

National Aeronautics and
Space Administration

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November 25, 2015

Reply to Attn of: RE-15-127

Mr. John E. Kieling, Chief
New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Subject: Additional Work Plan Requirement to Evaluate Potential Source of 600 Area Contamination

On April 28, 2015, NASA submitted the *600 Area Perched Groundwater Extraction Pilot Test Interim Status Report – Project Year 2* for NMED review. On July 15, 2015, NMED approved the report with modifications, indicating that "...further investigation as to the source of contamination is required." NMED directed NASA to "...submit a Work Plan in order to evaluate for a potential source of contamination."

NASA has already performed several investigations at the 600 Area Hazardous Waste Management Unit (HWMU), and concluded there is not a continuing source of contamination in the vadose zone beneath the HWMU. Based on the results of these investigations, NASA believes that the vadose zone and groundwater beneath and adjacent to the 600 Area HWMU have been adequately characterized. Enclosure 1 provides a summary of the environmental investigations performed at the 600 Area HWMU, the findings of those investigations, and the NMED responses to NASA's conclusions.

NASA demonstrated in the investigation reports referenced in Enclosure 1 that the source of soil vapor contaminants beneath and adjacent to the 600 Area HWMU is the underlying groundwater. Based on NMED approvals of these works plans, NASA understands that NMED agrees with this interpretation, although NMED has requested an additional investigation to identify the source. While VOCs remain in the soil vapor beneath and adjacent to the 600 Area HWMU, the source of these contaminants in soil vapor is not important in determining whether there is an unacceptable risk to human health or the environment. The source of the soil vapor contaminants, however, does have an impact on the selection of a remediation technology, if remediation is found to be necessary.

NASA and NMED have not determined whether the presence of VOCs in soil vapor presents a risk to human health or the environment, or if there are complete exposure pathways between the 600 Area HWMU and human receptors. NASA's Hazardous Waste Permit (November 2009) does not contain cleanup standards for soil vapor. In an effort to resolve this issue, NASA proposed site-specific risk-based concentrations to serve as soil vapor

criteria in June 2012, and requested NMED input on NASA's approach to developing those criteria. NMED did not have the opportunity to comment on NASA's proposed criteria before issuing the *Risk Assessment Guidance for Site Investigations and Remediation* in December 2014 (updated in July 2015). This guidance provides specific information on the development of screening levels for soil vapor contaminants, and for evaluating exposure pathways and receptors.

In the *200 Area Phase II Investigation Report* (submitted June 29, 2015), NASA proposed to develop a work plan for performing a quantitative assessment of the vapor intrusion pathway in the 200 Area adjacent to a former HWMU in that area. The proposed work plan will be submitted within 90 days of NMED approval of the Investigation Report. NASA recommends the inclusion of the 600 Area HWMU in the proposed work plan for vapor intrusion assessment. This approach will ensure consistent evaluation of both the 200 and 600 Area HWMUs, resolve the currently undetermined risk and pathway issues for the 600 Area HWMU, and fulfill the requirements of Section VII.I of the Hazardous Waste Permit. NASA expects to use NMED's July 2015 risk assessment guidance in developing the work plan for performing a vapor intrusion assessment at both HWMUs. If the assessment indicates a complete pathway and unacceptable risk is present at either HWMU, NASA expects to work with NMED to perform a corrective measures evaluation in accordance with Section VII.J of the Hazardous Waste Permit.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for known violations.

If you have any questions or comments concerning this submittal, please contact Michael Zigmond at 575-524-5484.



for Timothy J. Davis
Chief, Environmental Office

Enclosure

cc:
Mr. Gabriel Acevedo
Hazardous Waste Bureau
New Mexico Environment Department
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Summary of NASA WSTF 600 Area Closure Investigation Activities

Date: 8/30/2010 (initial); 3/30/2011 (revised)

Activity/Document: *600 Area Closure Investigation Report (IR)*

Summary: Between September 2009 and January 2010, NASA performed an investigation of the vadose zone and groundwater beneath and adjacent to the 600 Area Closure. Samples of soil, perched groundwater, and soil vapor were collected and analyzed. With the exception of arsenic and thallium, no hazardous constituents were detected in soil samples above cleanup levels. Concentrations of arsenic and thallium were below construction worker SSLs and were consistent with naturally occurring background levels. Grab samples of perched groundwater indicated TCE concentrations above groundwater cleanup levels. Most VOC concentrations in soil vapor samples were less than or equal to concentrations that would be in equilibrium with measured concentrations in regional groundwater, indicating the likely source of contamination in soil vapor was the result of off-gassing from the underlying contaminated groundwater.

Conclusion: Based on the evaluation of soil, groundwater, and soil vapor data, NASA concluded that the vadose zone beneath the Closure does not present a continuing source of contaminants to groundwater. NASA recommended the installation of an additional boring to more closely monitor perched groundwater. NASA also recommended a short-duration vapor extraction test to determine if soil vapor contamination was the result of off-gassing from groundwater.

NMED Response: NMED approved the report with modifications on 6/9/11. NMED stated that the high concentration of VOCs in soil vapor, and the potential for partitioning from groundwater, warranted an evaluation of soil vapor extraction (SVE). NMED agreed with the installation of a perched groundwater monitoring boring/well. NMED agreed with the installation of a boring for the evaluation of SVE and directed NASA to perform an SVE pilot test.

Date: 9/1/2011

Activity/Document: *600 Area Closure Soil Vapor Extraction (SVE) Pilot Test Work Plan*

Summary: In accordance with NMED direction, NASA prepared and submitted a pilot test work plan for the evaluation of SVE at the 600 Area Closure.

Conclusion: NA

NMED Response: NMED approved the work plan on 10/28/11 with four minor modifications and instructed NASA to perform the pilot test and submit the SVE pilot test report by May 31, 2012. (In a telephone conversation on 5/30/12, NMED agreed to extend the due date for the IR to 6/15/12.)

Date: 6/14/2012

Activity/Document: *600 Area Closure Soil Vapor Extraction (SVE) Pilot Test Investigation Report*

Summary: NASA installed the two additional borings and performed an SVE pilot test in March 2012. Soil vapor samples were collected from the SVE pilot test well and five adjacent multi-port soil vapor monitoring (MSVM) wells. A portable SVE unit was used to “step test” each of the three screened intervals in the test SVE well. The SVE well and MSVM wells were monitored for a variety of field and analytical parameters. Field data collected during the pilot test indicated extraction had a minor impact on the vadose zone beneath the Closure and that low levels of VOCs were extracted from the vadose zone and successfully treated by granular activated carbon. Analytical data from SVE and MSVM well samples were

consistent with the results of the previous investigation. Concentrations of VOCs were less than or equal to concentrations that would be in equilibrium with local groundwater. Concentrations of the five primary contaminants of concern (COCs) were at least one order of magnitude less than site-specific risk-based concentrations developed using the EPA-approved Johnson and Ettinger subsurface vapor intrusion model. Measured VOC concentrations in soil vapor remained below OSHA occupational exposure limits and residential indoor air screening levels.

Conclusion: Based on a comprehensive evaluation of the data from the previous investigation and the SVE pilot test, NASA concluded that VOC concentrations in the vadose zone beneath the 600 Area Closure were below all applicable regulatory levels. NASA concluded that corrective action of the vadose zone was not necessary and determined that the vadose zone was not a continuing source of contamination in groundwater. NASA recommended that no further investigation or corrective action be performed at the Closure.

NMED Response: NMED disapproved the report on 8/28/2012. NMED stated that concentrations of VOCs in soil vapor supported the concept that vertical concentration differences result from constituent vapor density contrasts relative to the density of air and the historical downward migration of contaminated water. NMED stated they would not consider any permit modification request that would preclude further investigation at the Closure. Several other NMED comments addressed minor report deficiencies. NMED directed NASA to revise and resubmit the report to address NMED comments.

Date: 6/14/2012

Activity/Document: *Development of Site-specific Risk-based Regulatory Criteria for Soil Vapor at the NASA White Sands Test Facility (WSTF)*

Summary: Because there were no regulatory criteria for VOCs in soil vapor at the time of the SVE pilot test, it was not possible to compare analytical results to cleanup levels. After a review of available literature and consultation with various regulatory and industry organizations, NASA was unable to identify any applicable soil vapor cleanup standards and determined that site-specific risk-based concentrations (RBC) were required to support future environmental restoration efforts at WSTF. NASA and a subcontractor utilized the EPA's Johnson and Ettinger model as a basis for the development of site-specific RBCs for soil vapor and provided them for NMED consideration.

Conclusion: NA

NMED Response: No NMED response was received.

Date: 9/13/2012

Activity/Document: *Response to NMED Disapproval – NASA White Sands Test Facility (WSTF) 600 Area Soil Vapor Extraction (SVE) Pilot Test Investigation Report (revised per NMED disapproval)*

Summary: NASA revised the SVE pilot test IR and addressed each of NMED's nine comments. The conclusions and recommendations were revised to incorporate NMED input and to clarify NASA's plans for the area.

Conclusion: NASA's conclusions remained unchanged: concentrations of VOCs in the vadose do not present a continuing source of contamination to groundwater; and corrective action of the vadose zone was not required. COC concentrations in soil vapor below the Closure were less than or equal to concentrations that would be in equilibrium with the local groundwater. NASA clarified the recommendation that no further investigation should be performed by indicating that it applied to the soil beneath the closure. NASA further recommended a pilot test to determine if contaminated perched groundwater could be extracted and treated to address groundwater contamination in the vicinity of the Closure.

NMED Response: NMED approved the IR on 9/28/12 with no further comments and directed NASA to develop and submit an abbreviated work plan for perched groundwater extraction at the Closure.

Date: 11/13/2012

Activity/Document: *600 Area Perched Groundwater Extraction Pilot Test Work Plan*

Summary: In accordance with NMED direction, NASA prepared and submitted a pilot test work plan for extracting and treating contaminated perched groundwater at the 600 Area Closure.

Conclusion: NA

NMED Response: NMED approved the work plan 1/16/2013 and directed NASA to begin groundwater extraction.

Date: 6/14/2013

Activity/Document: *200/600 Area Semi-Annual Soil Vapor and Groundwater Data Summary (Fourth Report – March 2013 Data)*

Summary: As directed by NMED, NASA performed four comprehensive, semi-annual sampling events at 14 MSVM wells and five multi-port soil vapor and groundwater monitoring (MSVGM) wells in the 200 and 600 Areas. Soil vapor and groundwater data were compared to data from previous sampling events and used to evaluate the relationship between the two media and to help determine if continuing sources of groundwater contamination were present in the vadose zone. NASA calculated soil vapor concentrations of VOCs in equilibrium with underlying groundwater, evaluated soil vapor VOC concentrations over time, and compared the VOC levels to regulatory and site-specific RBCs.

Conclusion: Based on the data obtained during the four sampling events, NASA concluded that concentrations of VOCs in soil vapor in the 200 and 600 Areas generally declined between August 2010 and March 2013 in conjunction with declining concentrations in groundwater. NASA observed a strong relationship between VOC concentrations in the vadose zone and in underlying groundwater, and noted the widespread increase in VOC concentrations with depth in the vadose zone. These observations further supported the conclusion that in many cases, VOC off-gassing from the groundwater is the primary source of VOCs in the vadose zone. NASA recommended an additional comprehensive soil vapor and groundwater sampling event following completion of the 200 Area Phase II investigation.

NMED Response: NMED approved the report on 8/9/2013 with direction to perform the recommended sampling.

Date: 4/17/2014

Activity/Document: *600 Area Perched Groundwater Extraction Pilot Test Interim Status Report*

Summary: NASA began extracting contaminated perched groundwater from monitoring well 600-G-138 in April 2013. Extraction continued for a year, during which 1,870 gallons were extracted and treated at the WSTF Mid-plume Interception and Treatment System. Groundwater and soil vapor samples were collected from the extraction well and nearby MSVM well on a quarterly basis. Field and analytical data indicated that contaminated groundwater remained present during the year and that concentrations of VOCs in soil vapor did not significantly decline during the year of pilot testing.

Conclusion: NASA concluded that the extraction of perched groundwater did not impact the concentrations of VOCs in the groundwater or soil vapor in the overlying vadose zone. Groundwater and soil vapor data were consistent with data from samples collected prior to the pilot test. NASA

concluded that the presence of contaminated perched groundwater beneath the 600 Area Closure continued to contribute to VOCs in the soil vapor above the perched groundwater, and potentially throughout the 600 Area. NASA recommended continued extraction and treatment of perched groundwater, regular sampling of groundwater and soil vapor, and another status report after a year of operation.

NMED Response: NMED approved the report on 8/14/2014, with a modification, requiring NASA to continue groundwater extraction to evaluate project status throughout the following year and to submit an appropriate report based on project success.

Date: 4/16/2015

Activity/Document: *600 Area Perched Groundwater Extraction Pilot Test Interim Status Report – Project Year 2*

Summary: NASA extracted and treated an additional 2,610 gallons of contaminated perched groundwater from monitoring well 600-G-138 during the second year of the pilot test. Groundwater and soil vapor samples were collected from the extraction well and nearby MSVM wells on a quarterly basis. Field and analytical data continued to indicate the perched groundwater was not reduced in thickness and that soil vapor VOC concentrations were not significantly reduced.

Conclusion: NASA concluded that the extraction of contaminated perched groundwater did not significantly impact the concentrations of VOCs in groundwater or soil vapor. Groundwater and soil vapor chemical analytical results from samples collected in the second year of the pilot test are consistent with past results. NASA concluded that the presence of contaminated groundwater beneath the Closure continued to contribute to VOCs in soil vapor in the vadose zone above the perched groundwater. NASA recommended additional groundwater extraction and treatment, groundwater and soil vapor monitoring, and an additional status report after the next year of project work.

NMED Response: NMED observed that there appears to be a decreasing trend in the concentrations of VOCs in groundwater and soil vapor. NASA concurs that there appears to be a slight downward trend based on two years of data, but believes additional data are required before that conclusion can be drawn for the long-term. NMED approved the report on 7/15/2015 with direction to develop and submit a work plan to evaluate the source of contamination at the 600 Area Closure.

Date: 6/29/2015

Activity/Document: *NASA WSTF 200 Area Phase II Investigation Report*

Summary: NASA performed the second phase of a comprehensive investigation of the WSTF 200 Area. As directed in NMED's 8/9/2013 approval of NASA's 6/14/2013 *200/600 Area Semi-Annual Soil Vapor and Groundwater Data Summary (Fourth Report – March 2013 Data)*, NASA performed soil vapor sampling at the new and existing soil vapor wells in the 100, 200, and 600 Areas. With a few exceptions identified in the investigation report, analytical data from soil vapor samples generally supported previous conclusions that most soil vapor VOCs likely originate from the VOC-contaminated groundwater underlying the investigation areas.

Conclusion: NASA observed that soil vapor VOC concentrations in the 200 Area have declined over time in conjunction with declining groundwater concentrations of the same VOCs and concluded that the two media are linked. NASA evaluated the concentrations of VOCs in soil vapor and compared them to the site-specific RBCs submitted for NMED review on 6/14/2012. With the exception of TCE, concentrations of VOCs in 100, 200, and 600 Areas soil vapor monitoring wells were below the proposed depth-appropriate site-specific RBCs. TCE concentrations in 200 Area MSVM and MSVGM wells exceeded the proposed depth-appropriate site-specific RBCs at some monitoring depths. At several locations near structures in the 200 Area, the concentrations of TCE in soil vapor also exceeded the recently established vapor intrusion screening level available in

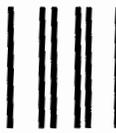
NMED's December 2014 *Risk Assessment Guidance for Site Investigations and Remediation*. Based on the findings, NASA recommended a quantitative assessment of the vapor intrusion pathway in the 200 Area adjacent to a former HWMU in that area.

NMED Response: NMED review of the *200 Area Phase II Investigation Report* is ongoing.

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