWMU] 9), the 200 Area Burn Pits 1 and 2 (*see* Section 9.5, *200 Area Additional Burn Pits*, 200 Area HIS), the GOx Impact Area Burn Pit, the 270 Area Transport Vehicles Fire Suppression Test Area and possibly the current location of military transport vehicles if the area was ever used for fire suppression training.

Perfluorocarbons, sometimes referred to as fluorocarbons or PFCs, are organofluorene compounds that contain carbon and fluorine bonded together in very strong carbonfluorine bonds. Historically, aqueous film forming foams (AFFFs) contained PFC compounds and AFFFs have been historically used in fighting hydrocarbon fueled fires. The primary PFCs of interest related to AFFF contamination are perfluorooctane sulfonate (PFOS) and perflurooctanoic acid (PFOA). The production of PFOS-based AFFF products stopped in 2002.

In January 2009, the U.S. Environmental Protection Agency's (EPA's) Office of Water established a provisional health advisory (PHA) of 0.2 micrograms per liter (μg/L) for PFOS and 0.4 μg/L for PFOA to protect against the potential risk from exposure of these chemicals via drinking water. EPA Region 4 has recommended a residential soil screening level of 6 milligrams per kilogram (mg/kg) for PFOS and 16 mg/kg for PFOA. Minnesota has established a health risk limit of 3 μg/L for both PFOS and PFOA in drinking water. New Jersey has established a preliminary drinking water guidance value of 0.04 μg/L for PFOA. North Carolina has established an interim maximum allowable concentration of 2 μg/L for PFOA in drinking water. To date, New Mexico has not developed soil screening levels nor safe drinking water quality standards for either compound or for other PFC compounds.

PFOS and PFOA are chemically and biologically stable in the environment and are resistant to biodegradation, atmospheric photo-oxidation, direct photolysis and hydrolysis. Because of the chemical stability of PFOS and PFOA and the low volatility of these substances in ionic form, the substances are persistent in both water and soil. PFOS and PFOA have a reported half-life of over 41 years and 92 years, respectively, in groundwater. Information concerning compound half-lives in soil are not readily available. Analysis of PFOA, PFOS and several other PFC compounds is available at various commercial environmental analytical laboratories.

PFCs were not discussed in the 200 Area HIS. Accordingly, NMED is uncertain if any of NASA WSTF's burning pits or fire suppression training areas were associated with AFFFs. NMED does believe that the Permittee must evaluate whether or not PFCs are present at one or more of the burn pits and fire suppression training areas.

Since PFCs were not mentioned in the 200 Area HIS, NMED suspects that the Permittee may not be able to determine realistic historical usage patterns by simply reviewing its historical files. The Permittee's effort at PFC evaluation will be further complicated by the fact that one or more of the former burn pits may now be occupied by newer buildings which were constructed after discontinuing use of the burn pits. NMED recognizes that subsurface conditions at the facility generally present difficult drilling conditions in terms of auger or split-spoon refusals and poor recoveries of representative soil samples.
Fortunately, as described in the 200 Area HIS, two of the former burn pits were only approximately 18 to 24 inches deep (the pits discussed in Section 9.5 of the HIS) and the main 200 Area pit was described as being only one foot in depth. Presumably, activities associated with the 270 Military Vehicle Transport Fire Suppression System (plus the military vehicle if affected) and the GOx Impact Area were performed at grade. As such, one or more of these sites may be accessible by use of geoprobe-type sampling equipment or test pit excavations. Soil sampling depths of slightly over 10 feet are acceptable to NMED at this time. In the event PFCs are found in soil samples, NMED will make a subsequent decision on groundwater testing for PFCs at appropriate site locations.

A proposal for PFC evaluation of one or more of the historic burn pits must be included in the Recommendations section of the revised Phase I Status Report. Revision of the Phase II IWP should be delayed pending receipt and review of NMED's comments on the revised Phase I Status Report.

16. Soil Vapor Extraction (SVE) Pilot Testing:

SVE pilot testing was conducted as part of the recent subsurface investigation in the 600 Area Closure. The conclusion of that testing effort indicated that subsurface conditions and vadose zone soil VOC concentrations did not warrant further evaluation of VOCs in the 600 Area vadose zone or further evaluation of SVE as a practical component of an interim remedy for the 600 Area Closure. The 600 Area Closure SVE pilot test utilized sampling points that were available at the time in conjunction with construction of SVE Pilot Test Well 600-SVE-1. The 600 Area SVE Pilot Test Investigation Report concluded that the radius of influence for the pilot test well (600-SVE-1) was 76 feet or less.

Two phases of passive soil gas sampling and analysis were performed as part of the recent Phase I Investigation conducted primarily in the 200 Area. This soil gas sampling project was different from the sampling conducted during the SVE Pilot Testing project conducted previously at the 600 Area Closure. During the 200 Area study, VOC mass was measured by analysis of sample modules that were placed for approximately two weeks in temporary, shallow soil borings that were installed in a gridded arrangement. In addition, sample modules were also placed in the upper two feet of 13 cased, conventional wells that are screened across the uppermost portion of the contaminated water table. The purpose of these installations was to allow comparison of VOC mass concentrations in the wells to data collected from the soil boring vadose zone installations. During the 600 Area Closure SVE pilot test investigation, samples were collected to measure actual VOC concentrations (mass per unit volume) over a limited time period. As such, direct comparison of data generated from both investigations is not possible but use of the soil gas module data still should allow some degree of Permittee review of relative concentrations within the module grid.

Historically, the highest site TCE concentrations in site groundwater have been found in the area near the 200-D well cluster. However, none of the contoured VOC (and TPH) concentration highs (illustrated in Figures 3-2 – 3.6) corresponded to that location. This phenomenon must be discussed in the revised Phase I Status Report, as appropriate.

Revisions to the Phase I Status Report must also include an analysis by the Permittee of whether and where SVE Pilot Testing should be performed in the 200 Area. To the extent possible, the analysis must include consideration of the VOC concentrations found in the 200 Area versus those found during pilot testing in the 600 Area Closure. Comparable data available to undertake this analysis is somewhat limited but data presented in the Permittee's *March 2011 200/600 Area Soil Gas and Groundwater Data Evaluation Report* and related reports must be considered. If appropriate, one of the proposed combination soil vapor/groundwater monitoring wells may be proposed to be constructed similarly to 600-SVE-1 and used for pilot testing in the 200 Area. In the event the Permittee's analysis indicates SVE Pilot Study testing is or may be useful in the 200 Area, the report's Recommendations section must be revised to reflect these findings.

The Permittee must complete responses to these comments and submit a revised Phase I IR by **June 20, 2013**. NMED will withhold comments on the concurrently submitted January 2013 *200 Area Phase II Investigation Work Plan* pending receipt and review of the revised Phase I IR. As part of the response letter that accompanies the revised Phase I IR, the Permittee shall include a table that details where all revisions have been made and that cross-references NMED's numbered comments. All submittals (including maps) must be in the form of two copies (one bound) and two electronic copies. The Permittee must also submit a redline-strikeout version that includes all changes and edits to the Phase I IR (electronic copy) with the response to this NOD.

If you have any questions regarding this letter, please contact Daniel Comeau at (505) 476-6043.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: N. Dhawan, NMED HWB
D. Cobrain, NMED HWB
R. Isaac, NMED GWQB
J. Dyer, NMED SWB
M. Dale, NMED HWB
S. Brandwein, NMED HWB
L. King, EPA 6PD-N
T. Davis NASA WSTF
M. Zigmond, NASA WSTF

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New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive, East Bldg.1
Santa Fe, New Mexico 87505

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Radel Bunker-Farrah
Chief, Environmental Office
NASA/WSTF
P.O. Box 20
Las Cruces, New Mexico 88004-0020

88004002020