# Technical Memorandum

## Pasadena Water & Power Monk Hill Treatment System
## National Aeronautics and Space Administration
## Jet Propulsion Laboratory, Pasadena, California

*Final* April 2015

This technical memorandum documents the performance of the Monk Hill Treatment System (MHTS) operations through December 2014. The treatment system was implemented under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program at the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL). Operation of the treatment system is a part of the remedial action for Operable Unit 3 (OU-3), documented in the Final Interim Record of Decision (ROD) 2007.[1] Table 1 provides an overview of the system operations to date. Startup testing was conducted in early 2011 and Pasadena Water and Power (PWP) began drinking water production operations in July 2011.

**Table 1. MHTS System Operational Summary (January 2011 through December 2014)**

| Parameter | Units | Windsor | Arroyo | Well 52 | Ventura | Total |
|---|---|---|---|---|---|---|
| Total Volume of Groundwater Extracted | acre-ft | 89 | 8,172 | 3,676 | 1,782 | 13,719 |
| Mass of Perchlorate Removed | lb | 1 | 833 | 70 | 25 | 929 |
| Mass of Carbon Tetrachloride ($CCl_4$) Removed | lb | 0 | 51 | 0 | 0 | 51 |
| Mass of Trichloroethene (TCE) Removed | lb | 0.50 | 15 | 19 | 13 | 347.5 |

## BACKGROUND

Liquid wastes (such as cleaning solvents, solid and liquid rocket propellants, cooling tower chemicals, and analytical laboratory chemicals) generated at JPL in the 1940s and 1950s were disposed of in seepage pits, a common and acceptable practice at the time. Some of these wastes contained chemicals (e.g., perchlorate and chlorinated solvents containing volatile organic compounds [VOCs]) that have been found in groundwater beneath and adjacent to JPL, including groundwater extracted from four drinking water wells operated by PWP (Windsor, Arroyo, Well 52, and Ventura). Figure 1 presents the location and boundaries of the JPL facility, PWP production wells, and MHTS.

VOCs were first detected in the PWP production wells in 1980. By 1989, VOC concentrations were increasing and all four wells were shut down. With NASA funding, PWP installed a VOC treatment facility for the wells in 1990; NASA also funded the ongoing operations of the plant. The VOC treatment facility consisted of an air stripping tower and vapor-phase granular activated carbon (VGAC). The treatment facility was operated in accordance with requirements of the California Department of Public Health (CDPH).[2]

[1] NASA. 2007. *Final Interim Record of Decision for Operable Unit, Off-Facility Groundwater*, National Aeronautics and Space Administration Jet Propulsion Laboratory, Pasadena, California. April.
[2] Following a reorganization in 2014, drinking water permits are now overseen by the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW).

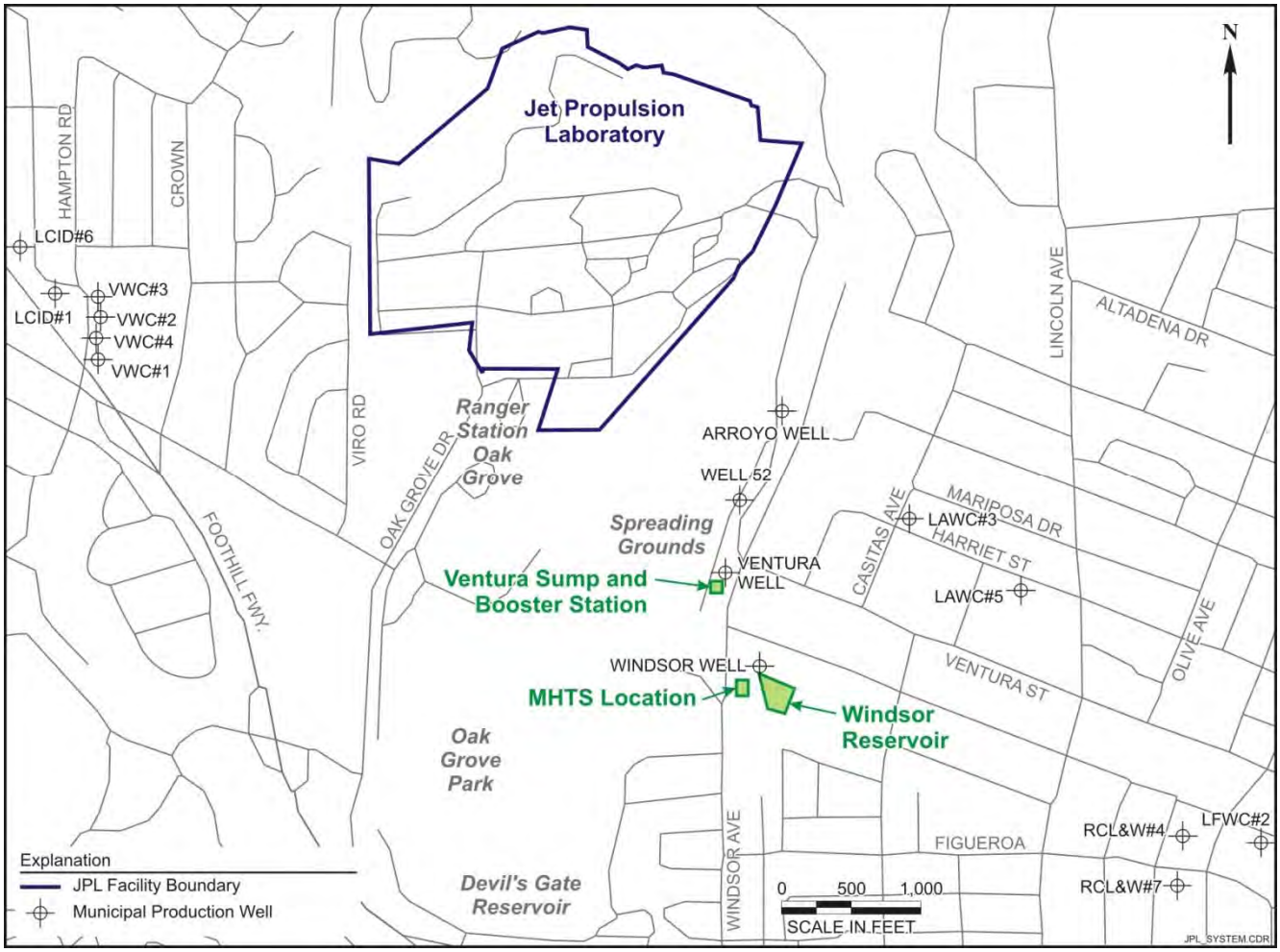


**Figure 1. Location Map**

Elevated perchlorate concentrations were detected in samples collected from the Arroyo Well in 1997, when an improved analytical method using ion chromatography was developed to detect low levels of perchlorate. The elevated perchlorate level caused an immediate shutdown in operation of the Arroyo Well; five years later, in 2002, the remaining PWP wells were shut down due to elevated perchlorate levels.

In 2009, construction was initiated for the MHTS. Construction and start-up testing were completed in March 2011 and a drinking water permit was issued. The MHTS consists of eight ion exchange (IX) treatment vessels and 10 liquid-phase granular activated carbon (LGAC) treatment vessels (Figure 2). The IX system is divided into four pairs of Calgon Carbon Corporation (CCC) Model 12 vessels operating in a lead/lag configuration. The LGAC system is divided into five pairs of 20,000 lb CCC vessels. CDPH issued a permit amendment on March 17, 2011 for the MHTS system. A copy of the permit is provided as Attachment A. NASA completed a MHTS Installation Report[3] in August 2011 as a record of the installation and construction activities. NASA completed a MHTS Installation Report Addendum[4] in

[3] NASA. 2011. *OU-3 Monk Hill Treatment System Installation Report.* National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California. August.

[4] NASA. 2012. *OU-3 Monk Hill Treatment System Installation Report Addendum, Liner Removal, Evaluation and Repair of Windsor Well (No. 48) and Well 52.* National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California. August.

December 2012 as a record of the liner removal, evaluation, and repair activities conducted at Windsor Well and Well 52.

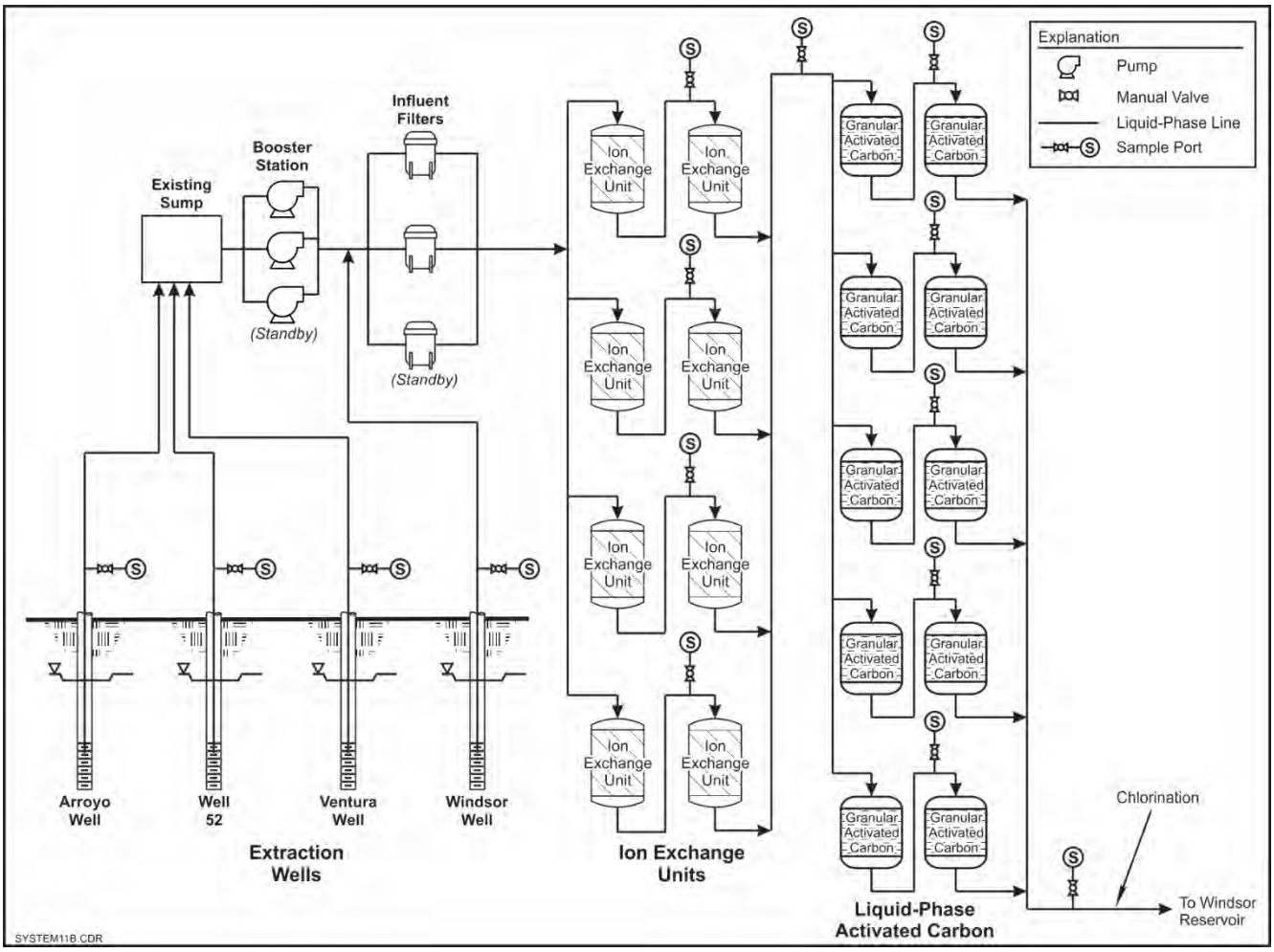


**Figure 2. Process Flow Diagram**

## PWP PRODUCTION WELLS (WINDSOR, ARROYO, WELL 52 AND VENTURA)

Table 2 summarizes the maximum and average perchlorate, $CCl_4$, and TCE concentrations detected in the PWP production wells. By the end of the reporting period, only Arroyo well was in operation. Well 52 was turned off in September 2014 due to low water levels associated with the drought and subsequently Ventura well was turned off due to elevated nitrate levels (not associated with the JPL CERCLA site). Also, Windsor Well is not operating due to elevated nitrate levels (not associated with the JPL CERCLA Site). Perchlorate concentrations in Arroyo ranged from 16 to 27 µg/L, with an average of 20 µg/L. Concentrations of $CCl_4$ and TCE in Arroyo were stable throughout the reporting period, averaging 1.4 µg/L and 0.7 µg/L, respectively. Perchlorate concentrations in Well 52 ranged from 4.5 to 8.4 µg/L, with an average of 6.0 µg/L. Concentrations of $CCl_4$ were < 0.5 µg/L and TCE ranged from 2.2 µg/L to 3.3 µg/L, with an average of 2.8 µg/L, showing a slight increase from 2013 readings. Perchlorate concentrations in Ventura ranged from 4.8 to 7.7 µg/L, with an average of 5.5 µg/L. Concentrations of $CCl_4$ and TCE in Ventura Well were stable throughout the reporting period, averaging < 0.5 µg/L and 4.3 µg/L, respectively. Figures 3, 4 and 5 are graphs of the concentrations in extracted groundwater samples collected at Arroyo, Well 52, and Ventura, respectively.

**Table 2. Summary of Chemical Concentrations in the MHTS Wells, Since Startup**

| Analyte | Units | WINDSOR | | ARROYO | | WELL 52 | | VENTURA | | MCL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Avg. | Max | Avg. | Max | Avg. | Max | Avg. | Max | |
| $CCl_4$ | µg/L | <0.5 | <0.5 | 2.2 | 3.8 | <0.5 | <0.5 | <0.5 | <0.5 | 0.5 |
| TCE | µg/L | 2.1 | 2.1 | 0.7 | 1.0 | 2.0 | 3.3 | 3.5 | 4.6 | 5 |
| Perchlorate | µg/L | 4.7 | 5.3 | 36.2 | 85.6 | 7.2 | 10.1 | 5.5 | 7.7 | 6 |

MCL = maximum contaminant level
Bold indicates concentration greater than MCL.

As part of the drinking water permit requirements for the MHTS, samples were collected quarterly from Arroyo, Well 52, and Ventura and analyzed for low-level 1,2,3-trichloropropane (TCP) and 1,4-dioxane. Results for all samples were non-detect.

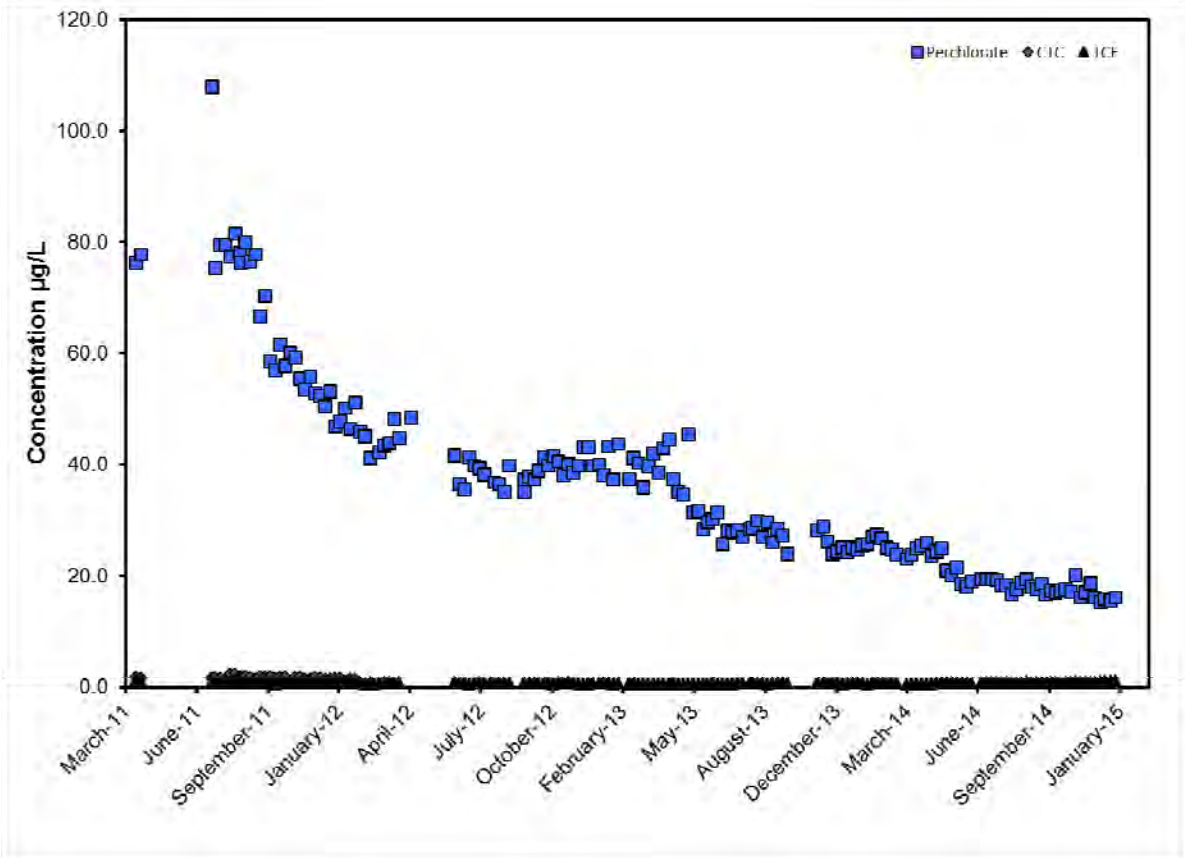


**Figure 3. Concentrations of Perchlorate, $CCl_4$ and TCE in Arroyo Well**

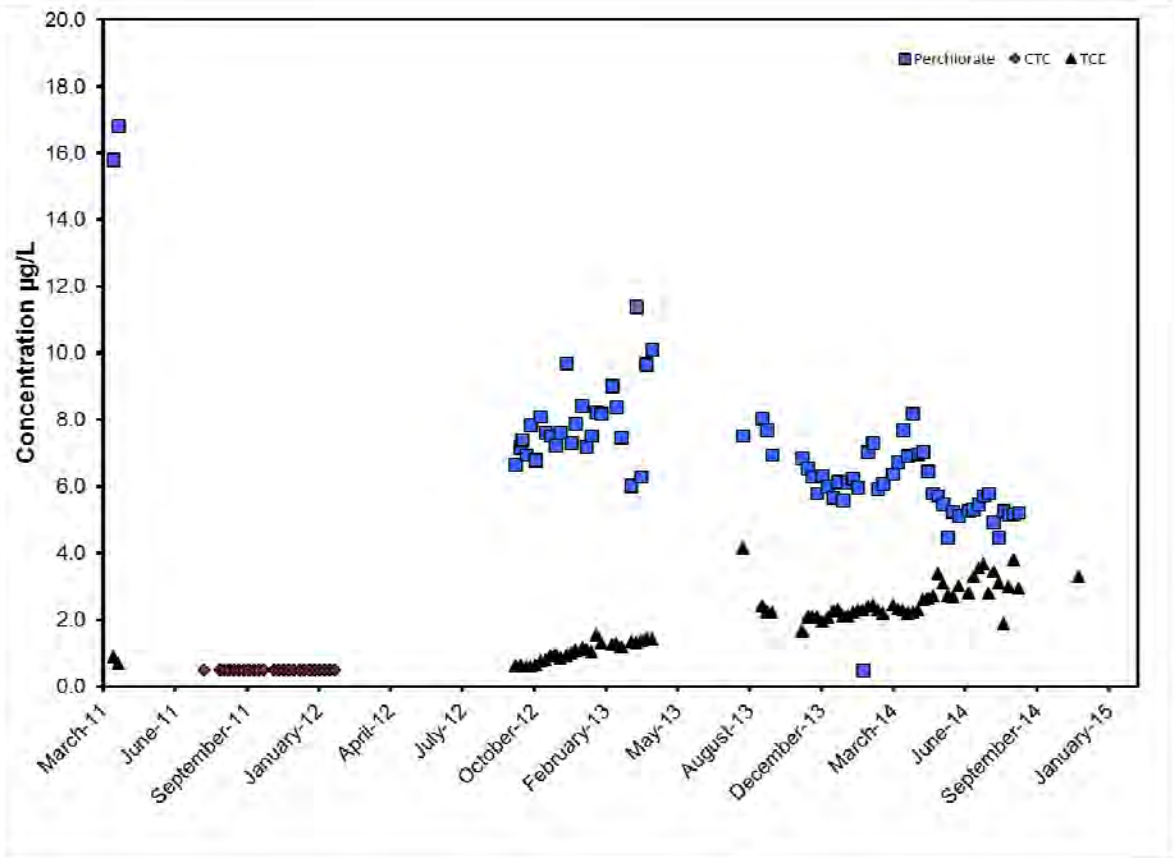


**Figure 4. Concentrations of Perchlorate, $CCl_4$ and TCE in Well 52**

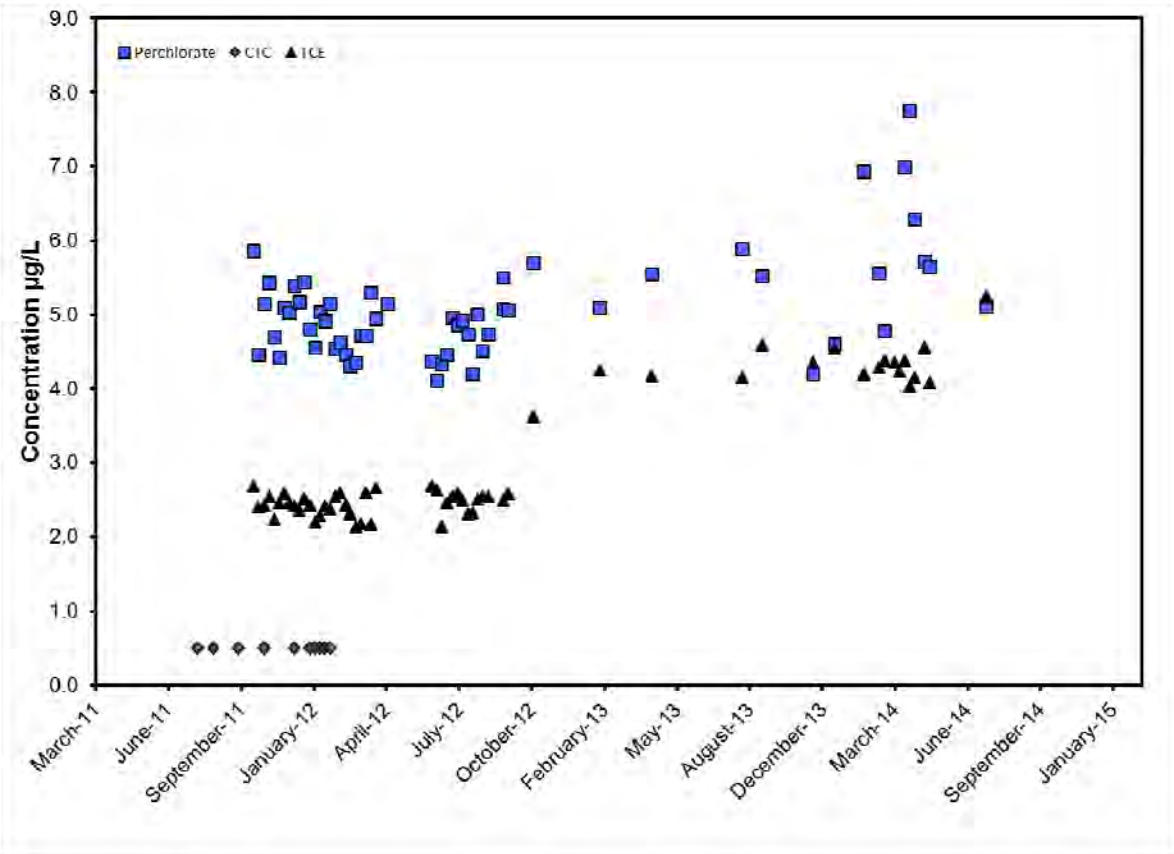


**Figure 5. Concentrations of Perchlorate, $CCl_4$ and TCE in Ventura Well**

**UPGRADIENT SURVEILLANCE MONITORING WELLS**

NASA JPL has multiple monitoring wells located within the vicinity of the MHTS production wells (see Figure 6). The drinking water permit provision #39 (Attachment A) identified MW-3 (Screen 2), MW-4 (Screen 2), MW-5, MW-10, MW-17 (Screen 3), MW-18 (Screen 4) and MW-19 (Screen 2) as part of the MHTS upgradient surveillance monitoring program. These wells are sampled quarterly as part of NASA's long-term groundwater monitoring program at JPL.

The upgradient surveillance monitoring wells serve as the best available indicator of near-future concentrations that may be observed in PWP production wells. Table 3 provides concentrations of $CCl_4$, TCE, and perchlorate for the year prior to MHTS startup (2010) and the current reporting period through the end of 2014. The sample results in Table 3 represent the maximum and average concentrations recorded at the sampling locations. All historical groundwater results for the NASA JPL monitoring wells can be found in the most recent quarterly groundwater monitoring report.[5] Concentrations of VOCs and perchlorate at the upgradient surveillance monitoring wells have decreased or remained relatively stable since MHTS operations began, with the exception of perchlorate in MW-4 (Screen 2). Even so, the observed concentrations do not indicate a need to modify treatment operations at the MHTS. The effect of sustained pumping on the chemical concentrations in monitoring wells near JPL will be closely monitored over the next several years of MHTS operations.

Low-level 1,2,3-TCP is monitored on an annual basis from the MHTS upgradient surveillance monitoring wells. During the 2014 annual sampling event (second quarter 2014), 1,2,3-TCP was detected at MW-18 (Screen 4) at a concentration of 0.030 µg/L which exceeds the state notification level of 0.005 µg/L. 1,2,3-TCP was not detected at the other six sampling locations. During the 2013 annual event, 1,2,3-TCP was detected in MW-18 (Screen 4) with concentrations of 0.035 µg/L, so concentrations appear to be stable.. 1,2,3-TCP was not detected at the other six sampling locations during the 2013 annual sampling events.

N-Nitrosodimethylamine (NDMA) is also monitored on an annual basis from the MHTS upgradient surveillance monitoring wells. During the 2014 annual sampling event (second quarter 2014), all seven sample results were non-detect for NDMA. During the 2013 annual sampling events, NDMA was also non-detect in all samples.

1,4-dioxane is also monitored on an annual basis from the MHTS upgradient surveillance monitoring wells. During the 2014 annual sampling event (second quarter 2014), there were no detections exceeding the state notification level of 1.0 µg/L. All concentrations were non-detect. During the annual 2013 sampling events, 1,4-dioxane was detected in MW-4 (Screen 2) at a concentration of 1.7 µg/L, which exceeded the state notification level of 1 µg/L. All other concentrations were non-detect.

It should be noted again that, samples were collected quarterly from Arroyo, Well 52, and Ventura and analyzed for low-level 1,2,3-TCP and 1,4-dioxane. Results for all samples were non-detect.

[5] NASA. 2015. *Technical Memorandum 2014 Groundwater Monitoring Summary.* National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California. January.

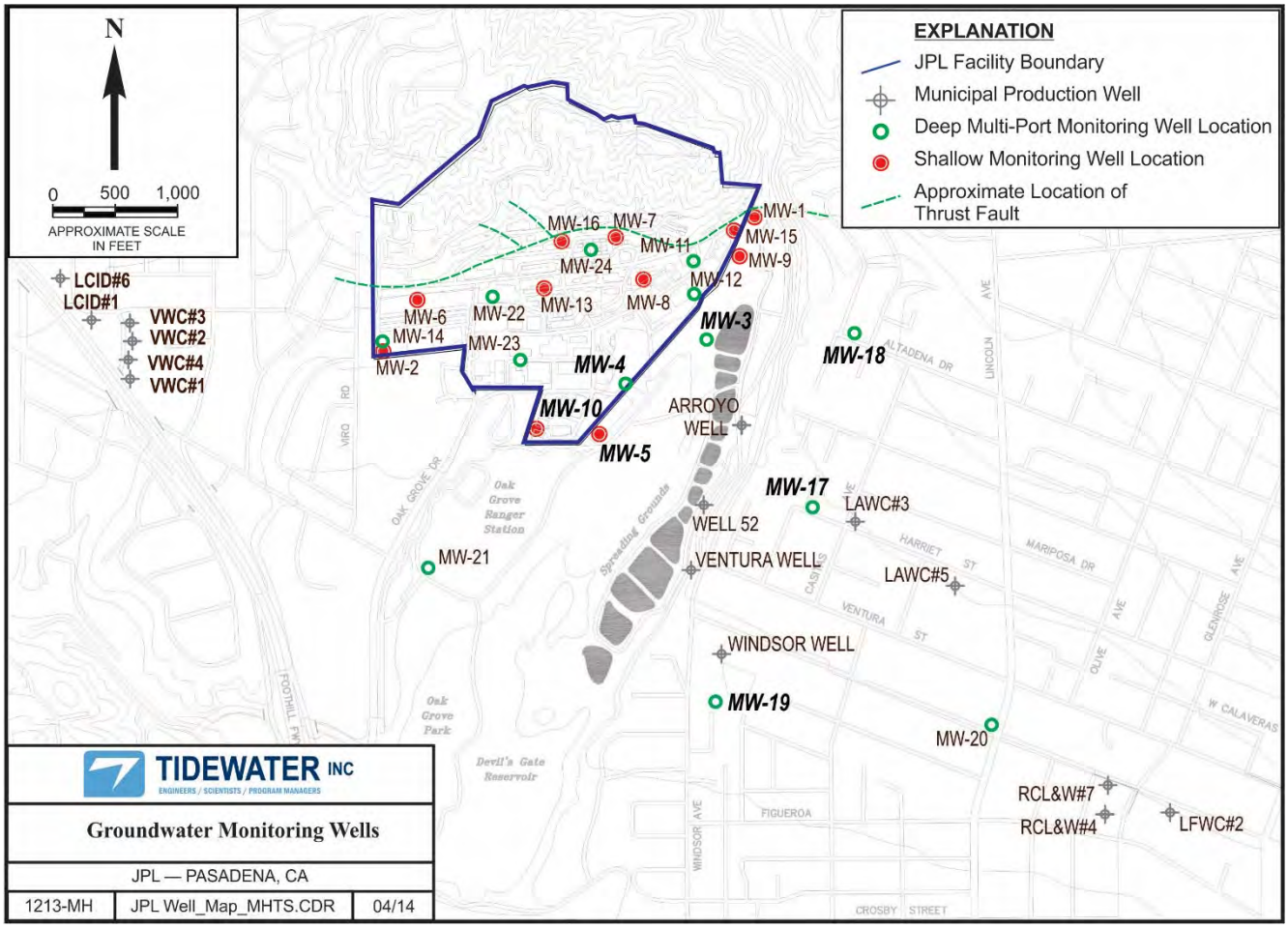


**Figure 6. Monitoring Well Locations**

**Table 3. Analytical Results Summary from Upgradient Surveillance Monitoring Wells**

| | | Perchlorate | | $CCl_4$ | | TCE | |
|---|---|---|---|---|---|---|---|
| | | 2010 | 2014 | 2010 | 2014 | 2010 | 2014 |
| | | MCL= 6.0 | | MCL= 0.50 | | MCL= 0.50 | |
| | | µg/L | | µg/L | | µg/L | |
| MW-3 (Screen 2) | Max | **184.0** | **32** | <0.5 | <0.5 | <0.5 | <0.5 |
| | Avg. | **175.2** | **23** | <0.5 | <0.5 | <0.5 | <0.5 |
| MW-4 (Screen 2) | Max | 3.8 | **100** | <0.5 | <0.5 | **0.9** | **2.0** |
| | Avg. | 3.1 | **52.5** | <0.5 | <0.5 | **0.7** | **1.2** |
| MW-5 | Max | <1.0 | **10** | <0.5 | <0.5 | <0.5 | **4.7** |
| | Avg. | <1.0 | **7.6** | <0.5 | <0.5 | <0.5 | **3.7** |
| MW-10 | Max | **75.9** | 4.2 | <0.5 | <0.5 | **5.1** | **8.1** |
| | Avg. | **43.8** | 4.1 | <0.5 | <0.5 | **3.7** | **7.3** |
| MW-17 (Screen 3) | Max | **10.7** | **7.6** | **0.5** | <0.5 | <0.5 | **0.6** |
| | Avg. | **9.9** | **6.9** | **0.5** | <0.5 | <0.5 | **0.5** |
| MW-18 (Screen 4) | Max | **67.2** | **16.0** | **10.0** | **4.2** | **1.2** | **2.2** |
| | Avg. | **54.1** | **15.5** | **7.2** | **2.2** | **1.1** | **1.2** |
| MW-19 (Screen 2) | Max | **6.8** | **6.3** | <0.5 | <0.5 | **1.9** | **0.8** |
| | Avg. | **6.0** | 5.85 | <0.5 | <0.5 | **1.4** | **0.7** |

Bold indicates concentration greater than MCL.

## ROUTINE MONITORING AND DISCHARGES

Table 4 summarizes the routine monitoring schedule for the MHTS and the associated production wells. PWP provides monthly reports to SWRCB DDW summarizing analytical and performance data from the system.

Figure 7 shows perchlorate analytical results associated with the IX system. The system was online for all of 2014 and treated approximately 310 acre-ft of water per month. The system operated effectively, removing perchlorate to below detectable levels at the effluent sample location. Perchlorate breakthrough in the lead IX vessels occurred four times during this reporting period, triggering IX resin change-out events. A total of 3,714 acre-ft of water was treated and distributed to customers during this reporting period.

The LGAC system operated effectively, removing VOCs to below detectable levels at the effluent sample location. Concentrations of $CCl_4$ and TCE at the MHTS prior to LGAC treatment averaged 0.82 and 1.6 µg/L, respectively, in 2014. VOC breakthrough in the lead LGAC vessels occurred 10 times during this reporting period, triggering carbon change-out events. LGAC and IX change-out frequencies have averaged 309 and 362 days, respectively, since system startup. LGAC and IX change-out frequencies will continue to be monitored closely to identify any operational issues.

**Table 4. Sampling Locations and Monitoring Schedule**

| Analyte | Method | Windsor Well* | Arroyo Well* | Well 52* | Ventura Well* | IX Influent | IX Effluent | LGAC-Effluent | Windsor Reservoir |
|---|---|---|---|---|---|---|---|---|---|
| $CCl_4$ | EPA 524.2 | W | W | W | W | - | W | W | W |
| TCE | EPA 524.2 | W | W | W | W | - | W | W | W |
| PCE | EPA 524.2 | W | W | W | W | - | W | W | W |
| Perchlorate | EPA 314.0 | W | W | W | W | W | W | W | W |
| Nitrate | EPA 300.0 | W | W | W | W | W | W | W | W |
| Total Coliform | EPA 1604 | M | W | W | W | W | W | W | W |
| Heterotrophic Plate Count | 9215B | W | W | W | W | W | W | W | W |

* Sampled when in operation only
M = Monthly; W = Weekly; EPA = Environmental Protection Agency

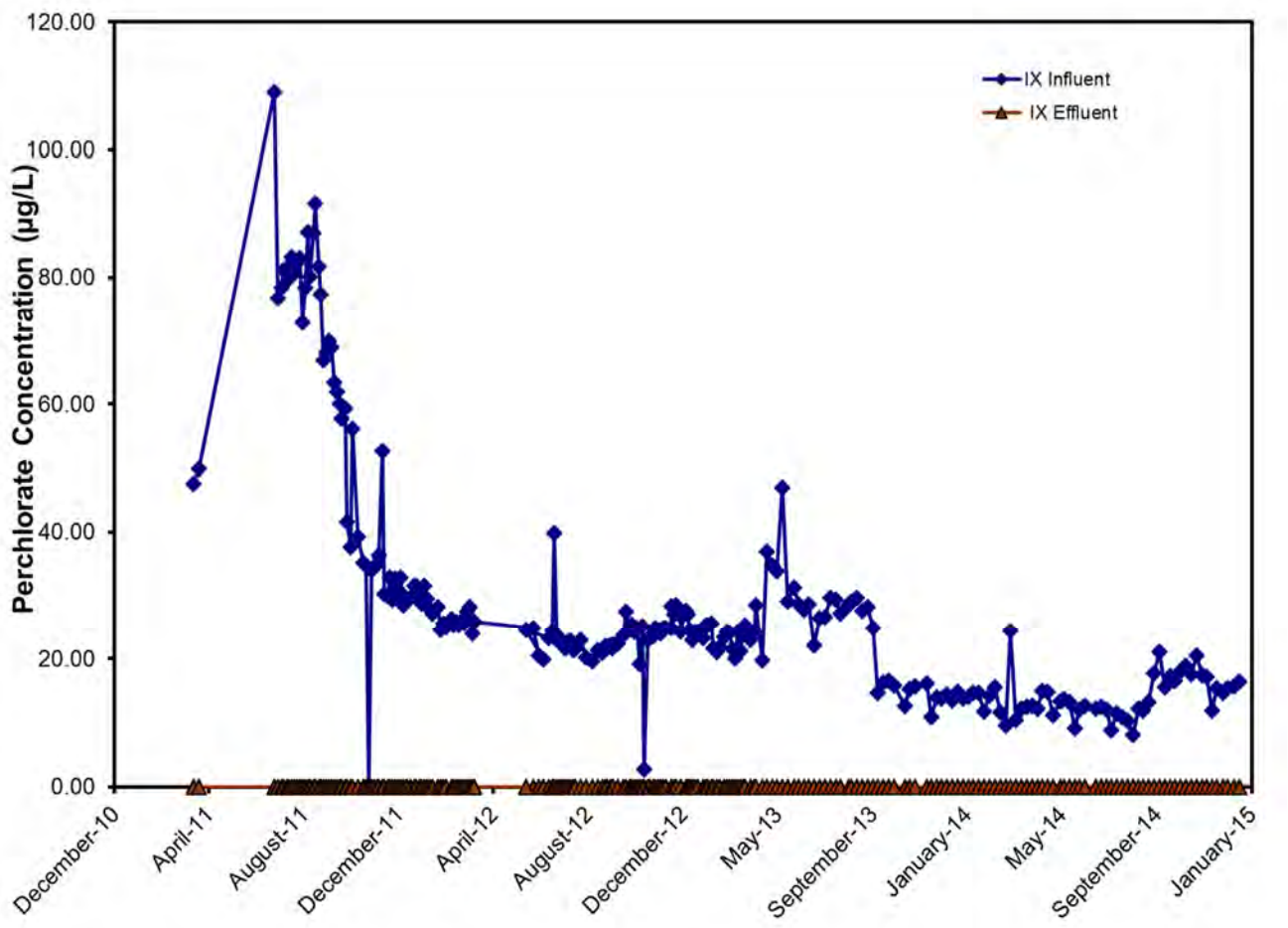


**Figure 7. Ion Exchange System Performance**

The combined effluent sampling locations have not contained detectable $CCl_4$, TCE, PCE, or perchlorate concentrations at any time since startup in July 2011. This demonstrates that the plant is operating effectively. Also, samples are collected at influent and effluent locations of the plant on a weekly basis to analyze for nitrate concentrations. During this reporting period, effluent concentrations of nitrate ($NO_3$) ranged from 18 to 37 mg/L. Lastly, total coliform and heterotrophic plate count sampling is conducted weekly to evaluate biological activity in the system. Results indicated that biological activity was effectively controlled.

LGAC and IX change-outs require utility water to backwash each vessel prior to being utilized for treatment. These discharges have followed the substantive requirements of General National Pollutant Discharge Elimination System (NPDES) Permit No. CAG914001 in accordance with CERCLA Section 121(e) (1) and the approved Discharge Protocol (NASA, 2010).[6] On March 7, 2013 the NPDES Permit No. CAG914001 was amended and as a result new discharge parameters were established and followed. All water discharged was stored in City of Pasadena spreading basins and allowed to percolate back into the aquifer from which it originated and was not allowed to flow into receiving waterways.

[6] NASA. 2010. *Discharge Protocol Monk Hill Treatment System Protocol for Discharge to Arroyo Seco.* National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California. April.

A total of approximately 55.38 acre-ft was discharged to Spreading Basin #5 during the course of this reporting period. Discharge samples were collected during each of the 5 of 6 discharge events that occurred in 2014. Nitrogen ($NO_3$ as N) was detected in the October 24, 2013 discharge sampling event at a concentration of 11.0 mg/L, which exceeds the effluent limitation of 8.0 mg/L. All other nitrogen results were < 8 mg/L. NDMA was detected in 2 discharge samples, March 3, 2014 and April 17, 2014 at 0.074 and 0.0046 µg/L. Both samples were below 0.5 µg/L but exceeded the maximum daily limit of 0.00069 µg/L. Nitrogen and NDMA will continue to be closely monitored as part of the annual discharge sampling events; if elevated nitrogen and NDMA concentrations are detected consistently during future sampling events, it will be investigated in more detail. Data tabulation for all 2014 discharge sample results is included as Attachment B.

The future surface discharges will remain consistent with the regulations and operations outlined within the Discharge Protocol.[6] The discharge operations will continue to be reviewed and optimized during the next annual reporting period.

**FIVE-YEAR REVIEW**

In February 2012, NASA completed its first Five-Year Review of the JPL CERCLA program.[7] The review concluded that the interim remedy at MHTS was protective of human health and the environment in the short term. Potential exposure pathways that could result in unacceptable risk (i.e., ingestion and contact with chemicals in groundwater) are being controlled through groundwater extraction and treatment by the MHTS. Treated water from the MHTS is in compliance with all water quality requirements specified by Federal and state regulations, with concentrations below Federal and California maximum contaminant levels (MCLs).

One recommendation was made in the Five-Year Review Report related to the MHTS. The recommendation was to minimize nitrosamine leaching from virgin resin at the MHTS by minimizing the use of chlorinated water to flush the resin; pre-rinse newly installed resin prior to placing the vessel into service; perform subsequent monitoring for nitrosamines; develop best practices with the vendor for on-site maintenance activities to minimize the formation of nitrosamines; and require that the vendor pre-rinse resin at an off-site location prior to placing it in the MHTS vessels. The nitrosamines have been minimized as follows:

- PWP currently flushes and rinses virgin resin using treated system water that is non-chlorinated. The vessel containing virgin resin is rotated to the lag position and the pair in lead-lag configuration is forward rinsed and operated in normal treatment mode.
- All resin deliveries are pre-rinsed prior to installation at MHTS.
- CCC recently installed a rinsing station for all resin deliveries. All resin will be rinsed (20-25 bed volumes) by CCC prior to delivery at MHTS. Resin was previously being rinsed in trailers by CCC prior to delivery.
- Samples for nitrosamines in drinking water are in compliance with levels set by the State of California.

[7] NASA. 2012. *Final First Five-Year Review Report,* National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California. February.

## SYSTEM OPTIMIZATION

NASA submitted a revised draft Optimization Work Plan[8] in April 2014. This plan proposed two potential voluntary optimization projects for MHTS: 1) a new production well located north of the Arroyo Well and within the Arroyo Seco for enhanced chemical removal, and 2) incorporation of PWP's existing Behner Plant into the MHTS for enhanced wastewater management. Both projects are in the conceptual design phase. In 2015, NASA will continue to work with PWP and the regulators on these potential optimization projects.

## COST SUMMARY

Table 5 summarizes the operational costs incurred between December 2013 and November 2014. These costs equate to $743.00 per acre-ft of treated water.

**Table 5. Operational Costs: December 2013 through November 2014**

| Description | Subtotal |
|---|---|
| Engineering Labor | $ 163,167.03 |
| Field Labor | $ 165,277.54 |
| Laboratory Fees | $ 4,828.00 |
| Carbon Treatment Costs | $1,188,949.39 |
| IX Treatment Costs | $768,868.04 |
| Pre-Filters | $18,929.04 |
| Disposal | $ - |
| Misc. Equipment | $ 25,784.80 |
| Misc. Services | $ - |
| Excess Energy Costs (Ventura Booster) | $138,913.66 |
| DPH Billing | $ - |
| Treated Water ($80/Acre-Ft) | $284,226.79 |
| **GRAND TOTAL** | **$2,758,944.29** |

[8] NASA, 2014. Draft Final Optimization Work Plan, National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California. April.

# Attachment A
# CDPH Drinking Water Permit

California Department of Public Health
Drinking Water Field Operations Branch

# PERMIT AMENDMENT 1910124PA-003

## CITY OF PASADENA WATER & POWER

Los Angeles County

System No. 1910124

March 17, 2011

STATE OF CALIFORNIA

# AMENDMENT TO THE

# DOMESTIC WATER SUPPLY PERMIT ISSUED TO

**City of Pasadena Water and Power**
**Public Water System Number – 1910124**

ORIGINAL PERMIT: ***04-15-99P-010*** DATE OF ISSUE: ***11/9/1999***

PERMIT AMENDMENT: ***1910124PA-001*** EFFECTIVE DATE: ***8/12/2002***

PERMIT AMENDMENT: ***1910124PA-002*** EFFECTIVE DATE: ***1/15/2003***

PERMIT AMENDMENT: ***1910124PA-003*** EFFECTIVE DATE: ***3/17/2011***

**WHEREAS:**

I. The ***City of Pasadena Water and Power (hereinafter, PWP)*** submitted an application to the California Department of Public Health on ***February 9, 2010*** for an amendment to the Domestic Water Supply Permit issued to the ***PWP*** on ***November 9, 1999***.

II. The purpose of the amendment, as stated in the application, is to allow the ***PWP*** to make the following modification to the public water system:

***Include treatment of contaminated groundwater from Arroyo Well, Well 52, Ventura Well, and Windsor Well at the Monk Hill Treatment System (MHTS); and distribution of the treated water for potable use.***

III. The ***PWP*** has submitted all of the supporting information required to evaluate the application.

IV. The California Department of Public Health has evaluated the application and the supporting material and has determined that the proposed modifications comply with all applicable State drinking water requirements.

## THEREFORE:

I. The California Department of Public Health hereby approves the application submitted by the ***PWP*** for a permit amendment. The Domestic Water Supply Permit issued to the ***PWP*** on ***November 9, 1999*** is hereby amended as follows:

***The PWP may treat Arroyo Well, Well 52, Ventura Well, and Windsor Well at the Monk Hill Treatment System, which consists of ion exchange treatment for perchlorate removal and liquid phase granular activated carbon treatment for volatile organic chemicals removal. The treated water will receive disinfection and nitrate blending at the Windsor Reservoir prior to distribution to the customers.***

II. This permit amendment is subject to the following conditions:

## GENERAL

1. This document amends and adds to the domestic water supply permit issued to Pasadena Water and Power (PWP) for the City of Pasadena's public water system on November 9, 1999 by the Department, and the subsequent amendments on August 12, 2002, and January 15, 2003. If any condition of this amendment conflicts with the permit and its subsequent amendments, the conditions of this amendment shall be followed.

2. PWP shall comply with all the requirements set forth in the California Safe Drinking Water Act, California Health and Safety Code and any regulations, standards or orders adopted thereunder. All water supplied by PWP for domestic purposes shall meet all Maximum Contaminant Levels (MCLs) established by the State Department of Public Health.

3. If the water quality does not comply with the California Drinking Water Standards, treatment shall be provided to meet standards. The plans and specifications for the proposed treatment facilities shall be submitted to the Department for review and approval prior to construction.

4. The only sources approved for potable water supply are those listed in Tables 1 and 2.

## Table 1. Groundwater Sources

| Source | Primary Station Code | Status | Treatment |
|---|---|---|---|
| Arroyo | 1910124-001 | Active | Ion exchange for perchlorate removal and activated carbon adsorption for organics removal and chloramination at MHTS |
| Bangham Well | 1910124-028 | Active | Blending VOCs, perchlorate, and nitrate at Sunset Reservoir |
| Chapman Well | 1910124-005 | Active | Chlorination |
| Copelin Well | 1910124-006 | Active | Blending VOCs, perchlorate, and nitrate at Sunset Reservoir |
| Craig Well | 1910124-007 | Active | Chlorination |
| Eaton Canyon Well | 1910124-009 | Other | Pending return to Standby Status. See Provision No. 7 of 1999 permit. |
| Garfield Well | 1910124-010 | Active | Blending VOCs, perchlorate, and nitrate at Sunset Reservoir |
| Monte Vista Well | 1910124-014 | Active | Chlorination |
| Sunset Well | 1910124-018 | Active | Blending VOCs, perchlorate, and nitrate at Sunset Reservoir |
| Ventura Well | 1910124-019 | Active | Ion exchange for perchlorate removal and activated carbon adsorption for organics removal and chloramination at MHTS |
| Villa Well | 1910124-020 | Active | Blending VOCs, perchlorate, and nitrate at Sunset Reservoir |
| Well No. 52 | 1910124-021 | Active | Ion exchange for perchlorate removal and activated carbon adsorption for organics removal and chloramination at MHTS |
| Windsor Well | 1910124-022 | Active | Ion exchange for perchlorate removal and activated carbon adsorption for organics removal and chloramination at MHTS |
| Woodbury Well | 1910124-023 | Active | Chlorination |
| Well 58 | 1910124-045 | Active | Chlorination |
| Well 59 | 1910124-047 | Active | Chlorination |
| Metropolitan Water District (MWD)-P1 Connection | 1910124-033 | Active | N/A |
| MWD-P2 Connection | 1910124-034 | Active | N/A |
| MWD-P3 Connection | 1910124-035 | Active | N/A |
| MWD-P4 Connection | 1910124-036 | Active | N/A |
| MWD-P5 Connection | 1910124-037 | Active | N/A |

The following are the only approved interconnections for receiving water from other water systems:

**Table 2. Interconnections with Other Systems**

| Water System | Location | Nominal Capacity (gpm) |
|---|---|---|
| Lincoln Avenue Water Company | Canyon Crest Road | 500 |
| Kinneloa Irrigation District | Kinneloa Canyon Road | 1200 |
| California American Water Company | Lamanda Park Reservoir | 2500 |
| Valley Water Company | St. Katherine Place | 1500 |
| Valley Water Company | Normandy Drive | 1200 |
| Foothill Municipal Water District | CalTrans Yard | 4000 |
| City of Sierra Madre | Michillinda Avenue | 300 |

5. The only approved treatment facilities are those listed in Table 3. The treatment facility and distribution system shall be operated by personnel who have been certified in accordance with Chapter 13, Title 22, California Code of Regulations (CCR) - Operator Certification. The minimum certification requirements for the chief and shift operator(s) for each PWP treatment facility are listed in Table 3. For MHTS, PWP will meet T4 chief operator certification requirement within two years of receiving this permit amendment.

**Table 3. Approved Treatment Facilities and Minimum Operator Certification Requirements**

| Treatment Facility | PS Code | Treatment Facility Classification | Min. Treatment Grade Required | |
|---|---|---|---|---|
| | | | Chief Operator | Shift Operator |
| Sunset Reservoir - Nitrate, perchlorate and VOCs blending for Bangham, Copelin, Garfield, Sunset, and Villa Wells | 1910124-030 (Sunset Reservoir 1 effluent) 1910124-031 (Sunset Reservoir 2 effluent) | T3 | T3 | T2 |
| Chapman Well – Chlorination | 1910124-038 | T1 | T1 | T1 |
| Craig Well - Chlorination | 1910124-039 | T1 | T1 | T1 |
| Monte Vista Well - Chlorination | 1910124-042 | T1 | T1 | T1 |
| Woodbury Well - Chlorination | 1910124-044 | T1 | T1 | T1 |
| Well 58 - Chlorination | 1910124-046 | T1 | T1 | T1 |

| Treatment Facility | PS Code | Treatment Facility Classification | Min. Treatment Grade Required | |
|---|---|---|---|---|
| | | | Chief Operator | Shift Operator |
| Well 59 - Chlorination | 1910124-048 | T1 | T1 | T1 |
| Monk Hill Treatment Facility (MHTS) – Arroyo, Ventura, Windsor Wells and Well 52<br>• Ion exchange (IX) for perchlorate removal<br>• Liquid phase granular activated carbon adsorption (LGAC) for organics removal<br>• Chloramination<br>• Nitrate blending at Windsor Reservoir | 1910124-051 (IX combined effluent)<br>1910124-050 (LGAC combined effluent)<br>1910124-025 (Windsor Reservoir Compliance Point for nitrate, perchlorate and VOCs) | T4 | T4 | T3 |

6. No changes, additions, or modifications shall be made to the sources or treatment mentioned in Conditions 4 and 5 unless an amended water supply permit has first been obtained from the Department.

7. PWP shall comply with Title 17, CCR, to prevent the water system and treatment facilities from being contaminated by possible cross-connections. PWP shall maintain a program for the protection of the domestic water system against backflow from premises having dual or unsafe water systems in accordance with Title 17. All backflow prevention devices shall be tested annually.

8. PWP shall monitor all active groundwater sources in accordance with the current Vulnerability Assessment and Monitoring Guidelines issued by the Department or as specified in this permit amendment.

9. Pursuant to Sections 64590 and 64591, Title 22 of the California Code of Regulations, no chemical or product shall be added to drinking water as a part of the treatment process unless it has been certified as meeting the specifications of American National Standard Institute/National Sanitation Foundation (ANSI/NSF) Standard 60, and no indirect additive shall be used unless it has been certified as meeting the specifications of ANSI/NSF Standard 61. PWP may use an uncertified chemical, material, or product if the requirements specified in Section 64593 are met.

## MONK HILL TREATMENT SYSTEM (MHTS)

10. Water leaving the MHTS shall not exceed any MCLs or Notification Levels (NLs) established by the Department. In addition, the MHTS should be operated to achieve a treatment goal of non-detect for perchlorate and VOCs.

11. Arroyo Well, Well 52, Ventura Well and the Windsor Well shall be the only sources for the MHTS. The entire flow from the wells shall be treated by all unit processes (ion exchange and granular activated carbon adsorption) of the MHTS prior to distribution as a domestic water supply. No treatment process shall be bypassed at any time.

12. The overall plant flow rate shall not exceed 7,000 gpm without written permission from the Department.

13. Except as specified in this permit amendment, the MHTS shall be operated in accordance with an Operations. Monitoring, and Maintenance Plan (OMMP) approved by this Department. All additions, deletions, or amendments to the OMMP shall be approved by the Department prior to implementation. PWP is responsible for ensuring that the OMMP is, at all times, representative of the operations, maintenance, and monitoring of the facility and appropriate changes to the OMMP are submitted to the Department for approval in a timely manner.

14. The MHTS shall be removed from service if concentrations of chemicals of concern in the plant influent significantly exceed the design concentration. PWP shall conduct an evaluation and make necessary operational adjustment, and/or plant modification, and obtain an approval from the Department before placing the treatment facility back into service. Permit amendment might be required depending on the extent of the required modification.

### ION EXCHANGE SYSTEM

15. PWP shall operate and maintain the inlet filters of the ion exchange system in a manner to minimize the build-up of solids within the media beds.

16. Each pair of ion exchange vessels shall be operated at not less than 350 gpm (1 gpm/$ft^3$ of media) and not more than 2,000 gpm, with a planned design capacity of 1,750 gpm when the plant is operating at 7,000 gpm. The vessels shall be operated in a down-flow mode, with two vessels operated in series (lead-lag).

17. At least 353 $ft^3$ of virgin CalRes 2109 resin that meets the specifications identified in the approved OMMP shall be used in each ion exchange vessel. Any change in resin employed shall be approved in writing by the Department. Only resin certified as meeting NSF Standard 61 may be used.

18. After virgin resin is installed, PWP shall flush the resin and conduct nitrosamine monitoring, using EPA method 521, to characterize the duration and extent of nitrosamine formation. Based on the monitoring results, PWP may modify the resin installation and flushing procedures to minimize the risk of producing water with nitrosamines and revise the OMMP accordingly.

19. Compliance with the perchlorate MCL shall be based on the results of the weekly samples collected at Windsor Reservoir (PS Code: 1910124-025). PWP shall be deemed in violation of the perchlorate MCL if a weekly sample, consisting of one result or the average of an initial result and a confirmation result, exceeds 6 µg/L. Department notification and Tier 1 public notification are required within 24 hours of a confirmed perchlorate MCL exceedance.

20. PWP shall ensure that the laboratory notifies PWP operators and management within 48 hours whenever the level of perchlorate in a single sample exceeds the MCL, and shall ensure that a contact person is available to receive such analytical results 24 hours a day. PWP shall also require the laboratory to immediately notify the Department of any perchlorate MCL exceedance if the laboratory cannot make direct contact with the designated contact person within 48 hours.

**LIQUID-PHASE GRANULAR ACTIVATED CARBON (LGAC) TREATMENT**

21. When delivering treated water to Windsor Reservoir and the distribution system, each train of LGAC vessels shall not be operated above its maximum design capacity of 1,400 gpm. In addition, they shall not be operated below 200 gpm. The empty bed contact time for each LGAC vessel shall be at least 7.1 minutes at all times. The vessels should be operated in a down-flow mode, with two vessels operated in series in each train.

22. The granular activated carbon utilized in the LGAC vessels shall be 40,000 pounds of virgin Filtrasorb 300 per vessel. Both the initial and replacement carbons shall meet the manufacturer's specifications. Any change of carbon specifications shall be approved in writing by the Department.

23. The replacement carbon shall be virgin or reactivated carbon that is NSF Standard 61 certified for use as drinking water system component.

24. PWP shall minimize system downtime by scheduling carbon changeouts in a timely manner. After changeout, PWP shall monitor for total coliform and HPCs.

25. The LGAC adsorption system shall be maintained according to the manufacturer's recommendations.

## NITRATE BLENDING

26. If any of the Monk Hill Wells exceeds 40 mg/L nitrate, PWP shall implement nitrate blending treatment in accordance with the approved OMMP.

27. PWP's blending plan shall include performing a daily blending projection, using the most recent wellhead water quality analysis results to determine the proper flowrate that shall be produced from each well, then control the pumping from each well so that the blended effluent is reliably below 80% of the nitrate MCL.

28. Compliance with the nitrate MCL shall be based on the results of the weekly samples collected at Windsor Reservoir (PS Code: 1910124-025). PWP shall be deemed in violation of the nitrate MCL if a sample, consisting of one result or the average of an initial result and a confirmation result, exceeds 45 mg/L. Department notification and Tier 1 public notification are required within 24 hours of a confirmed nitrate MCL exceedance.

29. PWP shall ensure that the laboratory notifies PWP operators and management within 24 hours whenever the level of nitrate in a single sample exceeds the MCL, and shall ensure that a contact person is available to receive such analytical results 24 hours a day. PWP shall also require the laboratory to immediately notify the Department of any nitrate MCL exceedance if the laboratory cannot make direct contact with the designated contact person within 24 hours.

## MONITORING

### General

30. All water samples for compliance purposes shall be analyzed by a laboratory certified by the Department's Environmental Laboratory Accreditation Program (ELAP) for each analytical technique. If no certification is available for a particular compound, the method and detection limit shall be submitted for approval by the Department on a case-by-case basis.

31. Except for bacteriological analyses and constituents without chemical storet numbers, all water quality monitoring results obtained from a certified laboratory shall be submitted to the Department by Electronic Data Transfer (EDT) using the PS Codes listed in Table 4.

**Table 4. MHTS Sampling Points**

| Location | Description | PS Code |
|---|---|---|
| Arroyo Well | Arroyo Well Discharge | 1910124-001 |
| Well 52 | Well 52 Discharge | 1910124-021 |
| Ventura Well | Ventura Well Discharge | 1910124-019 |
| Windsor Well | Windsor Well Discharge | 1910124-022 |
| IX Combined Effluent | Combined Ion Exchange Plant Effluent | 1910124-051 |
| LGAC Combined Effluent | Combined Plant Effluent after LGAC and before Disinfection | 1910124-050 |
| Windsor Reservoir | Compliance Point for Nitrate, Perchlorate, and VOCs | 1910124-025 |

32. Monitoring requirements for the Monk Hill production wells, MHTS, and Windsor Reservoir are provided in Table 5 and also described in Provisions 40 through 56.

## Table 5. Monitoring Requirements

| Monitoring Location | P.S. Code | Constituent | Frequency |
|---|---|---|---|
| **Monk Hill Production Wells** | | | |
| Arroyo Well<br>Well 52<br>Ventura Well<br>Windsor Well | 1910124-001<br>1910124-021<br>1910124-019<br>1910124-022 | VOCs, nitrate, perchlorate, total coliform, HPC | Monthly |
| | | Chlorate, 1,4-dioxane, and low level 1,2,3-TCP | Quarterly |
| | | Atrazine, simazine | Initially within 120 days of well activation and triennial thereafter |
| | | Inorganic per Table 64431-A; general mineral per Section 64449 (b)(2); and secondary standard chemicals per Tables 64449A&B | Per recent vulnerability assessment and monitoring frequency guidelines |
| | | Radionuclides including gross alpha, uranium, radium 226 and 228 | Four consecutive quarterly samples; subsequent monitoring requirements TBD |
| **Ion Exchange (IX)** | | | |
| Combined influent to IX vessels (after influent cartridge filters) | N/A | Perchlorate | Weekly |
| | | Nitrate | Weekly when nitrate blending plan is implemented |
| Each lead vessel effluent | N/A | Perchlorate | Weekly |
| IX combined effluent | 1910124-051 | Perchlorate | Twice weekly or weekly if combined influent perchlorate is consistently below 18 ug/L |
| | | Total coliform, HPC | Weekly and following any changeout or prolonged shutdown |
| Each lag vessel effluent | N/A | Perchlorate | Sample if detected at combined effluent (1910124-051) |
| Each lead and lag vessel effluent | N/A | Total coliform, HPC | Sample if combined effluent (1910124-051) is detected with total coliform |

| Monitoring Location | P.S. Code | Constituent | Frequency |
|---|---|---|---|
| **Liquid Phase Granular Activated Carbon (LGAC)** | | | |
| Combined influent to LGAC vessels | 19101240-051 | VOCs | Weekly |
| LGAC combined effluent (prior to chloramination) | 1910124-050 | VOCs | Weekly |
| | | Total coliform, HPC | Weekly and following any changeout or prolonged shutdown |
| | | Nitrate | Weekly when nitrate blending plan is implemented |
| Each lag vessel effluent | N/A | VOCs | Sample if detected at combined effluent (1910124-050) |
| Each lead vessel 25% port | | | Monthly until detected |
| Associated lead vessel 50% port with VOC detection in its 25% port | | | Monitor 50% port immediately following detection at 25% Port; Continue weekly until detected |
| Associated lead vessel 75% port with VOC detection in its 50% port | | | Monitor 75% port immediately following detection at 50% port; Continue weekly until detected |
| Associated lead vessel effluent with VOC detection in its 75% port | | | Monitor lead vessel effluent immediately following detection at 75% port; Continue weekly until detected |
| Each lead and lag vessel effluent | N/A | Total coliform, HPC | Sample if combined effluent (1910124-050) is detected with total coliform |

| Monitoring Location | P.S. Code | Constituent | Frequency |
|---|---|---|---|
| **Compliance Monitoring Location for Monk Hill Treatment System** | | | |
| Windsor Reservoir | 1910124-025 | VOCs, nitrate, perchlorate, total coliform, HPC | Weekly |
| | | Chlorate | Monthly |

33. The laboratory performing the analyses shall be instructed to report all calibrated peaks on gas chromatographic/mass spectroscopic (GC/MS) analyses. Uncalibrated peaks on chromatographic analyses shall be reported according to CDPH guidance documents Analysis and Reporting of Volatile Non-Target Organic Compounds in Extremely Impaired Water Sources and Recycled Water by Methods 524.2, and Analysis and Reporting of Non-Target Semi-Volatile Organic Compounds in Extremely Impaired Water Sources and Recycled Water Using Methods 3510C/8270 C.

    http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Drinkingwaterlabs/nt-vocs.pdf and

    http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Drinkingwaterlabs/nt-svocs.pdf

    If the TIC or unknown compound is repeatedly detected and not a one-time event, the Department may require and allow time for additional work to positively identify the compound(s) and/or additional testing of the MHTS plant effluent to verify removal of the compound(s).

    Records of the mass spectra, sample date and sample location for all TICs and unknown chemical species described above shall be maintained by PWP.

34. PWP shall comply with any additional monitoring and treatment requirements the Department deems necessary based on any newly identified constituents. If necessary, the Department may modify the monitoring provisions specified herein based on additional information. PWP may request a modification of any monitoring provision based upon substantiating data at any time.

35. Where specified, low level analysis for 1,2,3-trichloropropane (1,2,3-TCP) shall be performed by an ELAP certified laboratory with the lowest achievable reporting limit.

36. When analysis for metals is required, PWP shall follow The Protocol for Characterizing Severely Impaired Water Sources Through Elemental Analysis located on the Department's website:

http://www.cdph.ca.gov/certlic/drinkingwater/Documents/Drinkingwaterlabs/ProceduresforElementalAnalysis.pdf

All detected metals shall be reported.

37. Prior to proceeding with the requirements for further monitoring following a detection of a VOC, PWP may first confirm the analytical result, as follows: Within seven (7) days (24 hours for LGAC ports, LGAC effluent and Windsor Reservoir effluent) from the notification of an initial detection from a laboratory reporting the presence of one or more VOCs in a water sample, PWP may collect and analyze one or two additional samples to confirm the initial finding. Confirmation of the initial finding shall be shown by the presence of the VOC in either the first or second additional sample, and the detected level of the VOC for compliance purposes, if applicable, shall be the average of the initial and the confirmation sample(s). The initial finding shall be disregarded if two additional samples do not show the presence of the VOC.

38. PWP shall be responsible for, and require, the timely notification from the laboratory by telephone or fax of analytical results, particularly those which trigger additional sampling within time limits.

**Upgradient Surveillance Wells Monitoring**

39. Monitoring wells MW-5, MW-10, MW-3 (screen 2), MW-4 (screen 2), MW-17 (screen 3), MW-18 (screen 4), and MW-19 (screen 2), shall be monitored annually for explosives (TNT, HMX, and RDX), nitrosamines, fluoride, 1,4-dioxane, MTBE and related oxygenates (ETBE, TBA, and TAME), low level 1,2,3-TCP, total and hexavalent chromium, and triennially for semi-volatile organics (including PAHs, phthalates, PCBs, and phenol), total petroleum hydrocarbons, and 2,3,7,8-TCDD.

    Sampling should be coordinated with the long-term quarterly groundwater monitoring program implemented by NASA, which includes quarterly monitoring of perchlorate, VOC, and other contaminants of concern. Initial sampling shall be done within 120 days of issuance of this permit amendment.

**Monk Hill Production Wells Monitoring**

40. Each of the four Monk Hill production wells shall be sampled in accordance with the current Vulnerability Assessment table issued to PWP by the Department.

41. Each of the four Monk Hill production wells shall also be sampled in accordance with the raw water monitoring scheduled outlined in the approved OMMP, which includes monthly monitoring of VOCs, nitrate, perchlorate, coliform bacteria and heterotrophic plate count (HPC); and quarterly for chlorate, 1,4-dioxane, and low level 1,2,3-TCP.

The four Monk Hill production wells shall also be tested for atrazine and simazine within 120 days of activation of the wells and once every three years thereafter.

42. PWP shall begin initial radionuclide monitoring at each of the Monk Hill production wells within one quarter of initiating water service from the MHTS to the public.

43. PWP shall revise its raw water monitoring plan 1) if additional chemicals are detected in any upgradient surveillance well which might threaten the quality of the water produced by the Monk Hill production wells, 2) if new chemicals are detected in the production wells, or 3) if the monitoring data indicates a rapid change in a contaminant's concentration which warrants more frequent monitoring.

44. If any additional contaminant is consistently found in one or more of the surveillance wells, it should be tested for in the closest production wells. If the additional contaminant is detected in any of the production wells, it should be verified by sampling that it is removed by the treatment equipment.

**Ion Exchange Treatment Monitoring**

45. The perchlorate concentration of the IX combined effluent shall be operated to achieve a treatment goal of below California's Detection Limit for Reporting (DLR).

46. In order to verify the removal efficiency of the IX System, weekly perchlorate samples shall be collected at the combined influent to the IX vessels (the plant influent after the influent cartridge filters) and twice weekly at the IX combined effluent (PS Code: 1910124-051). If the influent concentration is reliably and consistently below 18µg/L, the IX combined effluent may be tested weekly.

47. Weekly perchlorate samples shall be collected at each lead vessel effluent, which is the cross-over point between the lead and lag vessels. The resin in the lead vessel will be changed out when the lead vessel effluent perchlorate concentration reaches the perchlorate MCL of 6 µg/L.

48. If perchlorate is detected above DLR at the IX combined effluent (PS Code: 1910124-051), sample each lag vessel effluent. Any vessel pair found to be discharging greater than DLR from the lag vessel shall be taken out of service and the lag vessel switched to the lead position, and fresh resin placed in the former lead vessel.

49. HPC and coliform samples shall be collected weekly and following any changeout or prolonged shutdown at the IX combined effluent to ensure no bacteriological contamination is occurring in the IX process. The IX combined effluent shall be free of total coliforms. If coliforms are detected, PWP shall inform the Department within 24 hours and begin weekly total coliform and HPC monitoring at the individual IX lead and lag vessels. The Department may require additional investigation. If monitoring results indicate a sudden or significant increase in coliform bacteria or HPC, the Department may require PWP to shut down the treatment facility and disinfect the resin and vessel.

**LGAC Treatment Monitoring**

50. Concentrations of all VOCs in the LGAC combined effluent (PS Code: 1910124-050) shall be operated to achieve a treatment goal of below their respective Detection Limits for Reporting (DLR).

51. In order to verify the removal efficiency of the LGAC System, weekly VOCs samples shall be collected at the combined influent to the LGAC vessels (PS Code: 1910124-051) and the LGAC combined effluent prior to chloramination (PS Code: 1910124-050).

52. If any VOCs are detected in the LGAC combined effluent above their respective DLRs, each lag vessel effluent must be tested and if breakthrough from one or more of the lag vessels has occurred, the LGAC in the associated lead vessel shall be replaced and that vessel then placed in the lag position.

53. In order to ensure that VOCs are not detected in the LGAC combined effluent, monthly samples should be collected at the 25 percent bed depth port of each lead vessel. Once any VOC is detected at a 25 percent port, the 50 percent sampling port should be immediately sampled and analyzed; sampling of the 50 percent port should continue weekly until any VOC is detected. Upon detection of the 50 percent port, the 75 percent port should immediately be tested; sampling of the 75 percent port should continue weekly until any VOC is detected. Upon VOC detection at the 75 percent port, the lead vessel effluent must be sampled immediately for VOCs and weekly thereafter. Detection of any VOC at the 75 percent sampling port shall trigger PWP to arrange for the replacement of the lead vessel bed, which will then become the lag bed.

    As PWP gains experience with the LGAC behavior and the actual levels of VOC, PWP may request a modification of the frequency of operational monitoring.

54. HPC and coliform samples shall be collected weekly and following any changeout or prolonged shutdown at the LGAC combined effluent to ensure no bacteriological contamination is occurring in the LGAC process. The LGAC combined effluent shall be free of total coliforms. If coliforms are detected, PWP shall inform the Department within 24 hours and begin weekly total coliform and HPC monitoring at the individual LGAC lead and lag vessels. The Department may require additional investigation. If monitoring results indicate a sudden or significant increase in coliform bacteria or HPC, the Department may require PWP to shut down the treatment facility and disinfect the media and vessel.

### Nitrate Blending Monitoring

55. Nitrate blend shall be operated to achieve a treatment goal of 36 mg/L and less than the nitrate MCL of 45 mg/L at the Windsor Reservoir effluent (PS Code: 1910124-25) at all times. Nitrate blending monitoring shall be implemented in accordance with the approved OMMP.

### Windsor Reservoir Compliance Monitoring

56. Windsor Reservoir (PS Code: 1910124-025) shall be the compliance monitoring location for MHTS. Weekly samples of nitrate, perchlorate, VOCs, total coliform, and HPC, and a monthly sample of chlorate shall be collected at Windsor Reservoir. These results shall be used to determine compliance with nitrate, perchlorate, and VOCs MCLs.

## OPERATION AND MAINTENANCE

57. The status of the Monk Hill production wells shall be recorded daily, and the treatment facilities shall be inspected daily, when in use, for any abnormal occurrences including, but not limited to, leaks, unusual noises, vibrations, pressure and flow readings. A checklist of items to be examined shall be filled out daily and maintained for a minimum of five years.

58. All instruments, including but not limited to chemical analyzers and flow meters, shall be calibrated at the frequencies and by the methods recommended by their respective manufacturers. Records for all instrument calibrations shall be maintained by PWP for at least five years and made available to the Department when requested.

59. Sampling ports for the Monk Hill production wells, LGAC vessels, ion exchange vessels, and Windsor Reservoir's inlets/outlets shall be maintained in good operating condition.

60. PWP shall update the OMMP to reflect the monitoring parameters, frequencies, and compliance locations as specified in this permit.

61. At the conclusion of the first year of operation, PWP shall prepare and submit to the Department an evaluation of the performance of the MHTS and any proposed revisions to the OMMP for review.

## RECORDS AND REPORTING

62. A monthly report of the MHTS shall be submitted to the Department by the 20th day of the following month. As a minimum, the report shall include:

    a) A summary of analytical results received by PWP in the reporting calendar month, including any results from the upgradient monitoring wells enumerated in this permit amendment.

    b) A summary of the bacteriological quality of water leaving the Monk Hill production wells, ion exchange combined effluent, LGAC combined effluent, and Windsor Reservoir.

63. PWP shall keep the following operational records for the MHTS:

    a) The daily operation and production of the Monk Hill production wells;

    b) Daily flowrate of the LGAC and ion exchange vessels;

    c) Daily disinfectant residual of the effluent leaving Windsor reservoir

64. The records shall also document any emergency and/or scheduled or unscheduled interruptions, including:

    a) Location of interruption,

    b) Cause of interruption,

    c) Date, approximate time, and duration of interruption,

    d) Precautions taken to minimize contamination of the supply and notification of the affected users, and

    e) Solution/resolution of the interruption and steps taken to prevent a reoccurrence.

65. Copies of reports, inspections and all records shall be kept for at least five years. Water quality records shall be kept for ten years.

66. Within 24 hours of receiving notification from the laboratory, PWP shall notify the Department of any exceedance of an MCL or NL in the finished water leaving the MHTS.

67. PWP shall prepare annual report to the Department, which shall include compliance with the permit provisions, the treatment plant's status, condition, and performance and any problems or difficulties and any proposed revisions to the OMMP for review. This report shall be due by March 30th of the following year.

    The annual report shall also provide an evaluation and technical review of the water quality data gathered from the upgradient surveillance monitoring wells listed in Condition 39, the Monk Hill production wells, the removal efficiency and reliability of the MHTS, and an evaluation of any changes in the characteristics of the contaminant concentrations and the possible impacts on the MHTS.

This amendment shall be appended to and shall be considered to be an integral part of the Domestic Water Supply Permit issued to the ***City of Pasadena Water and Power*** on ***November 9, 1999.***

FOR THE CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

March 17, 2011
***Date***

***Jeff O'Keefe, P.E., District Engineer***
***Metropolitan District***
***Los Angeles Region***

# Attachment B
# 2014 Discharge Sample Tabulation

| Parameters | Units | Effluent Limitations | | M001 | M001 | M001 | M001 | M001 | M001 |
|---|---|---|---|---|---|---|---|---|---|
| | | Average Monthly | Maximum Daily | 3/3/2014 | 4/17/2014 | 5/12/2014 | 5/21/2014 | 6/18/2014 | 11/20/2014 |
| Total Flow | Gal/day | -- | continuously | 2,090 | 4,060 | 1,351 | 2,400 | 3,973 | 3,550 |
| pH | S.U. | -- | 6.5 – 8.5 | 8.09 | 7.93 | 7.88 | 7.62 | 6.79 | |
| Temperature | F | -- | 80 | -- | -- | -- | -- | -- | 67.5 |
| Total Dissolved Solids | mg/L | -- | 1,550 | 340 | 440 | 310 | 550 | 470 | |
| Total Suspended Solids | mg/L | 50 | 75 | ND | 6.9 | 0.53 | ND | 6.7 | |
| Turbidity | NTU | 50 | 75 | 0.14 | 3.9 | ND | 0.13 | 2.6 | |
| BODs 20°C | mg/L | 20 | 30 | ND | ND | ND | ND | ND | |
| Oil and Grease | mg/L | 10 | 15 | ND | ND | ND | ND | 1.7J | |
| Settleable Solids | ml/L | 0.1 | 0.3 | ND | ND | ND | ND | ND | |
| Sulfides | mg/L | -- | 1 | ND | ND | ND | ND | ND | |
| Phenols | mg/L | -- | 1 | ND | ND | ND | ND | ND | |
| Residual Chlorine | mg/L | -- | 0.1 | ND | 0.1 | ND | ND | ND | |
| Sulfate | mg/L | -- | 350 | 60 | 83 | 77 | 71 | 95 | |
| Chloride | mg/L | -- | 150 | 56 | 54 | 58 | 53 | 59 | |
| $NO_3$ as Nitrogen plus $NO_2$ as Nitrogen | mg/L | -- | 8(1) | 6.5 | 4.4 | 7.3 | 6.6 | 11 | |
| Acetone | µg/L | -- | 700 | -- | -- | -- | -- | -- | |
| Acrolein | µg/L | -- | 100 | -- | -- | -- | -- | -- | |
| Acrylonitrile | µg/L | -- | 0.059 | -- | -- | -- | -- | -- | |
| Benzene | µg/L | -- | 1 | ND | ND | ND | ND | ND | |
| Bromoform | µg/L | -- | 4.3 | ND | ND | ND | ND | ND | |
| Cadmium | µg/L | 1.5 | 3.1 | ND | ND | ND | ND | ND | |
| Carbon tetrachloride | µg/L | -- | 0.25(2) | ND | ND | ND | ND | ND | |
| Chlorobenzene | µg/L | -- | 30 | ND | ND | ND | ND | ND | |
| Chlorodibromomethane | µg/L | -- | 0.401(2) | ND | ND | ND | ND | ND | |
| Chloroethane | µg/L | -- | 100 | ND | ND | ND | ND | ND | |
| Chloroform | µg/L | -- | 100 | ND | 0.31 | 0.26 | 0.32J | 0.39J | |
| Copper, Total Recoverable | µg/L | 8.5 | 17 | 0.48 | 0.64 | 5.1 | 1.4 | 0.55 | |
| Dichlorobromomethane | µg/L | -- | 0.56 | ND | ND | ND | ND | ND | |
| 1,1-Dichloroethane | µg/L | -- | 5 | ND | ND | ND | ND | ND | |
| 1,2-Dichloroethane | µg/L | -- | 0.38(2) | ND | ND | ND | ND | ND | |
| 1,1-Dichloroethylene | µg/L | -- | 0.057(2) | ND | ND | ND | ND | ND | |
| 1,2-Dichloropropane | µg/L | -- | 0.52 | ND | ND | ND | ND | ND | |
| 1,3-Dichloropropylene | µg/L | -- | 0.5 | ND | ND | ND | ND | ND | |
| Di-isopropyl ether (DIPE) | µg/L | -- | 0.8 | -- | -- | -- | -- | -- | |
| 1,4-Dioxane | µg/L | -- | 3 | ND | ND | ND | ND | ND | |
| Ethylbenzene | µg/L | -- | 700 | ND | ND | ND | ND | ND | |
| Ethylene dibromide | µg/L | -- | 0.05(2) | ND | ND | ND | ND | ND | |
| Lead, Total Recoverable | µg/L | 9 | 18 | ND | ND | 0.1 | ND | ND | |
| Chromium III, Total Recoverable | µg/L | 50 | 50 | ND | ND | ND | 6.6 | 10 | |
| Chromium VI, Total Recoverable | µg/L | 8 | 16 | 4.7 | 2.3 | ND | ND | 3.9 | |
| Chromium | µg/L | | | 2 | 1.4 | 1.9 | | | |
| Methyl bromide | µg/L | -- | 10 | ND | ND | ND | ND | ND | |
| Methyl chloride | µg/L | -- | 3 | ND | ND | ND | ND | ND | |
| Methylene chloride | µg/L | -- | 4.7 | ND | ND | ND | ND | ND | |
| Methyl ethyl ketone (MEK) | µg/L | -- | 700 | -- | -- | -- | | | |
| Methyl tertiary butyl ether (MTBE) | µg/L | -- | 5 | ND | ND | ND | ND | ND | |
| Naphthalene | µg/L | -- | 21 | ND | ND | ND | ND | ND | |
| N-Nitrosodimethylamine (NDMA) | µg/L | -- | 0.00069(2) | **0.074** | **0.0046** | ND | ND | ND | |
| Perchlorate | µg/L | -- | 6 | ND | ND | ND | ND | ND | |
| Tertiary butyl alcohol (TBA) | µg/L | -- | 12 | -- | -- | -- | | -- | |
| 1,1,2,2-Tetrachloroethane | µg/L | -- | 0.17(2) | ND | ND | ND | ND | ND | |
| Tetrachloroethylene (PCE) | µg/L | -- | 0.8 | ND | ND | ND | ND | ND | |
| Toluene | µg/L | -- | 150 | ND | ND | ND | ND | ND | |
| Total petroleum hydrocarbons(3) | µg/L | -- | 100 | ND | ND | ND | ND | ND | |
| 1,2-Trans-dichloroethylene | µg/L | -- | 10 | ND | ND | ND | ND | | |
| 1,1,1-Trichloroethane | µg/L | -- | 200 | ND | ND | ND | ND | ND | |
| 1,1,2-Trichloroethane | µg/L | -- | 0.6 | ND | ND | ND | ND | ND | |
| Trichloroethylene (TCE) | µg/L | -- | 2.7 | ND | ND | ND | ND | ND | |
| Vinyl chloride | µg/L | -- | 0.5 | ND | ND | ND | ND | ND | |
| Xylenes | µg/L | -- | 1750 | ND | ND | ND | ND | ND | |
| Zinc, Total Recoverable | µg/L | 79 | 160 | 3.1 | 4.1 | 5.3 | 6.2 | ND | |
| Acute Toxicity(4) | - | -- | 90% | -- | 100% | 100% | 100% | 100% | |
| E.coli density | MPN/100mL | 126 | 235 | <2 | 13 | 2 | | 80 | |

Notes:

(1) Nitrogen effluent limit is consistent with the concentration in the Monk Hill Subarea groundwater.

(2) If reported detection level is greater than effluent limit, then a non-detect result using 0.5 µg/L detection level is deemed to be in compliance.

(3) Toxicity of this chemical increases with decreasing hardness concentrations. The figure in the table is determined based on effluent $CaCO_3$ concentration of 100 mg/L.

(4) The acute toxicity of the effluent shall be such that the average survival in the undiluted effluent for any three (3) consecutive 96-hour static or continuous flow bioassay tests shall be at least 90%, with no single test less

Sample Result out of compliance.