FINAL

INSTITUTIONAL CONTROL 2020 ANNUAL REPORT
FOR OPERABLE UNIT 1 AND OPERABLE UNIT 3

National Aeronautics and Space Administration
Jet Propulsion Laboratory
Pasadena, California

EPA ID# CA9800013030

Prepared for:

National Aeronautics and Space Administration
Management Office, Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91109

March 2021
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>µg/L</td>
<td>microgram per liter</td>
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<tr>
<td>Caltech</td>
<td>California Institute of Technology</td>
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<tr>
<td>CERCLA</td>
<td>Comprehensive Environmental Response, Compensation and Liability Act</td>
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<tr>
<td>COC</td>
<td>chemical of concern</td>
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<tr>
<td>DDW</td>
<td>Division of Drinking Water</td>
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<td>DTSC</td>
<td>Department of Toxic Substances Control</td>
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<tr>
<td>FBR</td>
<td>fluidized bed reactor</td>
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<tr>
<td>FFA</td>
<td>Federal Facilities Agreement</td>
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<td>FFRDC</td>
<td>Federally Funded Research and Development Center</td>
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<td>FWEC</td>
<td>Foster Wheeler Environmental Corporation</td>
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<tr>
<td>gpm</td>
<td>gallons per minute</td>
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<tr>
<td>IC</td>
<td>institutional control</td>
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<tr>
<td>JPL</td>
<td>Jet Propulsion Laboratory</td>
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<td>LAWC</td>
<td>Lincoln Avenue Water Company</td>
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<tr>
<td>LGAC</td>
<td>liquid-phase granular activated carbon</td>
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<tr>
<td>MCL</td>
<td>maximum contaminant level</td>
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<tr>
<td>MHTS</td>
<td>Monk Hill Treatment System</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<tr>
<td>NEPA</td>
<td>National Environmental Policy Act of 1969</td>
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<tr>
<td>NPL</td>
<td>National Priorities List</td>
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<tr>
<td>OU</td>
<td>Operable Unit</td>
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<tr>
<td>RBMB</td>
<td>Raymond Basin Management Board</td>
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<tr>
<td>RCRA</td>
<td>Resource Conservation and Recovery Act</td>
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<tr>
<td>RI</td>
<td>remedial investigation</td>
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<tr>
<td>ROD</td>
<td>Record of Decision</td>
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<td>RWQCB</td>
<td>Regional Water Quality Control Board</td>
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<td>SWRCB</td>
<td>State Water Resources Control Board</td>
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<tr>
<td>TCE</td>
<td>trichloroethene</td>
</tr>
<tr>
<td>U.S. EPA</td>
<td>United States Environmental Protection Agency</td>
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<td>VOC</td>
<td>volatile organic compound</td>
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This Institutional Control (IC) 2020 Annual Report for Operable Unit (OU) 1 and OU3 documents the implementation of ICs included as part of the remedy selected in the Final Record of Decision (ROD) for OU1 and OU3 dated February 2018 (NASA, 2018) for the National Aeronautics and Space Administration’s (NASA) Jet Propulsion Laboratory (JPL). The selected remedy under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) includes operation of groundwater treatment systems and implementation of ICs to ensure the effectiveness of ongoing groundwater treatment and prevent exposure to impacted groundwater at JPL. The Institutional Control Remedial Design for OU1 and OU3, dated April 2019 (NASA, 2019), describes the implementation and assurance of ICs required as part of the NASA JPL CERCLA program.

JPL is a federally-funded research and development center (FFRDC) in Pasadena, California, with approximately 6,000 employees. JPL is operated by the California Institute of Technology (Caltech) under a contract with NASA. JPL’s primary activities include planetary exploration, Earth science, space-based astronomy, and technology development. JPL-developed technology used to enable new missions is also applied to technical and scientific problems of national significance.

Located in Los Angeles County, JPL is situated between the incorporated cities of La Cañada-Flintridge and Pasadena and is bordered on the east by the unincorporated community of Altadena. JPL encompasses approximately 176 acres of land and more than 150 buildings and other structures. Of the JPL facility's 176 acres, approximately 156 acres are federally owned. The remaining land is leased for parking from the Flintridge Riding Club. Development at JPL is primarily located in two regions – an early-developed northeastern area and a later-developed southwestern area. Figure 1-1 is a map showing the JPL facility and surrounding areas.

In October 1992, the JPL site was placed on the National Priorities List (NPL) and, is therefore subject to the provisions of CERCLA to regulate investigation and cleanup. For CERCLA purposes, the JPL site has been divided into three OUs. The three OUs are spatially distinct areas but are connected in terms of transport of chemicals originating from JPL. OU1 addresses on-facility groundwater at JPL; OU2 addresses on-facility vadose zone soil at JPL; and OU3 addresses off-facility groundwater adjacent to the JPL property. Cleanup of OU2 is complete, as documented in the Remedial Action Report for OU2 (NASA, 2007a).

The parties to the Federal Facilities Agreement (FFA) include NASA, the United States Environmental Protection Agency (U.S. EPA), the California Department of Toxic Substances Control (DTSC), and the Regional Water Quality Control Board (RWQCB). NASA is the lead federal agency, and the U.S. EPA, DTSC, and RWQCB provide guidance and oversight to the JPL CERCLA Program.
Note: (1) Devil's Gate Reservoir is dry most of the year.

Figure 1-1. Map of JPL and the Surrounding Area
During historic operations at JPL, various chemicals (including chlorinated solvents, solid rocket fuel propellants, cooling tower chemicals, sulfuric acid, Freon®™, and mercury) and other materials were used at the JPL facility. During the 1940s and 1950s, liquid wastes from materials used and produced at JPL (such as solvents and solid rocket propellants) were disposed of into seepage pits; a practice considered common at the time. The remedial investigation (RI) for on-facility soil (defined as OU2) identified 40 seepage pits, five waste pits, and four discharge points at the facility that were used during historic operations (Foster Wheeler Environmental Corporation [FWEC], 1999a). Some of the seepage pits received volatile organic compounds (VOCs) and other waste materials, which are currently found in groundwater beneath and adjacent to JPL. In the late 1950s and early 1960s, a sanitary sewer system was installed at JPL to handle sewage and wastewater. During this time, the seepage pits were closed and their use for sanitary and chemical waste disposal was discontinued. Today, laboratory chemical wastes are either recycled or sent off facility for treatment and disposal at regulated, Resource Conservation and Recovery Act (RCRA)-permitted hazardous waste facilities.

In 1980, the analyses of groundwater revealed the presence of VOCs in City of Pasadena water-supply wells located southeast of JPL in the Arroyo Seco. At about the same time, VOCs were detected in two water-supply wells used by the Lincoln Avenue Water Company (LAWC), located east of the Arroyo Seco (FWEC, 1999b). As a result, NASA initiated an investigation to evaluate VOCs originating from the JPL facility.

In 1988, a preliminary assessment/site inspection was completed at JPL, which indicated that further site characterization was warranted (Ebasco, 1988). Subsequent site investigations were conducted at JPL (Ebasco, 1990a; Ebasco, 1990b) and VOCs were detected in on-facility groundwater at levels above drinking water standards. In 1992, JPL was placed on the NPL of sites subject to regulation under CERCLA (47180-47187 Federal Register, Vol. 57, No. 199 [1992]). As part of this effort, NASA divided the site into three separate areas referred to as OUs: OU1 consists of on-facility groundwater (the “source area”), OU2 consists of on-facility soils (location of source material), and OU3 consists of off-facility groundwater adjacent to JPL.

After being placed on the NPL, an RI (FWEC, 1999a; FWEC, 1999b) was conducted at the JPL site to characterize the nature and extent of chemicals in soil and groundwater and assess both human health and ecological risk. Chemicals originating at JPL were not found in off-site soils or surface water. A quarterly groundwater monitoring program was initiated in August 1996 to monitor VOCs and other chemicals, including perchlorate, metals, anions, cations, and other field parameters. Historical groundwater monitoring activities have indicated that four chemicals of concern (COCs; carbon tetrachloride, trichloroethene [TCE], tetrachloroethylene, and perchlorate) have been detected in JPL monitoring wells at concentrations above the state and federal drinking water standards for each chemical. Carbon tetrachloride, TCE, and perchlorate continue to be consistently detected above state and federal drinking water standards. The perchlorate, carbon tetrachloride, and TCE plumes originating from JPL currently extend approximately 1 mile east-southeast of the source area (NASA, 2018). Analytical results from the groundwater monitoring program are summarized in quarterly technical memoranda that are available in the information repositories and on the CERCLA website (http://jplwater.nasa.gov).
In the early 1990s, NASA funded treatment facilities for LAWC and the City of Pasadena to remove VOCs from drinking water wells that were affected by chemicals from JPL. Then, in the late 1990s and early 2000, NASA conducted pilot testing of several technologies to determine the most effective means to address dissolved perchlorate in groundwater. The perchlorate treatment technologies tested included reverse osmosis, a fluidized bed reactor (FBR), packed bed reactors, in situ bioremediation, and ion exchange (FWEC, 2000; NASA, 2003a). Due to the depth and extent of the chemicals in groundwater, in situ (below ground) treatment is not cost-effective at the JPL facility; therefore, groundwater must be pumped from the ground, treated aboveground, and re-injected or used for drinking water.

A draft Feasibility Study was completed in January 2000 (FWEC, 2000) to evaluate potential response actions for groundwater at the JPL site. In addition, extensive groundwater modeling and aquifer testing (NASA, 2003b) at and adjacent to the JPL site were conducted to characterize the complex groundwater conditions and groundwater flow.

Based on the earlier pilot tests, NASA installed a demonstration treatment plant in early 2005 located in the source area on the JPL property. The system was subsequently expanded as the interim remedial action for OU1 in 2007 and has a treatment capacity of 300 gallons per minute (gpm). NASA and the regulators completed and signed the Interim ROD for OU1 in February 2007 (NASA, 2007b). The system currently consists of liquid-phase granular activated carbon (LGAC) treatment to remove VOCs and ion exchange treatment to remove perchlorate. Treated water is re-injected into the ground and is not used for drinking water purposes. Figure 2-1 shows the location of the OU1 system, including locations of extraction and injection wells.

Since system startup in early 2005, the OU1 treatment system has successfully treated more than 5,539 acre-feet of groundwater, removing approximately 2,106 pounds of perchlorate and 48 pounds of VOCs. Influent perchlorate concentrations at the OU1 system have decreased significantly, from approximately 2,300 micrograms per liter (µg/L) in February 2005 to approximately 39 µg/L in August 2020 (NASA, 2020a). Concentrations of perchlorate and VOCs at the effluent of the OU1 system (i.e., treated water) are consistently non-detect. In addition, operation of the source area treatment system appears to have resulted in a significant reduction of COCs in wells MW-7, MW-16, and MW-24, which are located within the treatment zone (i.e., within the area of influence for the extraction wells).

In July 2004, NASA implemented a removal action directed at the off-facility groundwater (OU3) to achieve quick, protective results and allow LAWC to continue use of its production wells during the high-demand summer months. This was accomplished by funding additional treatment facilities at LAWC to remove perchlorate in addition to VOCs. The perchlorate removal system uses an ion exchange technology that has worked well, successfully treating over 29,536 acre-feet of groundwater, removing approximately 1,315 pounds of perchlorate and 298 pounds of VOCs (NASA, 2020b). The LAWC system has a 2,000 gpm treatment capacity; although, the actual treatment rate is dependent on demand.

Based on the success of the LAWC removal action and the need for similar perchlorate and VOC treatment at four City of Pasadena wells, NASA issued the Proposed Plan for OU3 in April 2006 that consisted of continued funding for operation of the LAWC treatment system, as well as funding for construction and operation of a treatment system for groundwater from the four City
Figure 2-1. Location of OU1 and OU3 Groundwater Treatment Systems

of Pasadena drinking water production wells located just east of JPL near the Arroyo Seco. The Interim ROD for OU3 was finalized in August 2007 (NASA, 2007c). Figure 2-1 shows the location of the LAWC treatment facility, including locations of the production wells.

In accordance with the Interim ROD for OU3, NASA implemented an interim remedial action to also remove perchlorate and VOCs from four City of Pasadena drinking water production wells beginning in 2011. The Monk Hill Treatment System (MHTS) began operation in July 2011 and has successfully treated approximately 24,850 acre-feet of groundwater, removing approximately 1,266 pounds of perchlorate using ion exchange and 180 pounds of VOCs using granular activated carbon (NASA, 2020c). MHTS has a 7,000 gpm treatment capacity; although, the actual treatment rate is dependent on demand. Figure 2-1 shows the location of the MHTS, including locations of the production wells.

Groundwater treated by the current LAWC system and MHTS achieves all applicable drinking water requirements. Both systems are operating effectively and influent chemical concentrations at both systems are decreasing over time (NASA, 2017).
NASA’s selected remedy for groundwater is continued operation the interim remedies for OU1 and OU3 (NASA, 2018). The interim remedies included groundwater extraction, treatment, and reinjection at the OU1 source area, as well as operation of treatment systems to remove perchlorate and VOCs from pumped groundwater at four City of Pasadena (Mid-Plume Cleanup) and two LAWC drinking water production wells (Leading Edge Cleanup). NASA’s selected remedy also includes ICs to ensure impacted groundwater within the JPL site is not utilized without appropriate evaluation and/or treatment (NASA, 2018 and NASA, 2019). Lastly, the selected remedy also includes continuation of the existing groundwater monitoring program that was established in collaboration with supporting agencies. The groundwater monitoring program provides data to evaluate the performance and effectiveness of the remedy.

The ICs include an agreement with the State of California that requires the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW) to notify NASA of any proposed new extraction wells in the Monk Hill subarea, and that NASA evaluate the impact of any proposed extraction wells within/near the capture zones on the remedies for OU1 and OU3. In addition, NASA must conduct annual reviews of new well permits in the Monk Hill subarea as an additional control to prevent inadvertent exposure to chemicals.
4. INSTITUTIONAL CONTROLS IMPLEMENTATION AND ASSURANCE

In February 2019, NASA entered into an agreement with the California SWRCB DDW (NASA, 2019). This agreement includes a commitment that requires the agency to notify NASA of any new extraction wells proposed in the Monk Hill subarea of the Raymond Basin, as depicted in Figure 4-1. The SWRCB DDW oversees, regulates, and issues permits for public water systems, water recycling projects, and water treatment systems. In this role, permit applications for new groundwater wells proposed in the State of California (i.e., including the Raymond Basin aquifer) are submitted for review and approval by the SWRCB DDW.

In addition to the agreement, NASA must submit formal inquiries on an annual basis to the local management and enforcement agencies responsible for overseeing and regulating well construction, alteration, and destruction activities within the Monk Hill subarea of the Raymond Basin. These agencies include the Raymond Basin Management Board (RBMB), Los Angeles County, and the City of Pasadena, as follows:

Raymond Basin Management Board  
725 N. Azusa Avenue  
Azusa, CA 91702  
Phone: (626) 815-1300  

City of Pasadena  
Water and Power Department  
Water Division  
150 South Los Robles Avenue  
Pasadena, CA 92705  
Phone: (626) 744-4436

Los Angeles County  
Department of Health Services  
Drinking Water Program  
5050 Commerce Drive  
Baldwin Park, CA 91706  
Phone: (626) 430-5420

If RBMB, Los Angeles County, and/or the City of Pasadena report that permits/requests have been filed for new wells in the Monk Hill subarea of the Raymond Basin, NASA will request all relevant well data, make a determination within 30 days as to whether the installation of a well will adversely impact ongoing groundwater treatment efforts and/or result in exposure to impacted groundwater, and document the determination within 60 days.

Recognizing that changes in groundwater recharge may also affect OU1 cleanup efforts, NASA must also submit a formal inquiry to JPL on an annual basis to obtain information on any proposed rainwater recapture projects within the JPL facility. If projects are planned that include rainwater recapture, NASA will request all relevant data, make a determination within 30 days as to whether the rainwater recapture project will adversely impact ongoing groundwater treatment efforts, and document the determination within 60 days.

Finally, NASA must prepare an IC report annually to document results of assurance monitoring, and NASA will evaluate the effectiveness of IC implementation and assurance as part of Five-Year Reviews for the JPL CERCLA site.
Figure 4-1. Map of the Raymond Basin Showing the Monk Hill Sub-Area
5. INSTITUTIONAL CONTROLS ANNUAL SUMMARY

Regarding the agreement with SWRCB DDW, NASA has not been notified of any new extraction wells proposed in the Monk Hill subarea of the Raymond Basin.

On October 16 2020, NASA submitted formal inquiries to JPL, RBMB, Los Angeles County, and the City of Pasadena. These inquiries letters are provided as Attachment 1. JPL, RBMB, Los Angeles County, and the City of Pasadena did not provide responses to the letters, and NASA is not aware of any well installation or rainwater recapture activities in the Monk Hill subarea of the Raymond Basin that could adversely impact ongoing groundwater treatment efforts and/or result in exposure to impacted groundwater.

SUMMARY OF FINDINGS: Based on the available data for 2020, NASA is not aware of any well installation or rainwater recapture activities in the Monk Hill subarea of the Raymond Basin that could adversely impact ongoing groundwater treatment efforts and/or result in exposure to impacted groundwater.


National Aeronautics and Space Administration (NASA). 2007b. *Interim Record of Decision for Operable Unit 1 Source Area Groundwater, National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California*. March.

National Aeronautics and Space Administration (NASA). 2007c. *Interim Record of Decision for Operable Unit 3 Off-Facility Groundwater, National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California*. August.


ATTACHMENT 1

Formal Inquiry Letters
TO: Mr. Charles Buril  
JPL Environmental Affairs Program Office (503)  
4800 Oak Grove Drive (M/S: 200-119A)  
Pasadena, CA 91109  
Phone: 818-354-0180

Dear Mr. Buril:

SUBJECT: CY2020 Request for Information on Rainwater Recapture Activities in the Monk Hill Subarea

The remedy selected in the Final Record of Decision (ROD) for Operable Unit (OU) 1 and OU3, dated February 2018, for the National Aeronautics and Space Administration’s (NASA) Jet Propulsion Laboratory (JPL) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site, includes the implementation of institutional controls (ICs) to ensure the effectiveness of ongoing groundwater treatment and to prevent exposure to impacted groundwater near JPL. The IC Remedial Design for OU1 and OU3, dated April 2019, details the implementation of ICs at the JPL CERCLA Site. The ROD and IC Remedial Design are available at JPL CERCLA Program website (https://jplwater.nasa.gov/).

As part of the ICs, NASA must submit formal inquiries on an annual basis to JPL on an annual basis to obtain information on any proposed rainwater recapture projects within the JPL facility.

NASA is requesting information from you on any proposed rainwater recapture projects with the JPL facility, ongoing or planned. Please respond within two weeks with applicable information you may have in this regard.

Please contact me if you have any questions via e-mail at sslaten@nasa.gov or via phone at (818) 393-6683.

Sincerely,

Steven Slaten  
Facilities and Environmental Manager  
NASA Management Office / JPL
TO: Los Angeles County  
Environmental Health, Drinking Water Program  
5050 Commerce Drive  
Baldwin Park, CA 91706  
Phone: (626) 430-5420

To Whom It May Concern:

SUBJECT: CY2020 Request for Information on Production Well Construction, Alteration, and Destruction Activities in the Monk Hill Subarea

The remedy selected in the Final Record of Decision (ROD) for Operable Unit (OU) 1 and OU3, dated February 2018, for the National Aeronautics and Space Administration’s (NASA) Jet Propulsion Laboratory (JPL) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site, includes the implementation of institutional controls (ICs) to ensure the effectiveness of ongoing groundwater treatment and to prevent exposure to impacted groundwater near JPL. The IC Remedial Design for OU1 and OU3, dated April 2019, details the implementation of ICs at the JPL CERCLA Site. The ROD and IC Remedial Design are available at JPL CERCLA Program website (https://jplwater.nasa.gov/).

As part of the ICs, NASA must submit formal inquiries on an annual basis to the local management and enforcement agencies responsible for overseeing and regulating well construction, alteration, and destruction activities within the Monk Hill subarea of the Raymond Basin. These agencies include the Raymond Basin Management Board, Los Angeles County, and the City of Pasadena.

NASA is requesting information from you on any well construction, alteration, and destruction activities in the Monk Hill Subarea, ongoing or planned. Please respond within two weeks with applicable information you may have in this regard.

Please contact me if you have any questions via e-mail at slaten@nasa.gov or via phone at (818) 393-6683.

Sincerely,

Steven Slaten  
Facilities and Environmental Manager  
NASA Management Office / JPL
TO:  City of Pasadena  
      Water and Power Department, Water Division  
      150 South Los Robles Avenue  
      Pasadena, CA 92705  
      Phone: (626) 744-4436

Dear Mr. Boman:

SUBJECT:  CY2020 Request for Information on Production Well Construction, Alteration, and Destruction Activities in the Monk Hill Subarea

The remedy selected in the Final Record of Decision (ROD) for Operable Unit (OU) 1 and OU3, dated February 2018, for the National Aeronautics and Space Administration’s (NASA) Jet Propulsion Laboratory (JPL) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site, includes the implementation of institutional controls (ICs) to ensure the effectiveness of ongoing groundwater treatment and to prevent exposure to impacted groundwater near JPL. The IC Remedial Design for OU1 and OU3, dated April 2019, details the implementation of ICs at the JPL CERCLA Site. The ROD and IC Remedial Design are available at JPL CERCLA Program website (https://jplwater.nasa.gov/).

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Please contact me if you have any questions via e-mail at sslaten@nasa.gov or via phone at (818) 393-6683.

Sincerely,

Steven Slaten  
Facilities and Environmental Manager  
NASA Management Office / JPL
TO: Tony Zampiello  
Raymond Basin Management Board  
725 N. Azusa Avenue  
Azusa, CA 91702  
Phone: (626) 815-1300

Dear Mr. Zampiello:

SUBJECT: CY2020 Request for Information on Production Well Construction, Alteration, and Destruction Activities in the Monk Hill Subarea

The remedy selected in the Final Record of Decision (ROD) for Operable Unit (OU) 1 and OU3, dated February 2018, for the National Aeronautics and Space Administration’s (NASA) Jet Propulsion Laboratory (JPL) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site, includes the implementation of institutional controls (ICs) to ensure the effectiveness of ongoing groundwater treatment and to prevent exposure to impacted groundwater near JPL. The IC Remedial Design for OU1 and OU3, dated April 2019, details the implementation of ICs at the JPL CERCLA Site. The ROD and IC Remedial Design are available at JPL CERCLA Program website (https://jplwater.nasa.gov/).

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Please contact me if you have any questions via e-mail at sslater@nasa.gov or via phone at (818) 393-6683.

Sincerely,

Steven Slaten  
Facilities and Environmental Manager  
NASA Management Office / JPL