National Aeronautics and
Space Administration

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White Sands Test Facility
P.O. Box 20
Las Cruces, NM 88004-0020

November 26, 2024

Reply to Attn of: RE-24-173

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

Subject: 200 and 600 Area Vapor Monitoring and Intrusion Assessment (VMIA) Abbreviated Investigation Work Plan (AIWP)

On April 18, 2024 the New Mexico Environment Department (NMED) provided an approval with modifications for NASA's April 27, 2023 *Response to Second Disapproval 200 and 600 Area Vapor Intrusion Assessment Report.* NMED directed NASA to address four comments and submit a revised VIAR no later than July 31, 2024. NASA submitted the *Response to Approval with Modifications for the 200 and 600 Area Vapor Intrusion Assessment Report* on July 19, 2024, and indicated that in response to NMED's request, an AIWP for follow-on vadose zone soil vapor sampling at the 200 and 600 Areas would be submitted no later than November 27, 2024.

This submittal provides the *200 and 600 Area VMIA AIWP* that includes soil vapor sampling as a component of the proposed investigation. A printed version of the document as Enclosure 1. Enclosure 2 includes a CD-ROM with an electronic copy of the final VMIA AIWP.

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 knowing violations.

If you have any questions or comments concerning this submittal, please contact Antonette Doherty of my staff at 575-202-5406.

Sincerely,

ANTONETTE Doherty

Digitally signed by ANTONETTE Doherty
Date: 2024.11.26 12:00:57 -08'00'

For: Timothy J. Davis
Chief, Environmental Office

cc:
Mr. Gabriel Acevedo
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2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

200/600 Area Vapor Monitoring and Intrusion Assessment Abbreviated Investigation Work Plan

Introduction	A revised version of the National Aeronautics and Space Administration (NASA) *200 and 600 Area Vapor Intrusion Assessment Report* (VIAR) was submitted to the New Mexico Environment Department (NMED) on April 27, 2023 (NASA, 2023b). The objective of the fieldwork described in the 200 Area and 600 Area VIAR was to perform a complete evaluation of the vapor intrusion pathways at the priority locations within the 200 and 600 Areas that present the most likely routes for vapor intrusion based on previous investigation (NASA, 2013a; NASA, 2015c). This 200/600 Area Vapor Monitoring and Intrusion Assessment (VMIA) abbreviated investigation work plan (AIWP) is submitted in accordance with the NMED requirement within Comment 3a of their *Approval with Modifications 200 and 600 Area Vapor Intrusion Assessment Report* provided to NASA on April 18, 2024 (NMED, 2024). NMED required, …the collection of additional soil vapor data in the vadose zone on a regular schedule could potentially serve the purpose of further characterization, temporal tracking of soil vapor contamination in the subsurface, and the collection of more current representative data for use during any future screen evaluations or other investigations (NMED, 2024). The recommended approach for follow-on sampling of the 200 and 600 Area specifically targets additional monitoring and assessment of the vapor intrusion pathways at the two primary target locations at Building 200 in the 200 Area and Building 637 in the 600 Area. The investigation incorporates: 1) a quantitative verification of pressure controls and an airflow evaluation at the two target buildings; and 2) the collection of additional vadose zone soil vapor, groundwater, indoor air, and outdoor air samples. The NASA Johnson Space Center White Sands Test Facility (WSTF) is located at 12600 NASA Road in central Doña Ana County, New Mexico. The site is approximately 18 miles northeast of Las Cruces, New Mexico and 65 miles north of El Paso, Texas (Figure 1). Because specific soil vapor samples in the WSTF 200 Area were identified that exceeded soil vapor screening levels during screening processes (NASA, 2015b), NASA continued the investigation in the form of a vapor intrusion assessment that focused on the areas of greatest potential concern. The objective of the 200 and 600 Area VIAR (NASA, 2023b) was to evaluate the vapor intrusion pathways at priority locations within the 200 and 600 Areas that presented the most likely routes for vapor intrusion (Figure 2). The VIAR evaluated the potential for vapor to affect industrial/occupational indoor air in specific buildings in accordance with NMED Risk Assessment Guidance for Site Investigations and Remediation (RA Guidance; NMED, 2022). It was predicated that a complete vapor intrusion exposure pathway had already been established. 200 Area Building 200 The primary 200 Area target of the planned investigation is the foundation of Building 200 in the vicinity of Rooms 204 through 206 above the location of the former Clean Room tank closed hazardous waste management unit

Introduction (cont.)	(HWMU). Building 200 is occupied daily during a regular 40-hour work week by WSTF laboratory personnel. The building is located adjacent to multiport soil vapor monitoring (MSVM) wells 200-SV-05 and 200-SV-09, and multiport soil vapor and groundwater monitoring (MSVGM) well 200-LV-150 (Figure 3). The location of MSVGM 200-LV-150 has historically provided the highest soil vapor concentrations in the 200 Area vadose zone for the primary contaminant of potential concern (COPC) trichloroethylene (TCE), 1,1,2-trichloro-1,2,2-trifluoroethane (Freon®[1] 113), and tetrachloroethene (PCE; NASA, 2015b). The highest recorded concentration of TCE was 410,000 micrograms per cubic meter (µg/m^3) at 200-LV-150 at 34 feet (ft) below ground surface (bgs) in August 2017 (NASA 2024b; Table 1). This location exceeded the NMED vapor intrusion screening level (VISL) for TCE (69.5 µg/m^3 residential, 328 µg/m^3 industrial; NMED, 2022) and the equivalent WSTF site-specific risk-based concentration (RBC) for TCE at 25 ft bgs (3,700 µg/m^3 residential and 180,000 µg/m^3 commercial; NASA, 2024c). This location is immediately adjacent to Building 200 and falls into the "complete pathway" category for vapor intrusion according to the NMED RA Guidance (NMED, 2022). 600 Area Building 637 The primary 600 Area target of the planned investigation is Building 637, located 150 ft to the southeast of the 600 Area closed HWMU. Proximal MSVM wells comprise 600-SGW-1, 600-SGW-2, 600-SGW-5, and 600-SGW-6 (Figure 4). MSVM well 600-SGW-5 has historically provided the highest soil vapor concentrations in the 600 Area vadose zone for TCE and some of the highest for Freon 113 during the October 2014 comprehensive soil vapor sampling event (NASA, 2015b). Building 637 is the most proximal structure to the southeast side of the 600 Area HWMU and is used for a few hours daily during a regular 40-hour work week by Environmental Department technicians. The highest concentration of TCE in 600 Area soil vapor of 15,000 µg/m^3 was reported during the comprehensive 200 and 600 Area sampling event in 2014 at location 600-SGW-5, in the deep port directly above groundwater at 137.5 ft bgs (NASA, 2015b; Table 1). The latest concentration for this zone at 600-SGW-5-137.5 reported in the Perched Groundwater Extraction Pilot Test Year 11 report was 8,300 µg/m^3 (NASA, 2024a). The soil vapor concentration appears to be trending down in conjunction with the declining trend of TCE in groundwater as evidenced in the latest NASA Periodic Monitoring Report (PMR; NASA, 2024d). This concentration can be compared with the NMED industrial/occupational (soil vapor) VISLs for TCE (69.5 µg/m^3 residential, 328 µg/m^3 industrial; NMED, 2022), and the equivalent WSTF site-specific RBC for TCE at 100 ft bgs (6,800 µg/m^3 residential and 220,000 µg/m^3 commercial; NASA, 2024c). The elevated concentration at 600-SGW-5 at 137.5 ft bgs is being evaluated as a conservative approach relative to potential vapor intrusion.

[1] Freon is a registered trademark of The Chemours Company CF, LLC.

Regulatory Background	The concentrations and distribution of soil vapor contaminants in the 200 and 600 Area vadose zones have been defined by previous comprehensive vadose zone investigations (NASA, 2011; 2013a; 2015b) that have been approved with modifications by NMED (NMED, 2011; 2013; 2015b). Additional monitoring of 200/600 Area soil vapor distribution was performed through sequential semi-annual sampling of all accessible multiport soil vapor monitoring ports in the 200 and 600 Areas along with groundwater sampling at underlying or nearby locations (NASA, 2012a; 2012b; 2013b; 2015b). NASA submitted the *200 Area Phase II Investigation Report* (IR; NASA, 2015b) on June 29, 2015. The IR described a comprehensive 200 Area vadose zone investigation and included the results of a comprehensive soil vapor sampling event in the 200 and 600 Areas conducted in October 2014. Based on the results of the IR, NASA proposed a quantitative assessment of the complete vapor intrusion pathway for the Building 200 foundation near the location of the former underground Clean Room tanks (also known as the 200 Area west closure HWMU). NMED agreed with NASA's intent to address potential complete vapor intrusion pathways in their approval with modifications for the IR on November 30, 2015 (NMED, 2015b). The additional assessment of vapor intrusion in the 600 Area was proposed following written communication between NASA and NMED. On April 16, 2015, NASA submitted the *600 Area Perched Groundwater Extraction Pilot Test Interim Status Report – Project Year 2* for NMED review (NASA, 2015a). NMED approved the report with modifications on July 15, 2015, and required further investigation of the source of contamination at or near the HWMU (NMED, 2015a). Previous investigations at the 600 Area HWMU had concluded there is not a continuing source of contamination in the vadose zone beneath the HWMU. In a November 25, 2015 letter to NMED (NASA, 2015c), NASA included 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 submitted the *200 and 600 Area Vapor Intrusion Assessment Work Plan* (VIAWP) on February 26, 2016 (NASA, 2016), and this was approved by NMED on May 27, 2016 (NMED, 2016). The *200 and 600 Area Vapor Intrusion Assessment Report* was first submitted to NMED on June 18, 2018 (NASA, 2018). Subsequently, a revised version of the *200 and 600 Area Vapor Intrusion Assessment Report* was submitted to the NMED on April 27, 2023 (NASA, 2023b). NMED provided an *Approval with Modifications 200 and 600 Area Vapor Intrusion Assessment Report* to NASA on April 18, 2024 (NMED, 2024). NASA submitted the *Response to Approval with Modifications for the 200 and 600 Area Vapor Intrusion Assessment Report* on July 19, 2024 and indicated that in response to NMED's request, an AIWP for follow-on vadose zone soil vapor sampling at the 200 and 600 Areas would be submitted no later than November 27, 2024. In accordance with Permit Sections 2.3, 7.3.5 and Attachment 5 (NMED, 2023), NASA continues to perform required post-closure care inspections and activities at the 200 Area and 600 Area closures.

200 Area and 600 Area Vapor Intrusion Assessment Report Summary, Conclusions, and Recommendations	The *Response to Approval with Modifications for the 200 Area and 600 Area VIAR* (NASA, 2024b) evaluated the potential for a complete pathway between soil vapor in the vadose zone and industrial/occupational indoor air in specific 200 and 600 Area buildings in accordance with NMED guidance (NMED, 2015b). Historically, concentrations of COPCs in soil vapor exceeded NMED and/or WSTF-specific screening criteria at specific locations (NASA, 2015b). The two locations with the greatest potential for vapor intrusion in proximity to buildings were evaluated: the 200 Area on the west side of Building 200 at the location of the former Clean Room tanks HWMU; and 600 Area Building 637 located near the 600 Area HWMU. Two semi-annual sampling events were performed in August 2017 and February 2018. Soil vapor samples were analyzed using Environmental Protection Agency (EPA) Method TO-15. The 200 and 600 Area soil vapor risk and hazard results were combined with previous soils risk and hazard data, and risk screening evaluations for soil vapor including carcinogenic and noncarcinogenic toxicity and were performed (NASA, 2024b). 200 Area Building 200 Soil vapor samples were collected from the shallow ports of three MSVM wells on the west side of Building 200. Indoor samples were collected at several locations in Building 200 above the subsurface footprint of the former 200 Area Clean Room Tanks HWMU, and outdoor air samples were collected adjacent to Building 200. The shallow soil vapor port within three wells on the west side of Building 200 (adjacent to the location of the former Clean Room Tanks HWMU) were utilized for the air intrusion evaluation. Wells (200-SV-05, 200-SV-09, and 200-LV-150-34) were historically associated with TCE soil vapor concentrations that exceeded WSTF RBCs (NASA, 2015b). Vadose zone TCE concentrations in soil vapor from MSVM wells 200-SV-05 at 9 feet (ft) below ground surface (bgs), 200-SV-09 at 19 ft bgs, and 200-LV-150 at 34 ft bgs exceeded NMED VISLs and the WSTF RBC at 25 ft bgs for the August 2017 and February 2018 semi-annual sampling events (NASA, 2024b; Table 1). PCE soil vapor concentrations exceeded the NMED VISLs in all three wells for the August 2017 sampling event but were below the WSTF RBC at 25 ft bgs. In February 2018, only the PCE concentration at well 200-LV-150 at 34 ft bgs exceeded the NMED VISLs. The concentrations for the other remaining COPCs in vadose zone soil vapor were below the corresponding NMED VISLs (except 1,1-Dichloroethane) and WSTF RBCs. Concentrations in Building 200 outdoor air samples were either non-detect or below 1 µg/m^3 for COPCs. Traces of Freon 11 were observed in August 2017 and February 2018 and traces of 2-butanone were observed in August 2017. NASA concluded that outdoor air did not present a significant risk of industrial/occupational exposure and proposed no additional investigation or mitigation. Concentrations in Building 200 indoor air samples were generally non-detect or COPCs were present at trace concentrations. A single low concentration of

200 Area and 600 Area Vapor Intrusion Assessment Report Summary, Conclusions, and Recommendations (cont.)	Freon 113 (3,200 µg/m^3) was reported in August 2017 at location 200-IA-5 (described as a Freon 113 material storage closet). This concentration is two orders of magnitude below the NMED VISL for industrial indoor air. Indoor air concentrations for all COPCs were well below NMED VISLs. As stated in the NMED RA Guidance (NMED, 2022), the "application of the VISLs is appropriate as a first-tier screening assessment." Although the vadose zone soil vapor concentrations may exceed NMED VISLs and updated NMED-approved WSTF RBCs, the subsurface contribution to indoor volatile organic compound (VOC) levels is below indoor air NMED VISLs and WSTF RBCs. Based on the results of a visual inspection of the structural stability of WSTF Building 200, an evaluation of personnel management practices, and the quantitative assessment of soil vapor and air sample laboratory results with comparison to available vapor intrusion screening levels including NMED VISLs and WSTF RBC, it was concluded that: • According to NMED RA Guidance on vapor intrusion pathway designation (NMED, 2022), there is a complete exposure pathway in the 200 Area. • Potential vapor intrusion into Building 200 does not present a risk of industrial/occupational exposure to personnel working in the building. <u>600 Area</u> In the 600 Area, the shallow soil vapor ports within three wells located on the 600 Area HWMU adjacent to Building 637 were sampled as part of the vapor intrusion evaluation. Well 600-SGW-2 has periodically yielded concentrations of TCE that have exceeded WSTF RBCs (NASA, 2013b; 200/600 semi-annual report – March 2013 data). TCE soil vapor concentrations for well 600-SGW-1-12.5 in August 2017 and February 2018 and well 600-SGW-2-12.5 in August 2017 exceeded the NMED VISL but were below the WSTF RBC at 10 ft bgs (NASA, 2024b; Table 1). All other maximum concentrations for the remaining COPCs for the August 2017 and February 2018 sampling events were below the respective NMED VISL and WSTF RBC in soil vapor. Indoor air samples were collected in Building 637 along with outdoor air samples at adjacent locations. The concentrations for COPCs in Building 600 outdoor air samples were generally non-detect or below 1 µg/m^3. Traces of Freon 11, 2-butanone, and acetone in August 2017 were reported. NASA concluded that outdoor air does not present a significant risk of industrial/occupational exposure. Building 600 indoor air concentrations for specific COPCs were slightly above the outdoor air samples collected, but orders of magnitude below the concentrations observed within soil vapor in the shallow vadose zone reported from MSVM wells. The maximum concentration for indoor air samples were generally non detect or below 1 µg/m^3 for the COPCs. Trace concentrations were observed for four COPCs: Freon 11 in February; 2-

200 Area and 600 Area Vapor Intrusion Assessment Report Summary, Conclusions, and Recommendations (cont.)	butanone in August 2017; acetone in August 2017; and 2-propanol in August 2017. No concentrations of indoor air COPCs exceeded the NMED VISLs. Based on the results of a visual inspection of the structural stability of WSTF Building 637, an evaluation of personnel management practices, and the quantitative assessment of soil vapor and air sample laboratory results with comparison to available vapor intrusion screening levels including NMED VISLs and WSTF RBC, it was concluded that: • According to NMED RA Guidance on vapor intrusion pathway designation (NMED, 2022), there is a complete exposure pathway in the 600 Area. • Potential vapor intrusion into Building 637 does not present a risk of industrial/occupational exposure to personnel working in the building. From the Decision Rule in the approved VIAWP (NASA 2016; Section 3.1.4): "If the vadose zone soil vapor concentrations exceed NMED VISLs and updated NMED-approved WSTF RBCs, but the subsurface contribution to indoor VOC levels is below risk-based indoor air concentrations…, then current vapor intrusion risks are acceptable." NASA concluded that potential vapor intrusion into the buildings does not present an unacceptable risk of industrial/occupational exposure to personnel.
Purpose and Objectives	This 200/600 Area VMIA AIWP proposes the collection of additional datasets to further demonstrate vapor intrusion into the primary locations at Building 200 and Building 637 is not a risk to WSTF personnel. Additional soil vapor data will be derived from the vadose zone as requested by NMED (NMED, 2024), in addition to supplemental samples from groundwater, indoor air, and outdoor air. The datasets acquired will help support development of a decision rule at Building 200 and Building 637 and can be used to address the potential feasibility of passive soil vapor extraction within the vadose zone. Primary objectives of the VMIA AIWP are as follows: • Quantitatively verify the building pressure controls and air-flow patterns relative to Building 200 and Building 637 to assess the potential intrusion of soil vapor from the subsurface into buildings. The verification test will provide performance data on the use of the building pressure control technique to understand the potential impact of vapor intrusion on indoor air. • Collect additional soil vapor, groundwater, indoor air, and outdoor air samples in the vicinity of the Building 200 and Building 637 target locations support further characterization, temporally track soil vapor contamination in the subsurface, and provide more current representative data for future risk screen evaluations or other investigations. Additional sampling will be performed during semi-annual events to address the potential issue of seasonal building pressure gradients that can influence vapor intrusion into buildings.

Verification of Building Pressure Differential and Evaluation of Air Flow	Additional verification of the pressure differential resulting from the heating, ventilating, and air conditioning (HVAC) configuration in Building 200 and Building 637 and an evaluation of the air flow will be performed to supplement the detailed building inspections and HVAC system evaluations performed as part of the VIAR (NASA, 2024b). HVAC systems can strongly influence vapor intrusion potential and its mitigation for commercial and industrial buildings (Shea et al, 2010). This is the conceptual basis for the building pressure control evaluation that will be performed for this AIWP. The Building 200 and Building 637 HVAC system design and operating conditions are known to create a positive-pressure environment when operating. Buildings 200 and 637 are both equipped with engineered HVAC systems with controlled environments and rates of air exchange within specified limits. Engineered HVAC adjustments can have a significant impact on indoor air quality. The EPA has discussed the verification of building pressure control for the assessment of vapor intrusion (EPA, 2011b). Controlling the risk to human health related to inhalation exposure due to vapor intrusion is a primary objective of the building design, integrity, and building pressure control. One technique evaluated by the EPA that has shown potential for reducing contaminants of concern vapor concentrations is the manipulation of building pressure. Measuring a positive pressure in the building that drives indoor air out of the building should reduce potential vapor intrusion. Alternately, negative pressure conditions where outdoor air is pulled into a building can potentially increase vapor intrusion. Pressure differentials will be monitored in conjunction with the collection of vadose zone, groundwater, indoor air, and outdoor air sampling. Building 200 comprises a single floor structure built on a 6-inch (in.) concrete slab. Airflow is through cycled air, and outdoor air infiltration can enter the building through open doors, door thresholds, and air ducts in the roof. Heating is through hot air circulation sourced by natural gas, and air conditioning is provided through central air. The HVAC systems run constantly to preserve the laboratory environment. Based on the continuous operation of the Building 200 HVAC system at positive pressure and the use of the facility for administrative and laboratory purposes over a standard work week, NASA believes that any vapor intrusion risk and hazard to building occupants originating from vadose zone concentrations is now and will continue to be acceptable and remain well below regulatory targets. Building 637 comprises a single floor structure built on a 6-in. concrete slab. During summer months, airflow is through forced central air generated by evaporative coolers located on the ground on the north side of the building. Heating is through hot air circulation sourced by natural gas. The HVAC systems run intermittently due to the irregular usage of the building on working days. An evaluation will be performed relative to the potential influence on vapor intrusion and air quality patterns in the building space. Quantitative

Verification of Building Pressure Differential and Evaluation of Air Flow (cont.)	verification of the pressure differential gradient and air flow will be evaluated by measuring indoor and outdoor pressures at building egress to assess any potential impacts on vapor intrusion. The evaluation will present an overview of the building HVAC components and their influence on indoor air quality based on air pressure gradients and air exchange. The objective will be to document any favorable or unfavorable effects of the positive-pressure HVAC operations and evaluate any potential benefits that may result from adjustments to HVAC systems for protection against vapor intrusion. The pressure differential evaluation for Building 200 and Building 637 will take place over approximately two days and coincide with each sampling event. This will include preparation of the buildings for testing including setting up for the operation of the air sampling equipment and instrumentation. To represent standard operating conditions, building doors and windows will be maintained under standard conditions (closed). The building pressure differential evaluation will be used to assess potential vapor intrusion enhancement or reduction. NASA will perform the field work data collection, and interpretation of the results. An Omniguard 4 (or similar) differential pressure meter will be utilized for monitoring and documenting vacuum and differential pressure inside and outside every egress at Building 200 and Building 637. Pressure monitoring will be used to establish the airflow patterns during both 1) non-operation and 2) operation of the local HVAC systems (in conjunction with soil vapor, indoor air, and outdoor air sampling). The pressure meter will be used to monitor and record the differential pressure between the inlet port and a reference point using the dual inlet ports and tubing extensions that allow for the monitoring of pressure differential between two locations. The maximum tubing length is limited to 70 ft for a 3/16-in. diameter hose to sustain the reading accuracy. The self-contained design of the equipment streamlines operation of the unit. Pressure monitoring data is recorded as logs that will be utilized for the presentation of results in the VMIA report.
Soil Vapor, Groundwater, Indoor Air, and Outdoor Air Sampling Locations	Soil vapor, groundwater, indoor air, and outdoor air samples (Table 2) will be collected as coincidentally as possible during a two to three day sampling event to conceptualize the conditions inside and outside Building 200 (Figure 5) and Building 637 (Figure 6) at a specific point in time. Four individual semi-annual sampling events will be performed that are separated by six months between the summer and winter seasons to account for potential seasonal differences in HVAC performance and related air pressure fluctuations that could influence vapor intrusion. During winter months, heated air rises within buildings and exits through the roof. This reduces indoor air pressure, may draw in soil vapor, and potentially increases vapor intrusion rates. Vadose Zone Samples Soil vapor samples from the shallow vadose zone port will be collected from MSVM and/or MSVGM wells in the 200 and 600 Areas that are located closest to the primary vadose zone source established from previous investigations (NASA, 2015b; NASA, 2024b; Table 2). In the 200 Area, MSVM wells 200-SV-05 and 200-SV-09 and MSVGM well 200-LV-150 are

Soil Vapor, Groundwater, Indoor Air, and Outdoor Air Sampling Locations (cont.)	all located within 84 ft of the west side of Building 200. Vertical delineation of soil vapor concentrations adjacent to the closed 200 Area Clean Room Tanks HWMU and comparison to the groundwater concentration will be performed at well 200-LV-150 by collecting soil vapor samples from three ports and a groundwater sample depth. In the 600 Area, four MSVM wells (600-SGW-1, 600-SGW-2, 600-SGW-5, and 600-SGW-6) are all located within 250 ft of Building 637. For vertical delineation of soil vapor concentrations adjacent to the closed 600 Area HWMU and comparison to the groundwater concentration, MSVM well 600-SGW-5 will be sampled at four vapor port locations, and adjacent well 600-G-138 will be sampled for groundwater. Proposed soil vapor samples are provided in Table 2 and are listed below. Building 200 adjacent to the closed 200 Area Clean Room Tanks HWMU (Figure 5): • 200-SV-05 at 9 ft bgs • 200-SV-09 at 19 ft bgs • 200-LV-150 at 34 ft bgs • 200-LV-150 at 64 ft bgs • 200-LV-150 at 84 ft bgs Building 637 adjacent to the closed 600 Area HWMU (Figure 6): • 600-SGW-1 at 12.5 ft bgs • 600-SGW-2 at 12.5 ft bgs • 600-SGW-5 at 7.5 ft bgs • 600-SGW-5 at 52.5 ft bgs • 600-SGW-5 at 102.5 ft bgs • 600-SGW-5 at 137.5 ft bgs Groundwater Samples At Building 200, the groundwater zone in MSVGM well 200-LV-150 (Figure 5) will be sampled at the same time as soil vapor sampling. At MSVM well 600-SGW-5, the equivalent groundwater zone will be sampled at conventional groundwater monitoring well 600-G-138 (Figure 6) at the same time as soil vapor sampling. Proposed groundwater samples are provided in Table 2 and are listed below. • 200-LV-150 screened 150 ft bgs – 170 ft bgs • 600-G-138 screened 138 ft bgs – 148 ft bgs Indoor and Outdoor Air Samples The locations of indoor and outdoor air samples correspond to the locations of specific samples collected as part of the VIAR (NASA, 2024b). These samples were strategically selected based on building size, proximity to the potential intrusion source, the scale of the vadose zone vapor impact, subsurface heterogeneity, and sample purpose. Where rooms exceed 500 square feet (ft^2) in size as in the case of Building 200, previous indoor samples were collected at a frequency of approximately one sample per 500 ft^2 (NASA, 2024b). The six most proximal indoor air

Soil Vapor, Groundwater, Indoor Air, and Outdoor Air Sampling Locations (cont.)	samples above and surrounding the former Clean Room Tanks HWMU will be collected at Building 200 (Figure 5), and the two most proximal indoor air samples to well 600-SGW-2 will be collected at Building 637 (Figure 6). Samples will be collected within the normal breathing zone at a height of between 3 to 5 ft above the building floor using the sample containers and strategy in Table 2. Two ambient outdoor air samples will be collected at each of the Building 200 and Building 637 locations. Indoor and outdoor air sample locations are summarized below. Building 200 – Laboratories (Table 2, Figure 5) • Six indoor air samples within rooms 204, 205, 206, and 206B above and adjacent to the subsurface footprint of the former 200 Area Clean Room Tanks HWMU. • Two outdoor air samples adjacent to Building 200 near the former 200 Area Clean Room Tanks HWMU at locations upgradient of the prevailing wind direction on the day of sampling. • One indoor air sample duplicate will be collected. Building 637 – Groundwater Assessment Building (Table 2, Figure 6) • Two indoor air samples in Building 637 located on the side of the building most proximal to the 600 Area closure HWMU. • Two outdoor air samples adjacent to Building 637 at locations upgradient of the prevailing wind direction on the day of sampling. • One indoor air sample duplicate will be collected.
Sampling Preparation, Procedures, and Schedule	Building Inspection Building 200 (laboratories) and Building 637 (Environmental Department sampling equipment) are utilized for the storage of small amounts of potentially hazardous chemicals. For the workplace vapor intrusion evaluations, pre-sampling building walkthrough inspections will be performed to supplement previously documented comprehensive inspections (NASA, 2024b). The inspection rationale is that the detection of specific COPCs inside a building is not always definitive evidence of vapor intrusion since these can also be common contaminants in ambient air with interior sources. Indoor air commonly contains detectable levels of many vapor-forming compounds regardless of whether the building slab overlies a subsurface vapor source. During indoor air sampling activities, any potential indoor vapor sources near the sampling locations will be listed in the VMIA report. The contributions of COPCs from chemical supplies is anticipated to be minimal due to the limited inventory, locations in storage areas, handling methods, and overall housekeeping. Outdoor air surrounding Building 200 and Building 637 may also potentially contain detectable levels of several VOCs and polycyclic aromatic hydrocarbons that may originate from vehicular traffic or use of various solvents and cleaning agents near the sampling locations. During outdoor air sampling activities, any potential indoor vapor sources near the sampling locations will also be listed in the VMIA report.

Sampling Preparation, Procedures, and Schedule (cont.)	Sample Preparation NASA will instruct personnel to avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.). Every effort will be made to remove likely background sources of indoor air contamination from the building 24 hours prior to indoor air sampling activities, and potential contaminants will be noted in the field notebook. Weather information (temperature, barometric pressure, relative humidity, wind speed and direction) and indoor temperature and humidity at the beginning of the sample event will also be recorded. Sampling Procedures NASA has developed comprehensive internal procedures for soil vapor, groundwater, and air sample collection and management. These procedures provide specific information on sample management and related documentation, including instructions for sample custody (internal to NASA and external during shipment), storage, packaging, shipment, delivery tracking, and related recordkeeping. Internal procedures will be followed during this assessment to ensure appropriate sample management. Groundwater sampling will be performed in accordance with the WSTF Groundwater Monitoring Plan (NASA, 2023a). For soil vapor and air samples, collection techniques and flow rates will conform to the specifications for the EPA TO-15 sample collection method. Soil vapor samples will be collected in accordance with the previously approved procedures used for sampling in the 200 and 600 Areas (e.g., NASA 2024a [PGEPT]; NASA, 2024b [VIAR]) and pursuant to procedures outlined in ASTM International D 5314-92 (ASTM, 2006). Specific soil vapor procedures include: • Samples will be collected using passivated and evacuated stainless steel canisters for analysis by EPA Method TO-15 provided by the analytical laboratory. • Sampling start times and the initial/final vacuum gauge readings for soil vapor (1 liter) and indoor and outdoor air 8-hour (hr) canisters (6 liter) will be recorded in the field logbook and on the internal chain-of-custody (CoC) form. • For the indoor and outdoor air samples, a flow-controller will be affixed to the canister at a rate pre-set by the laboratory to provide for collection of the samples over an 8-hr period. Indoor and outdoor sampling periods will be the same. Outdoor air samples will be initiated one hour before starting the indoor samples to reduce potential errors. The EPA (EPA, 2011a) estimates that indoor air undergoes a complete exchange every one to two hours. Initiating outdoor air sampling early will compensate for this potential lag time. • Sample valves on each canister will be opened to perform sample collection. Upon the completion of vadose zone, indoor air, and outdoor air sampling, the valve on each canister will be closed and the time and ending vacuum pressure recorded in the field sampling logbook and on the internal CoC form.

Sampling Preparation, Procedures, and Schedule (cont.)	• Canisters will be shipped as a single shipment to the analytical laboratory for each sampling event. • Disposable gloves will be worn to collect all soil vapor and air samples and will be changed between sampling locations. Gloves and other disposable materials contacting the samples will be collected and managed in accordance with the investigation-derived waste (IDW) Management Plan. • Field quality control samples will be collected to ensure high quality data are generated during the assessment and will be analyzed for the same parameters as the primary samples. • Soil vapor and air duplicate samples will be collected at a rate of 10% of the project sampling locations (two samples per sampling event). • Four field blanks (one outdoor and one indoor for each of the two target buildings in the 200 Area and 600 Areas) will be collected for each sampling event. • One trip blank will be collected for each sampling event (one per sample shipment). • The samples will be managed according to established site procedures that included labeling, CoC documentation, storage, packing, and expedited overnight shipment to the analytical laboratory for analysis. <u>Sampling Schedule</u> • Samples for soil vapor from MSVM and MSVGM wells, groundwater, indoor air, and outdoor air for Building 200 and Building 637 will be collected sequentially within a two-to-three-day interval. • Samples from the 200 and 600 Areas will be collected on consecutive days. • Four semi-annual sampling events will be performed for vadose zone and groundwater (two in the summer and two in the winter seasons) approximately six months apart to provide additional data to evaluate potential concentration trends and to account for seasonal temporal variation associated with potential vapor intrusion. Four sets total are planned to provide additional data to evaluate potential soil vapor concentration trends. Two semi-annual sampling events will be performed for indoor and outdoor air samples in the summer and winter seasons approximately six months apart to address potential seasonal building pressure gradients that can influence vapor intrusion into buildings. Any COPC concentrations identified in ambient air can vary over time and may fluctuate diurnally due to the ebb and flow of industrial/occupational activity, and as a result of atmospheric heating and cooling cycles, air pressure changes, and wind speed.

Analytical Method	Soil vapor samples will be analyzed using EPA Method TO-15. NASA contracts services from off-site National Environmental Laboratory Accreditation Program-accredited analytical laboratories as required to support program and project needs. Potential laboratories must respond to a comprehensive statement of work developed to meet the project objectives defined in this VMIA AIWP. Analytical standard operating procedures (SOPs), laboratory quality manuals, and other laboratory-specific documentation are provided following award of the contract and are not available in advance. These documents are retained in the project record and will be available for NMED review as required. The overall objective for laboratory analysis is to produce data of known and sufficient quality. Appropriate procedures and quality assurance checks will be used so that known and acceptable levels of accuracy and precision are maintained for each data set. All samples were analyzed by a fully qualified laboratory in accordance with the laboratory's quality plan, which ensures that the contract laboratory adheres to standardized analytical protocols and reporting requirements and is capable of producing accurate analytical data. Method blanks and laboratory quality control samples are prepared and analyzed in accordance with the laboratory's method-specific SOPs. The analytical results of method blanks will be reviewed to evaluate the possibility of contamination caused by analytical procedures. At a minimum, the laboratory will analyze method blanks and laboratory control samples at a frequency of 1 in 20 for all batch runs.
Field Documentation	NASA will keep a record of daily VMIA field activities, a log of site personnel, safety briefings, and any wastes generated in a project specific logbook. NASA will also maintain an independent logbook detailing all sampling activities with the appropriate sample types, collection times, type of analysis to be performed, and any miscellaneous data related to the sampling process. Logbooks are bound with durable and serial numbered pages. Entries will be made in ink with no erasures. Each day's record will be reviewed and approved by another individual involved in the project. The field supervisor logbook entries will include, as applicable, information that includes at a minimum: • Standard Daily Header – project name, logbook number, date, weather conditions, team members present and their affiliations (including subcontractors), sample location identification, day's task(s), daily safety meeting topics, personal protective equipment (PPE) to be used, equipment in use, and any calibration information, if applicable. • Daily activities (time and observations recorded) – site arrival and departure, visitors, the purpose of their visit, drilling information, sampling information, soil type, soil conditions, decontamination (i.e., method, equipment cleaned), waste management, and reference data sheets or maps, if applicable.

Field Documentation (cont.)	• Daily summary – action items, materials used, changes or deviations made from planned protocol, plan for next day. • Signatures (field personnel and logbook reviewer). Evidential records for the entire project will be maintained in hard copy or electronic form and will consist of: • Project VMIA AIWP with any deviations redlined. • Site-specific internal procedural documentation or plans. • Project logbooks. • Field data records (i.e., surveyed site location). • Correspondence with NMED. • Final analytical data packages. • Reports. • Miscellaneous related records such as photos, maps, drawings, etc.
Investigation-Derived Waste	WSTF RCRA Permit Part 6 (NMED, 2023; Section 6.2.13, p86) requires that a description of IDW management be provided in an appendix to each work plan. IDW management is presented in this section of the AIWP in lieu of a separate appendix. The limited quantity of IDW anticipated for the 200/600 VMIA project will be managed as hazardous until characterized as non-hazardous. Waste management will be conducted in accordance with Section 2 (Section 2.5, Waste Sources). All waste will be properly managed and disposed of in accordance with NASA procedures and state and federal regulations. The potential waste streams that will be generated during the Building 200 and Building 637 VMIA will comprise, contact waste (i.e., rags, wipes, and disposable PPE), and groundwater. <u>200/600 VMIA Waste Streams</u> • Contact waste or debris such as used disposable towels used to decontaminate equipment, surgical gloves (PPE) worn by technicians when handling the sample collection media to prevent media contamination, and disposable sampling equipment will be managed as hazardous using established procedures and waste accumulation areas. • Groundwater generated during sampling activities will be managed as listed hazardous waste. Potentially contaminated groundwater IDW generated will be treated at the WSTF Mid-plume Interception and Treatment System. If that system is not capable of receiving the waste, it will be disposed of at a permitted RCRA Facility in accordance with all applicable regulations. A limited volume of groundwater is anticipated from the two monitoring well locations that will be sampled.

Reporting Schedule	The schedule for the 200/600 VMIA AIWP is contingent on the NMED final approval date. The proposed schedule for the associated fieldwork, sampling, and reporting is as follows: • NMED approval of the 200/600 VMIA AIWP – 0 days. • VMIA equipment and sampling procurements and fieldwork preparation – 60 days. • Perform two comprehensive pressure differential monitoring events (Events 1 and 2) in conjunction with vadose zone, groundwater, indoor air, and outdoor air sampling events at Building 200 and Building 637, separated by 6 months. Perform two additional soil vapor and groundwater sampling events (Events 3 and 4) at Building 200 and Building 637, separated by 6 months. o Event 1 (Summer/Winter depending on start date after 60-day preparation). o Event 2 (Summer/Winter – 180 additional days). o Event 3 (Summer/Winter – 180 additional days). o Event 4 (Summer/Winter – 180 additional days). • Receipt of Event 4 analytical results, data review, and development of 200/600 VMIA report – 90 additional days • Submit two annual 200/600 VMIA periodic monitoring reports to NMED; one following Events 1 and 2, and one following Events 3 and 4 – 60 days following the shipping of samples for Event 2 and Event 4.
References	ASTM. (2006). D 5314-92, *Standard Guide for Soil Gas Monitoring in the Vadose Zone*. EPA. (2011a, October). *Exposure Factors Handbook*. Office of Research and Development: Washington, DC. 2011. EPA. (2011b, December). *Verification of Building Pressure Control as Conducted by GSI Environmental, Inc. for the Assessment of Vapor Intrusion*. Environmental Technology Verification Report. NASA Johnson Space Center White Sands Test Facility, (2011, March 30). *600 Area Closure Investigation Report Provided in Response to a NMED Notice of Disapproval*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility, (2012a, March 1). *200/600 Area Semi-Annual Soil Gas and Groundwater Data for NASA WSTF - November 2011*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2012b, November 1). *200/600 Area Semi-Annual Soil Vapor and Groundwater Data for NASA WSTF - June 2012 Data*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2013a, January 30). *200 Area Investigation - Phase I Status Report*. Las Cruces, NM.

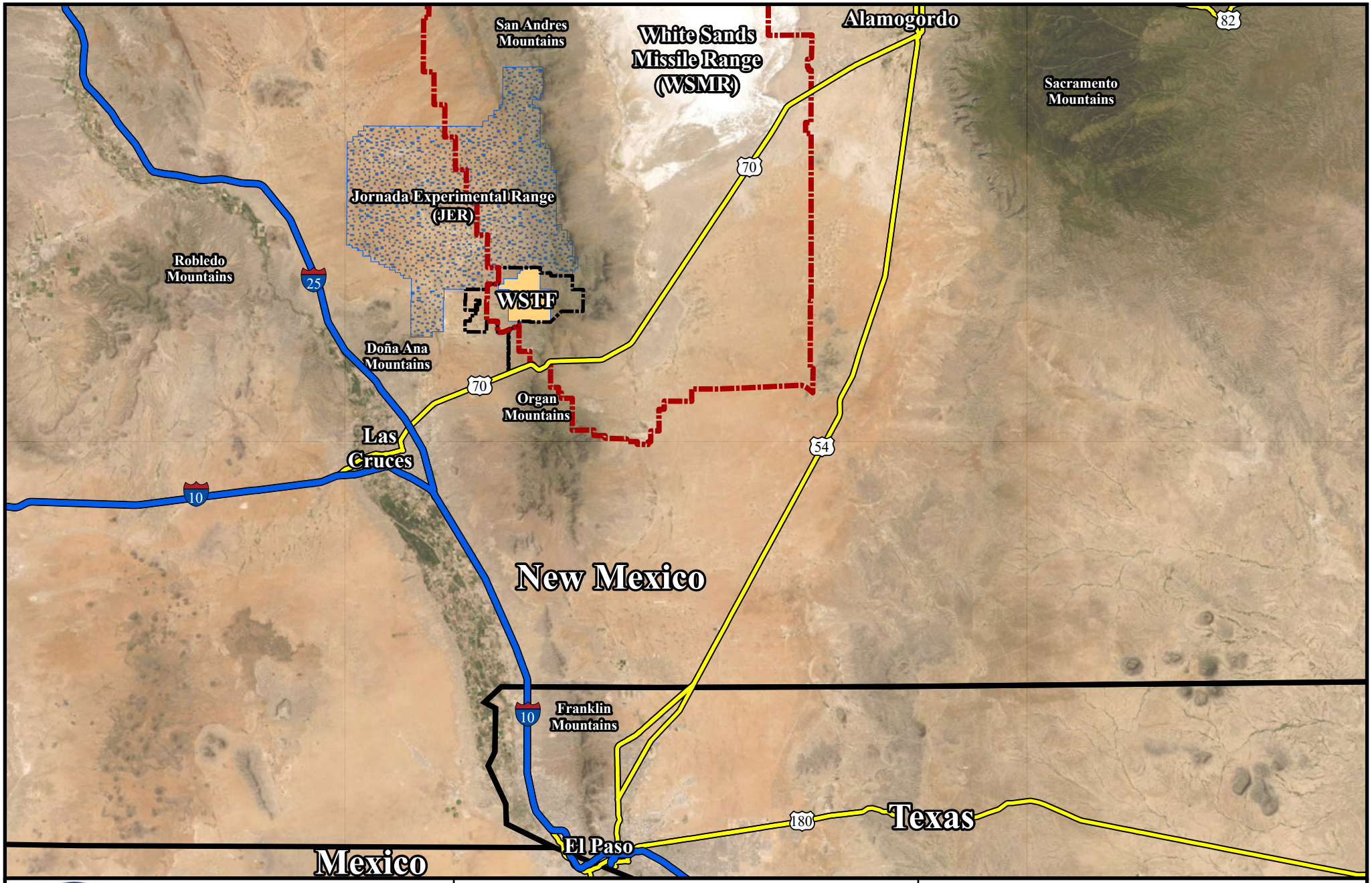
References (cont.)	NASA Johnson Space Center White Sands Test Facility. (2013b, June 14). *200/600 Area Semi-Annual Soil Vapor and Groundwater Data for NASA WSTF - March 2013 Data*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2015a, April 16). *600 Area Perched Groundwater Extraction Pilot Test Interim Status Report - Project Year 2*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2015b, June 29). *NASA WSTF 200 Area Phase II Investigation Report*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2015c, November 25). *Additional Work Plan Requirement to Evaluate Potential Source of 600 Area Contamination*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2016, February 25). *200 and 600 Area Vapor Intrusion Assessment Work Plan*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2018, June 18). *200 Area and 600 Area Vapor Intrusion Assessment Report*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2023a, April 27). *NASA WSTF Groundwater Monitoring Plan Update for 2023.* Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2023b, April 27). *Response to Second Disapproval 200 and 600 Area Vapor Intrusion Assessment Report*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2024a, April 29). *600 Area Perched Groundwater Extraction Pilot Test Interim Status Report – Project Year 11*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2024b, July 19). *Response to Approval with Modifications for the 200 and 600 Area Vapor Intrusion Assessment Report (VIAR)*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2024c, September 27). *NASA White Sands Test Facility (WSTF) 2024 Soil Vapor Risk Based Concentrations (RBCs) Memorandum*. Las Cruces, NM. NASA Johnson Space Center White Sands Test Facility. (2024d, October 30). *NASA WSTF Periodic Monitoring Report – Third Quarter 2024*. Las Cruces, NM. NMED Hazardous Waste Bureau. (2011, June 9). *Approval with Modifications: 600 Area Closure Investigation Report and 200/600 Area Soil Gas and Groundwater Data Evaluation Report*. Santa Fe, NM. NMED Hazardous Waste Bureau. (2013, October 22). *Approval with Modifications for 200 Area Investigation - Phase I Status Report*. Santa Fe, NM.

References (cont.)	NMED Hazardous Waste Bureau. (2015a, July 15). *Approval with Modifications 600 Area Perched Groundwater Extraction Pilot Test Interim Status Report - Project Year 2*. Santa Fe, NM. NMED Hazardous Waste Bureau. (2015b, November 30). *Approval with Modification 200 Area Phase II Investigation Report*. Santa Fe, NM. NMED Hazardous Waste Bureau. (2016, May 27). *Approval 200 Area and 600 Area Vapor Intrusion Assessment Work Plan*. Santa Fe, NM. NMED Hazardous Waste Bureau. (2022, November). *Risk Assessment Guidance for Site Investigations and Remediation Volume I Soil Screening Guidance for Human Health Risk Assessments*. Santa Fe, NM. NMED Hazardous Waste Bureau. (2023, March 28). *RCRA Permit EPA ID # NM8800019434*. Santa Fe, NM. NMED Hazardous Waste Bureau. (2024, April 18). *Approval with Modifications 200 and 600 Area Vapor Intrusion Assessment Report*. Santa Fe, NM. Shea, D. & Lund, C.G. & Green, B.A. (2010). *HVAC influence on vapor intrusion in commercial and industrial buildings.* 2. 597-608. Contaminated Site Clean-Up Information (CLU-IN) https://clu-in.org

Figures

Figure 1 **WSTF Location Map**

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November 2024

Edited by: srees

- WSMR Boundary
- WSTF Boundary
- Jornada Experimental Range (JER)
- WSTF Industrial Area

WSTF Location Map

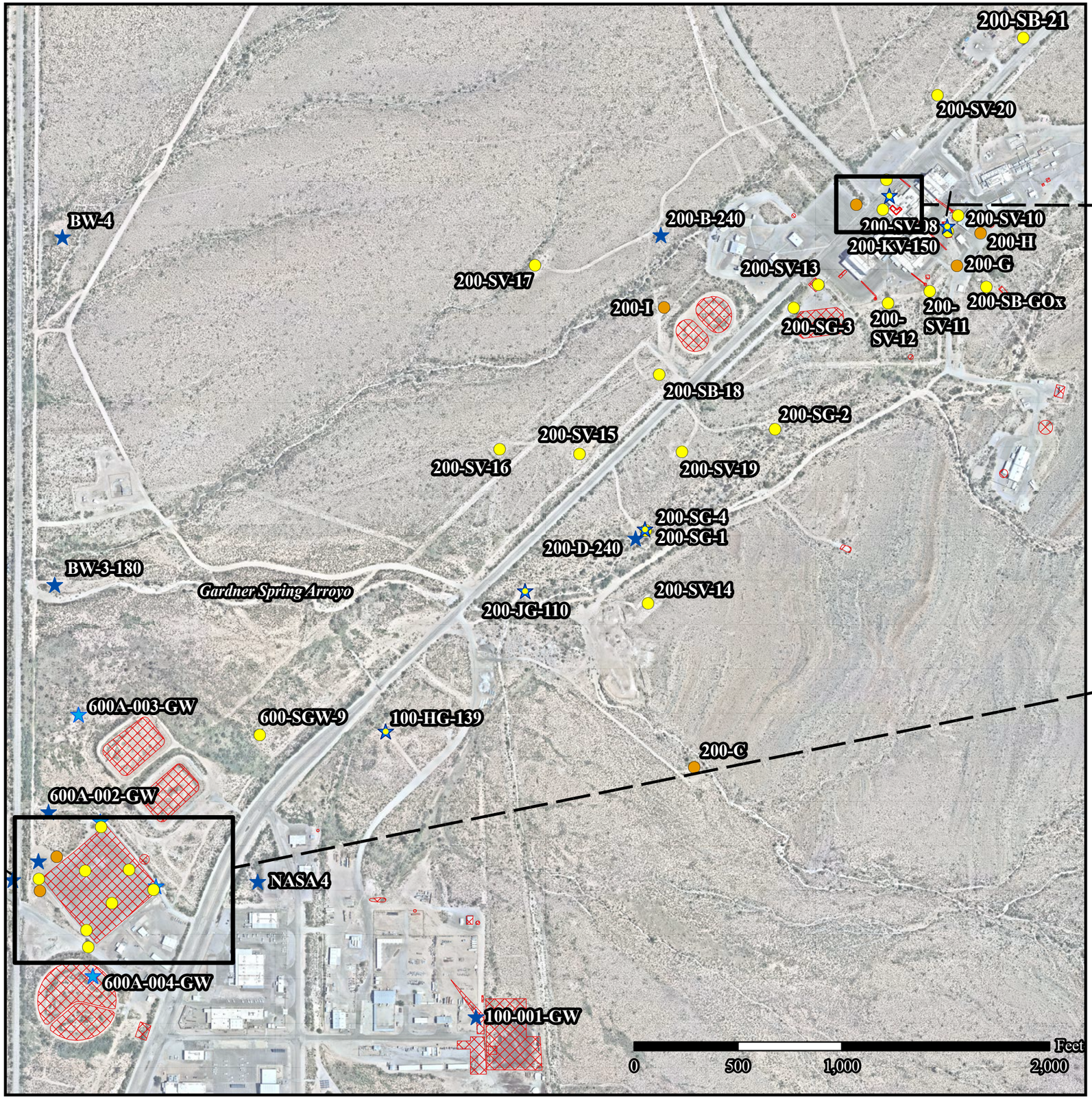
NASA Johnson Space Center
White Sands Test Facility
Las Cruces, New Mexico

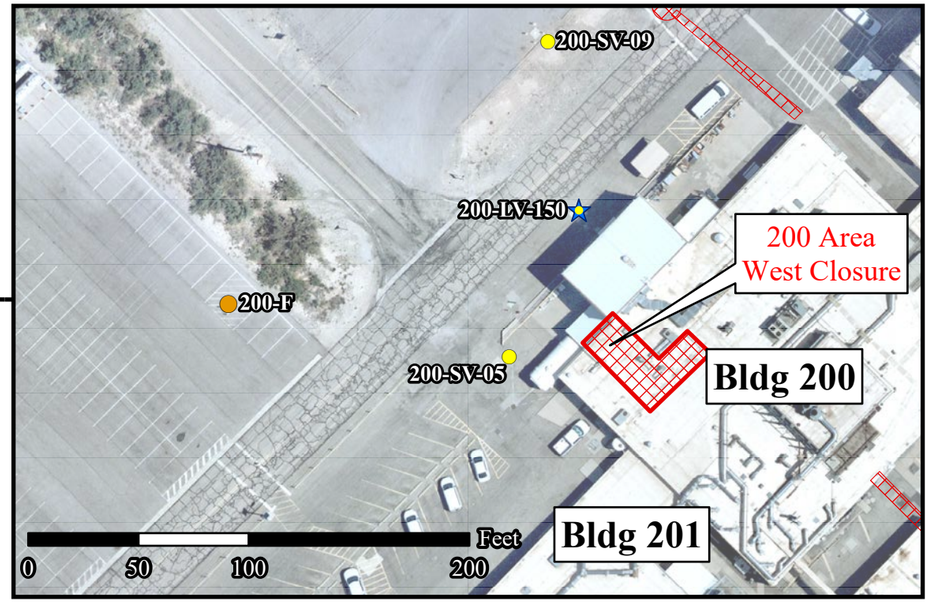
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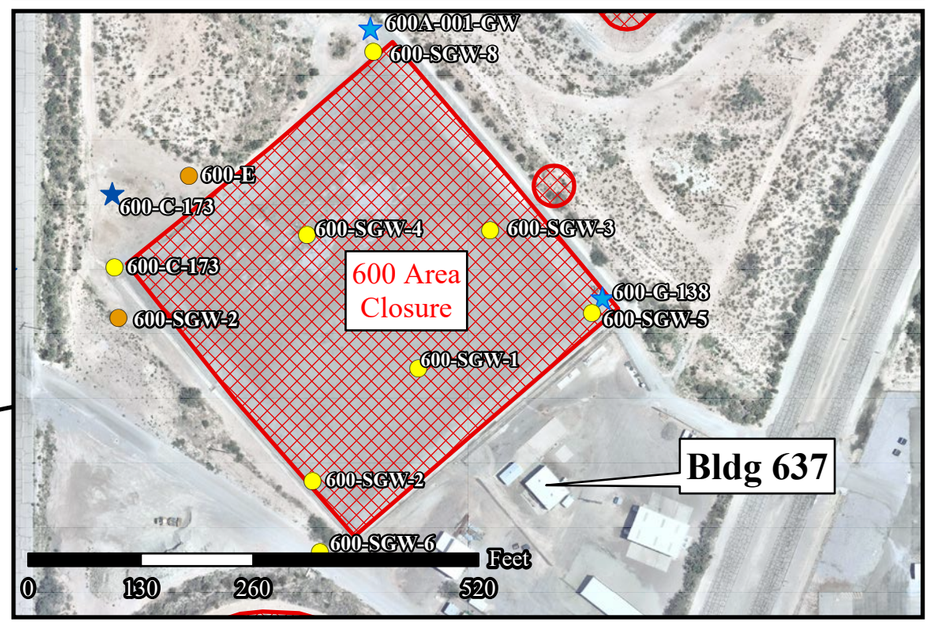
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Figure 2 **Vapor Intrusion Assessment Building Locations**

(SEE NEXT PAGE)







Vapor Intrusion Assessment Building Locations

NASA Johnson Space Center White Sands Test Facility Las Cruces, New Mexico

- Conventional Groundwater Well
- Perched Groundwater Well
- Multiport Groundwater Well
- Multipot Soil Vapor Well
- Multiport Soil Vapor & Groundwater Well
- SWMU or HWMU

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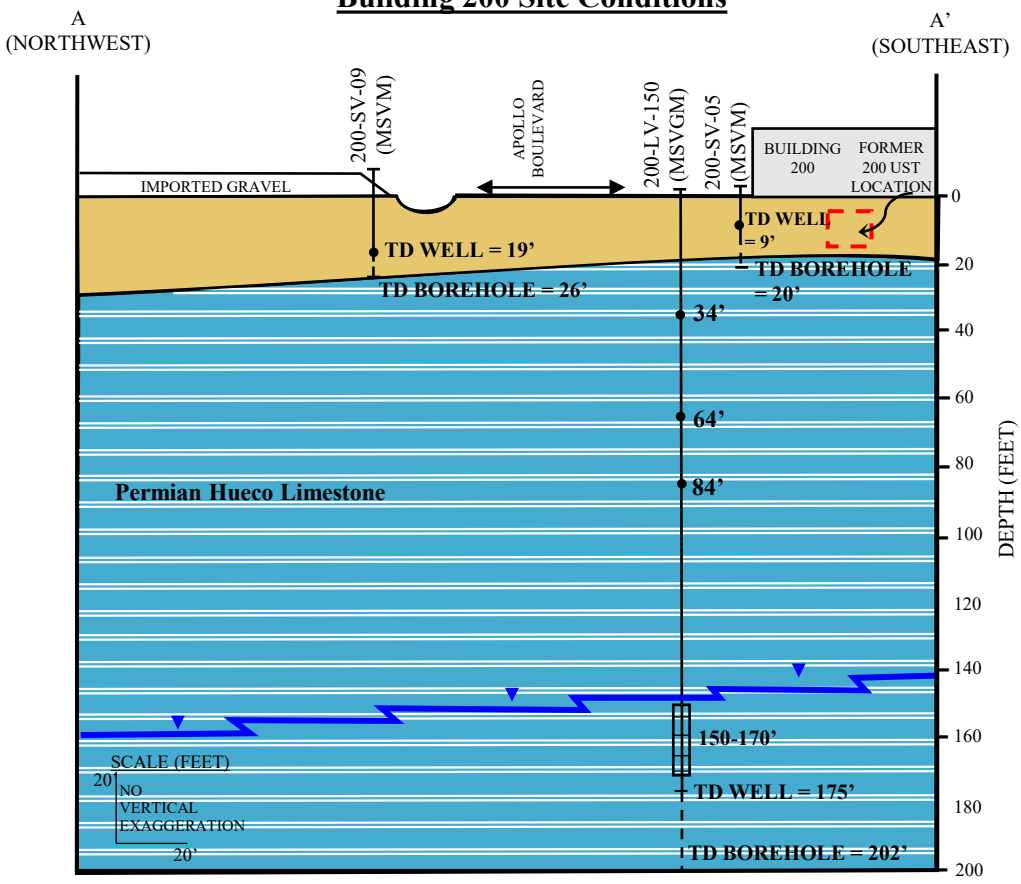
November 2024

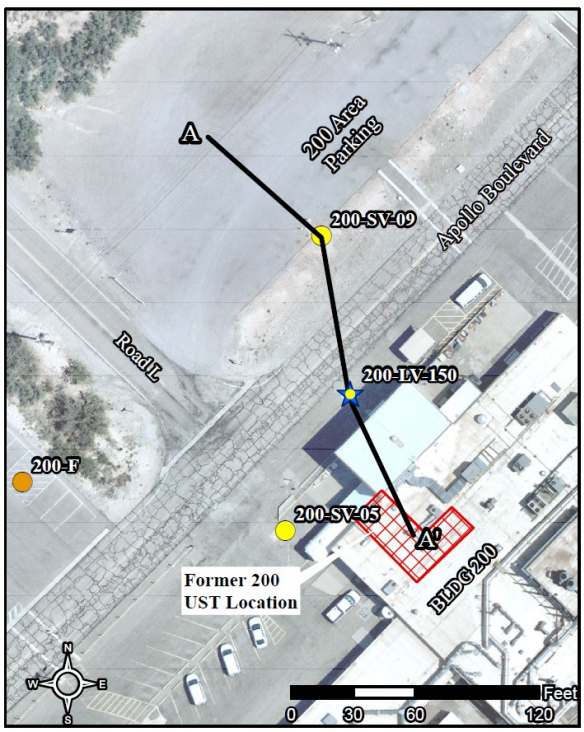
Prepared by:srees

Figure 3 **Building 200 Site Conditions**

(SEE NEXT PAGE)

Building 200 Site Conditions





TD Well = 9'
TD Borehole = 20'
MSVM WELL WITH VAPOR PORTS (DEPTH IN FEET)

84'
170-150'
TD Well = 9'
TD Borehole = 20''
MSVM WELL WITH VAPOR PORTS AND GROUNDWATER MONITORING ZONES (DEPTH IN FEET)

QUARTERNARY CAMP RICE ALLUVIUM

PERMIAN HUECO LIESTONE

WATER TABLE (INFERRED FROM MONITORING WELL DATA)

CROSS-SECTION EXTENT (A-A')

HWMU

MULTIPORT GROUNDWATER WELL

MSVGM WELL

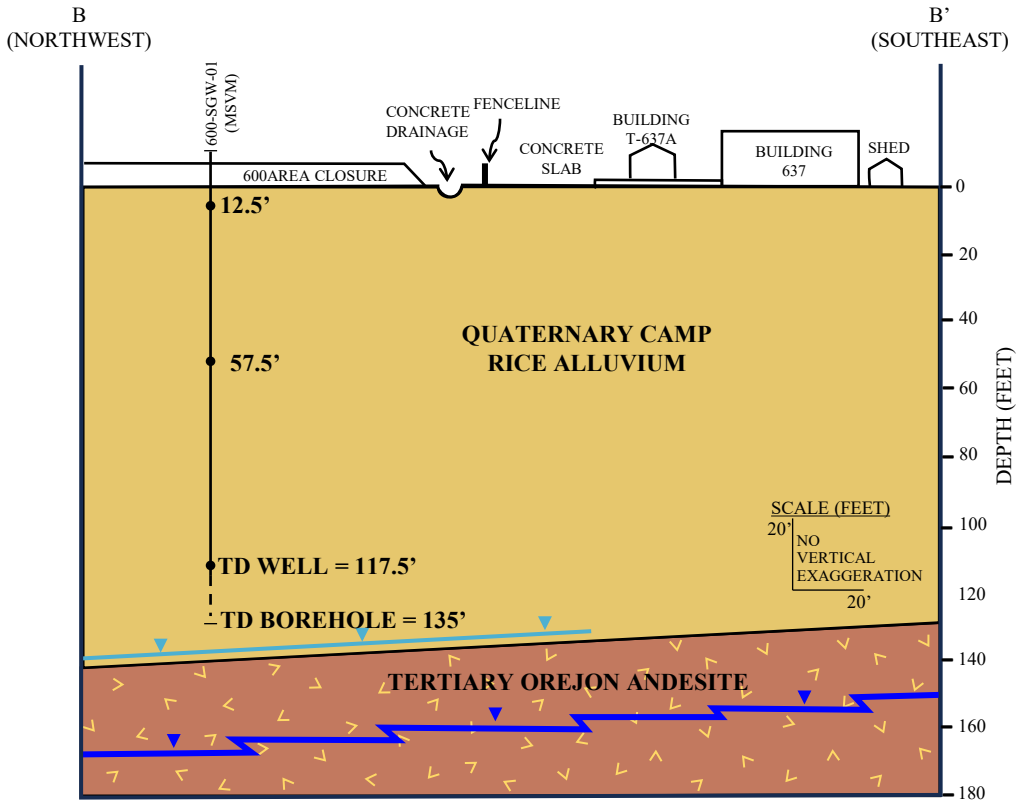
MSVM WELL

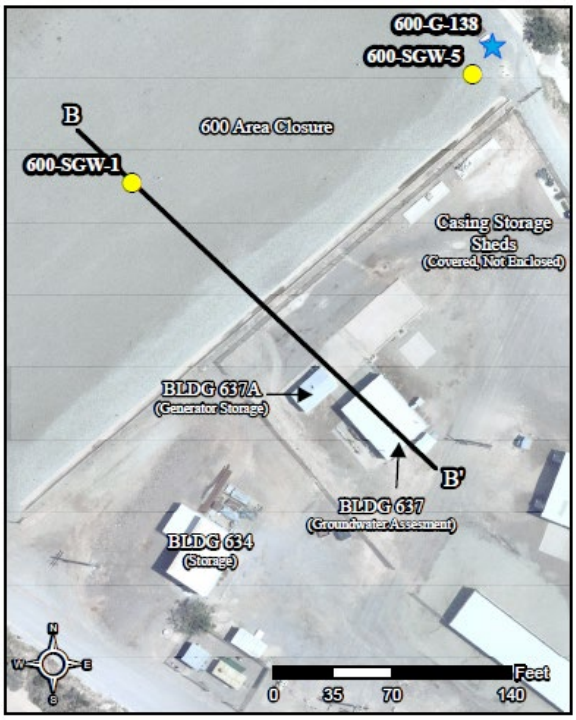
November 2024

Figure 4 **Building 637 Site Conditions**

(SEE NEXT PAGE)

Building 637 Site Conditions





TD Well = 9'
TD Borehole = 20''

MSVM WELL WITH VAPOR PORTS (DEPTH IN FEET)

QUATERNARY CAMP RICE ALLUVIUM

TERTIARY OREJON ANDESITE

WATER TABLE (INFERRED FROM MONITORING WELL DATA)

PERCHED WATER TABLE (INFERRED FROM WELL 600-G-138)

CROSS-SECTION EXTENT (B-B')

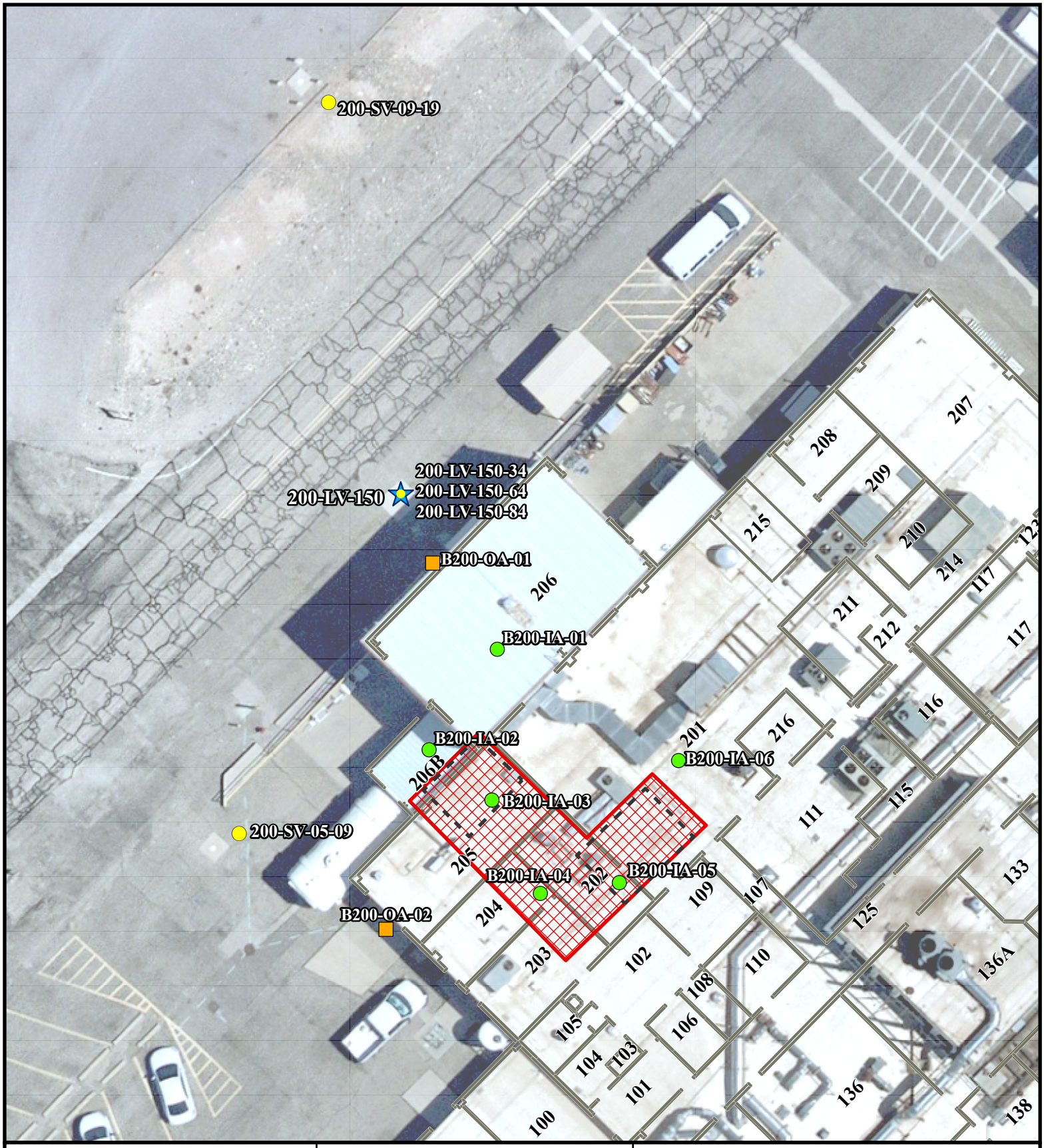
MSVM WELL

PERCHED GROUNDWATER WELL

November 2024

Figure 5 West Building 200 Area Sampling Locations

(SEE NEXT PAGE)



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Prepared by:srees

- Vadose Zone Sample
- Indoor Air Sample
- Outdoor Air Sample
- Vadose Zone and Groundwater Sample
- Closed Clean Room Tank HWMU
- Approximate Tank Footprint

West Building 200 Area Sampling Locations

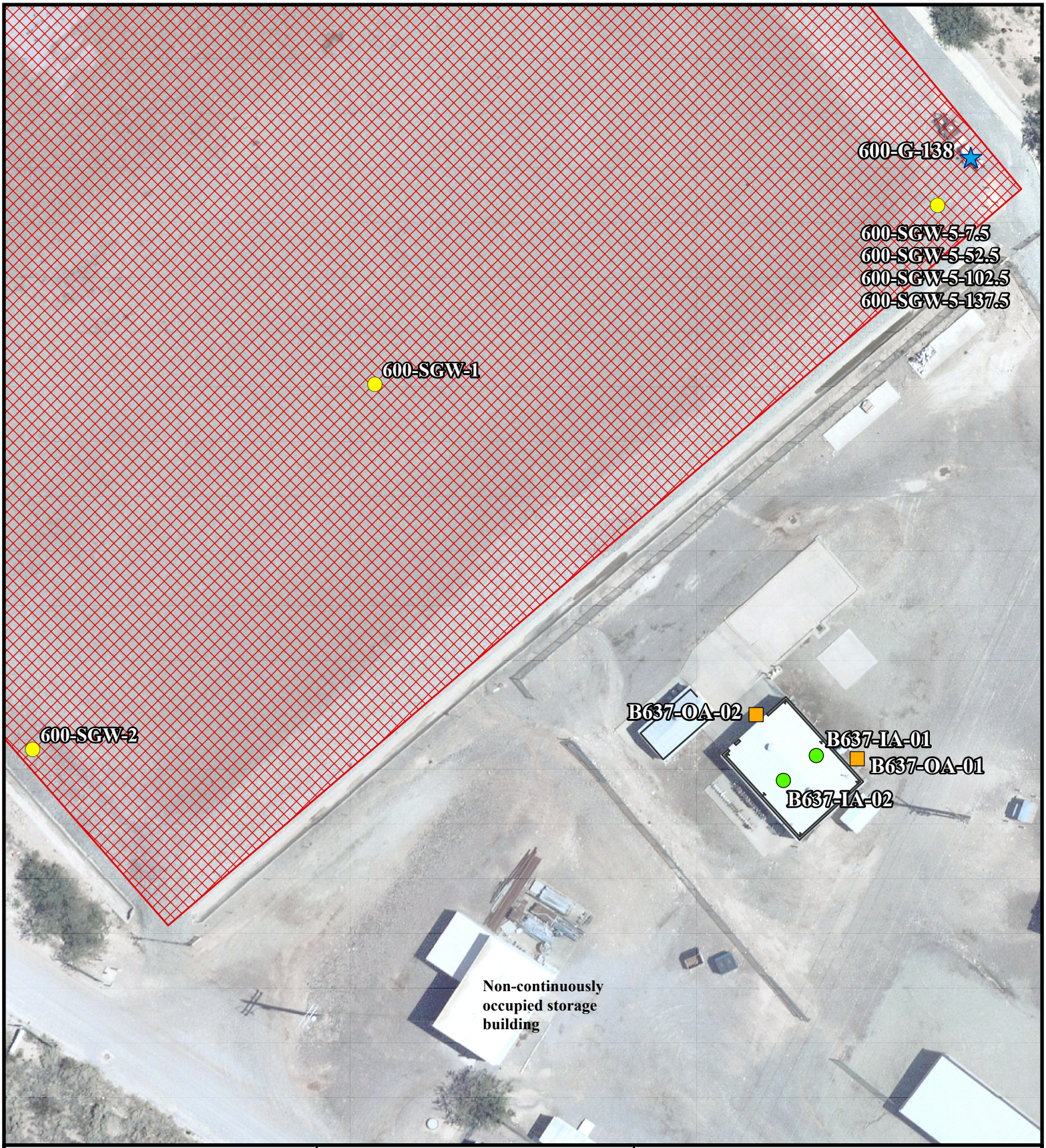
NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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Figure 6 **Building 637 Sampling Locations**

(SEE NEXT PAGE)



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November 2024

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Prepared by:srees

- Closed 600 Area HWMU
- Indoor Air Sample
- Outdoor Air Sample
- Vadose Zone Vapor Sample
- Groundwater Sample

Building 637 Sampling Locations

NASA Johnson Space Center
White Sands Test Facility Las Cruces, New Mexico

Coordinate System:
NAD 1983 StatePlane New Mexico Central FIPS 3002 Feet

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Tables

Table 1 Historical TCE Soil Vapor Sample Events and Concentrations in the Vicinity of Building 200 and Building 637

Soil Vapor Sample Location	Well Type	TCE Concentration October 2014 Specific to Phase II IR[1] (µg/m^3)	TCE Concentration August 2017 Specific to VIAR[2] (µg/m^3)	TCE Concentration February 2018 Specific to VIAR[2] (µg/m^3)	TCE Concentration January 2024 Specific to PGEPT Year 11 Report[3] (µg/m^3)	Comment
200-SV-05 at 9 ft	MSVM	47,000	40,000	26,000	---	Declining over time
200-SV-09 at 19 ft	MSVM	23,000	35,000	31,000	---	Fluctuating over time
200-LV-150 at 34 ft	MSVGM	Blocked	410,000	140,000	---	Declining over time
200-LV-150 at 64 ft	MSVGM	380,000	---	---	---	One datapoint only
200-LV-150 at 84 ft	MSVGM	250,000	---	---	---	One datapoint only
600-SGW-1 at 12.5 ft	MSVM	1,600	480	740	---	Fluctuating over time
600-SGW-2 at 12.5 ft	MSVM	1,000	330	270	---	Declining over time
600-SGW-5 at 7.5 ft	MSVM	7.5	44	42	19	Declining over time
600-SGW-5 at 52.5 ft	MSVM	2,000	---	---	720	Declining over time
600-SGW-5 at 102.5 ft	MSVM	1,700	---	---	800	Declining over time
600-SGW-5 at 137.5 ft	MSVM	15,000	---	--	8,300	Declining over time
600-SGW-6 at 7.5 ft	MSVM	550	---	---	---	One datapoint only

Notes:

[1] Collected for the *200 Area Phase II Investigation Report* (NASA, 2015b).

[2] Collected for the *200 and 600 Area Vapor Intrusion Report* (NASA, 2024b).

[3] Collected for the *600 Area Perched Groundwater Extraction Pilot Test Report Year 11 Report* (NASA, 2024a). Note – soil vapor data has been collected for well 600-SGW-5 PGEPT evaluation on a quarterly basis since March 2013 with the results included in NASA (2024a).

--- Sample not collected as part of the investigation.

Table 2 Soil Vapor, Groundwater, Indoor Air, and Outdoor Air Sampling Locations

Sample ID	Horizontal Distance from Primary Vadose Zone Vapor Source* (ft)	Sample Location Type	Sample Frequency	Sample Collection Location and Strategy	Sample Canister Volume and Analytical Method	Sampling style
Building 200 (West Side 200 Area) in the Vicinity of the Clean Room Tank HWMU						
200-SV-05 at 9 ft	35	MSVM well	Two semi-annual sampling events separated by 6 months in the summer and winter seasons.	Soil vapor samples will be collected from 12” soil vapor implant ports in the vadose zone	1-Liter passivated stainless steel canister, analysis by TO-15	Grab sample with pre-purging using Landtec GEM 2000
200-SV-09 at 19 ft	125	MSVM well				
200-LV-150 at 34 ft	50	MSVGM[1] well				
200-LV-150 at 64 ft	50	MSVGM[1] well				
200-LV-150 at 84 ft	50	MSVGM[1] well				
B200-IA-01	15	Indoor air		Indoor samples will be collected with outer wall windows and doors closed to minimize any contribution from outside air	6-Liter passivated stainless steel canister, analysis by TO-15	Flow controller over 8-hour period
B200-IA-02	4	Indoor air				
B200-IA-03	0	Indoor air				
B200-IA-04	0	Indoor air				
B200-IA-05	0	Indoor air				
B200-IA-06	6	Indoor air				
B200-OA-01	33	Outdoor air		Outdoor air samples from a representative upwind location away from any obstructions		
B200-OA-02	23	Outdoor air				
Building 637 in the Vicinity of the Southeast Side of the 600 Area Closure						
600-SGW-1 at 12.5 ft	180	MSVM well	Two semi-annual sampling events separated by 6 months in the summer and winter seasons.	Soil vapor samples will be collected from 12” soil vapor implant ports in the vadose zone	1-Liter passivated stainless steel canister, analysis by TO-15	Grab sample with pre-purging using Landtec GEM 2000
600-SGW-2 at 12.5 ft	250	MSVM well				
600-SGW-5 at 7.5 ft	180	MSVGM[2] well				
600-SGW-5 at 52.5 ft	180	MSVGM[2] well				
600-SGW-5 at 102.5 ft	180	MSVGM[2] well				
600-SGW-5 at 137.5 ft	180	MSVGM[2] well				
600-SGW-6 at 7.5 ft	250	MSVM well				
B637-IA-01	92	Indoor air		Indoor samples will be collected with outer wall windows and doors closed to minimize any contribution from outside air	6-Liter passivated stainless steel canister, analysis by TO-15	Flow controller over 8-hour period
B637-IA-02	93	Indoor air				
B637-OA-01	100	Outdoor air		Outdoor air samples from a representative upwind location away from any obstructions		
B637-OA-02	100	Outdoor air				

Notes:

[1] MSVGM well 200-LV-150 groundwater zone will be sampled at the same time as soil vapor sampling.

[2] MSVM well 600-SGW-5 twinned groundwater zone will be sampled at well 600-G-138 at the same time as soil vapor sampling.