



5 Year REVIEW

Groundwater Cleanup at JPL

Three areas known as Operable Units (OUs) have been the focus of NASA cleanup activities. OU1 addresses groundwater beneath the JPL “source area,” and OU3 addresses deep groundwater off-facility, or beyond the JPL fence line. Both OU1 and OU3 are included in this five-year review. Cleanup activities at OU2, within the dry soil beneath the source area, were completed in 2007.

Remedies are effective, protective, and making progress toward meeting the stringent cleanup goals.

JET PROPULSION LABORATORY GROUNDWATER CLEANUP PROGRAM

Third Five-Year Review of Operable Units 1 (OU1) & 3 (OU3)

A Third Review: Calendar Years 2017-2021

NASA recently completed a five-year review of the JPL groundwater cleanup project – the third review of its kind since cleanup began. This is a technical assessment, required by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), to determine if the current remedies that were implemented as part of the approved Record of Decision (ROD) continue to be effective and protective of human health and the environment. NASA, along with the U.S. Environmental Protection Agency (EPA), and California State agencies (i.e., the Regional Water Quality Control Board [RWQCB] and the Department of Toxic Substances Control [DTSC]), evaluated data collected since the last (second) review in 2017, documented cleanup progress, identified any issues and recommended ways to address them moving forward.

The Review Process Overview

NASA posted a public notice to the JPL CERCLA Program website to inform the community that the third five-year review would be conducted and to solicit input and provide answers to any questions about the review process. A subsequent public notice informed the community of availability of the final Third Five-Year Review Report and this fact sheet.

Seeking input from stakeholders, NASA sent community involvement questionnaires to local water purveyors, officials, and community groups asking them about the installation and operation of the off-site water treatment systems in the neighboring communities. Responses were positive saying they appreciated NASA’s outreach efforts and that the JPL CERCLA Program website was an effective way to distribute information.

NASA reviewed documents and monitoring activities for the treatment systems from the past five years to evaluate their performance, effectiveness, and protectiveness. Additionally, NASA performed site inspections of the treatment systems in November 2021. This inspection, on top of the regular and routine monitoring and inspections that NASA does, documented that the groundwater treatment and monitoring equipment are in good working order. **The 2017-2021 Five-Year Review confirmed that the remedies are effective, protective, and making progress toward meeting the stringent cleanup goals.**

As part of the review process, federal, state, and local officials were given the opportunity to provide comments on the draft report. The final Five-Year Review Report is posted on the NASA JPL Cleanup Program website <https://jplwater.nasa.gov>.

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An Update on Cleanup Activities

In February 2018, shortly after the second five-year review was completed, a Record of Decision (ROD) for OU1 and OU3 was approved by federal and state government agencies as the best approach to reaching the cleanup goals and to maintaining protection of human health and the environment. This enabled NASA to continue with ongoing groundwater extraction, treatment, and reinjection at OU1 and to continue operation and maintenance of the NASA-funded treatment systems owned by Pasadena Water and Power (PWP) and the Lincoln Avenue Water Company (LAWC) both located in OU3. NASA would also continue groundwater monitoring in OU1 and OU3 and beginning in 2019 implement Institutional Controls (ICs). NASA prepared the Institutional Control Remedial Design for OU1 and OU3 in April 2019 that outlined communication and coordination with state and local officials. ICs help ensure any new well activity within the Monk Hill Subarea and/or rainwater recapture projects within the JPL facility are properly evaluated to determine if there is a potential impact to the NASA's cleanup program that could result in exposure to VOCs and perchlorate.

In the past five years, NASA has successfully continued safe and effective groundwater cleanup activities. At the same time, NASA has made improvements to treatment systems that enhance operations all the while meeting the challenges of pandemic-related safety requirements and responding to impacts from the ongoing drought in Southern California.

OU1

The five-year review demonstrates that the source area treatment system is operating as designed to meet the cleanup goals. NASA heeded the recommendation made in the previous five-year review to better address the perchlorate levels in the vicinity of monitoring well MW-13 in OU1.

NASA installed a new groundwater extraction well (EW-4), which began operating as part of the source area treatment system in January 2020 and perchlorate concentrations in MW-13 subsequently decreased. Due to low water levels associated with the drought, MW-13 has not been sampled since mid-2020. NASA is continuing to evaluate the impact of EW-4 as part of the source area treatment system.

Importantly, the overall perchlorate concentrations coming into the OU1 treatment system have decreased significantly since operation began 11 years ago. In addition to installing the new EW-4, NASA made further enhancements in 2021 by replacing the fluidized bed reactor (FBR) system with a new, fully automated ion exchange system. Ion exchange is a proven, more cost-effective method to achieve removal at the existing lower perchlorate levels.

With these improvements in place, a total volume of 1,683 acre-feet of water was extracted and treated by the OU1 treatment system to remove 250 lbs. of perchlorate over the past five years. A liquid-phase granular activated carbon (LGAC) system has removed 4.2 lbs. of VOCs from groundwater during that same period. Removing these chemicals at the source area means that they will not migrate to OU3, thus reducing the timeframe needed for operation of the LAWC and PWP treatment systems.

In the past five years, NASA has continued safe & effective groundwater cleanup activities.



NASA's OU1 source area groundwater treatment system at JPL.

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Groundwater treated at NASA-funded systems can be used for drinking water.

OU3

The Monk Hill Treatment System (MHTS) consists of four City of Pasadena drinking water wells in the Arroyo Seco and a groundwater treatment system located on Windsor Avenue in Pasadena. The Lincoln Avenue Water Company (LAWC) treatment system in Altadena consists of three drinking water wells since a third NASA-funded well was put into operation in late 2017. These treatment systems continue to prove effective in removing perchlorate from groundwater using ion exchange systems and removing VOCs using LGAC systems.



Ion exchange vessels and associated piping removes perchlorate from extracted groundwater.

Effective operation of the MHTS prevailed over the past five years with a total of 12,634-acre feet of groundwater being extracted and treated removing approximately 310 lbs. of perchlorate and nearly 90 lbs. of VOCs. At LAWC, the total volume of 8,648 acre-feet of groundwater was extracted removing 302 lbs. of perchlorate and 90 lbs. of VOCs. **Together, the two off-site OU3 treatment systems**

are performing effectively, preventing migration of the chemicals originating from JPL, and allowing beneficial use of the groundwater whereby the treated water is disinfected and used by Pasadena and LAWC for drinking water.

Groundwater Monitoring Shows Remedies are Effective and Protective

NASA's 25 monitoring wells on and in the vicinity of JPL demonstrate that the treatment systems in place continue to be effective in removing perchlorate and VOCs from groundwater. Quarterly monitoring reports are posted to the JPL CERCLA Program website.

In addition to the primary chemicals included in the ROD, there are some other so-called emerging compounds being evaluated as part of the LAWC and Pasadena drinking water treatment systems. One compound, 1,2,3-trichloropropane (1,2,3-TCP) was highlighted by the City of Pasadena as a concern due to the State of California having established a safe drinking water standard since the last five-year review was conducted. The standard, also known as the maximum contaminant level (MCL) is 5 parts per trillion (ppt). NASA has analyzed samples for 1,2,3-TCP from select JPL wells since 2003. **The compound has never been detected in MHTS or LAWC wells at levels above the new drinking standard.** NASA will continue monitoring for 1,2,3-TCP as part of annual monitoring of wells upgradient of MHTS, and NASA will assess all monitoring wells at JPL (see recommendations in Summary section, page 4).

NASA annually monitors two other emerging compounds from select JPL wells. Detections of the compound known as NDMA have been below the State of California's notification level of 10 ppt in all wells. The compound 1,4-dioxane was detected just above the State's notification level of 1 part per billion (ppb) in a few JPL monitoring wells. In the past five years, all samples from the MHTS and LAWC wells were below the State's notification level for 1,4-dioxane. **Based on the results from monitoring wells and drinking water production wells, no further action is necessary at this time. NASA will continue to monitor these compounds.**

In addition to the efforts described above, NASA is proactively evaluating facilities across the U.S., including JPL for the presence of per- and polyfluoroalkyl substances (PFAS). NASA prepared a Preliminary Assessment (PA) Report in 2021 to identify past or present activities that may have resulted in a release of PFAS to the environment and follow-up investigations are planned (see recommendations in Summary section, page 4). **PFAS have not been detected above State notification levels in the MHTS or LAWC wells.**

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Summary and Conclusion

This five-year review confirmed that all remedies are operating as designed and are performing effectively. The report documents three issues of possible concern and the recommendations to address them. If the drought continues, and groundwater levels fall further due to very limited aquifer recharge, groundwater pumping in the Monk Hill Subarea of the Raymond Basin would need to be limited to slow the rate of dropping groundwater levels. It is recommended that NASA engages in contingency planning with local water purveyors to keep some treatment system wells pumping. The report also recommends further evaluation of two emerging compounds. NASA will conduct low level 1,2,3-TCP analysis in all JPL monitoring wells and will prepare a technical memorandum to document conclusions and next steps, if necessary. The five-year report recommends NASA continue its proactive effort to document the presence of PFAS at JPL. Site investigation activities will include groundwater sample collection from some existing monitoring wells at JPL in three areas and soil sample collection at a fourth area for possible presence of PFAS.

Field activities are currently planned for the spring of 2022 and results will determine any next steps.

NASA's groundwater cleanup program at JPL maintains a solid performance and demonstrates health protectiveness.

Based on all the data and information reviewed from the past five years, NASA's groundwater cleanup program at JPL maintains a solid performance and demonstrated protectiveness of human health and the environment. Continued operation of the systems to achieve the groundwater cleanup goals is expected to take another five to ten years. NASA will continue to keep the public informed about cleanup activities. As a respondent to this five-year review questionnaire said, "From the very beginning, NASA engaged the community... and established relationships that have allowed members of the community to continuously reach out and have their questions or concerns addressed."

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"From the very beginning, NASA engaged the community... and established relationships that have allowed members of the community to continuously reach out and have their questions or concerns addressed."