EFFECTIVE TREATMENT AND MONITORING

NORTH HOLLYWOOD WEST WELL FIELD

(Step 4 of 97-005 Evaluation)

Prepared for

California State Water Resources Control Board, Division of Drinking Water

Prepared on Behalf of

Los Angeles Department of Water & Power

Water Quality Division, Groundwater Remediation Group

Prepared by

Owner's Agent Team led by Hazen and Sawyer (Hazen) with primary input from Worley and Arcadis

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EXECUTIVE SUMMARY

The Division of Drinking Water (DDW) 97-005 evaluation process consists of 11 steps for assessing proposals, establishing appropriate permit conditions, and approving the use of an extremely impaired drinking water source. This report documents Step 4 of the 97-005 evaluation process, i.e., “Effective Treatment and Monitoring” for the Los Angeles Department of Water and Power’s (LADWP’s) owned and operated North Hollywood West (NHW) Well Field.

As groundwater in the vicinity of the NHW Well Field is impaired by contamination, LADWP is required to demonstrate compliance with the California State Water Resources Control Board (SWRCB), DDW 97-005 Process Memo for Extremely Impaired Sources (DDW Process Memo 97-005) (DDW, 2015). DDW considers a source to be “extremely impaired” if it meets two or more of 10 DDW-developed criteria. Based on available water quality data, groundwater in the vicinity of the NHW Well Field meets up to four criteria.

LADWP, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), has selected the NHW Interim Remedial Action (IRA) to address hazardous substances dissolved in groundwater entering the NHW Well Field under active pumping conditions. LADWP’s selected IRA is a groundwater pump and treatment system intended to reduce the toxicity, mobility, and volume of contaminated groundwater through treatment and help restore the beneficial uses of groundwater in the vicinity of the NHW Well Field. The NHW IRA involves extracting and treating impacted groundwater from up to five wells (i.e., three Remediation Wells with a design that allows expansion to enable treatment of five Remediation Wells to avoid the need for new or amended permitting in the event that a future response action involves pumping two additional Remediation Wells and conveying water from those wells to the NHW treatment plant, following compliance with the NCP). The treated water will be used as a source of potable water supply. The associated planned treatment facility is referred to as the North Hollywood West Wellhead Treatment (NHWWT).

In accordance with the DDW 97-005 Process Memo (DDW, 2015), this report documents the following:

- Evaluation of treated water goals to ensure the cumulative risk posed by multiple contaminants in plant effluent, under normal NHWWT operation, is addressed. The MCL-equivalent assessment results, using the production and monitoring wells data sets, shows the overall MCL-equivalent for the NHWWT effluent under normal anticipated operations is below the DDW draft guidance threshold of ≤1.0 for both acute and chronic risk constituents of concern (COPCs). As such, the level of treatment to be provided by the NHWWT facility is considered to be acceptable and appropriate. Using the results of the MCL-equivalent assessment, the treated water goals comprise treatment of the following COPCs to their applicable DDW detection limits for reporting (DLRs): 1,4-dioxane, tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE) and cis-1,2-dichloroethene (cis-1,2-DCE).
- Treatability assessment describing the treatment necessary to achieve the treated water goals (*see previous bullet point*) established for the NHWWT facility.
- Performance standards outlining the level of treatment per technology used in the facility. The NHWWT facility includes pre-treatment for sediment control (sand separators and cartridge filters), ultraviolet oxidation process for 1,4-dioxane and volatile organic compounds (VOCs), and granular activated carbon (GAC) for excess peroxide quenching.

- Operations Plan that identifies operational procedures, failure response triggers, monitoring and optimization procedures, staffing requirements, and routine inspection procedures.
- Reliability features to account for potential future changes to the contaminant plume or treatment requirements. The facility offers Ultraviolet Advanced Oxidation Process (UV AOP) treatment flexibility features, such as an additional train, in case of higher contaminant levels.
- Compliance Monitoring and Reporting Program that describes manual, online sampling and analysis plan. The Monitoring and Reporting program implements a comprehensive manual and online sampling guide that analyses treatment performance by sampling before and after UV AOP treatment.
- Notification Plan delineating emergency contacts for various emergency conditions.
- Water Quality Surveillance Plan developed for monitoring groundwater quality in the NHW Well Field and NHWWT facility to provide an early warning in case unexpectedly high concentrations or new contaminants are moving towards NHW production wells. The WQSP identifies the monitoring network, rationale for selection of wells comprising the monitoring network, monitoring information, analytical schedule, sampling frequency and groundwater monitoring methodology.

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Acronym/Abbreviation	Term
1,1-DCE	1,1-dichloroethene
%	Percent
µ	micron
µg	microgram
µg/L	microgram(s) per Liter
AOP	Advanced Oxidation Process
BATs	Best Available Technologies
Ca	Calcium
CA	Contaminant Assessment
cfs	Cubic Foot/Feet Per Second
cis-1,2-DCE	Cis-1,2-Dichloroethene
City	City of Los Angeles
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CEQA	California Environmental Quality Act
Cr[VI]	Hexavalent Chromium
COPCs	Constituents of Potential Concern
CPO	Chief Plant Operator
DDW	Division of Drinking Water
DEHP	Di(2-ethylhexyl)phthalate
DLR	Detection Limit for Reporting
DTSC	Department of Toxic Substances Control
EBCT	Empty Bed Contact Time
ENP	Emergency Notification Plan
EPA	Environmental Protection Agency
Fe	Iron
FS	Feasibility Study
ft	Feet
FTW	Filter to Waste
HAA5	Haloacetic acids
GAC	Granular Activated Carbon
gph	gallons per hour

Acronym/Abbreviation	Term
gpm	Gallon per Minute
H_2O_2	Hydrogen peroxide
IRA	Interim Remedial Action
LADWP	Los Angeles Department of Water and Power
lbs	Pounds
LCP	Local Control Panel
LPHO	Low-Pressure High Output
MCL	Maximum Contaminant Level
MGD	Million Gallon per Day
mm	Millimeters
Mn	Manganese
MRL	Method Reporting Limit
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NH	North Hollywood
NHW	North Hollywood West
NHWWT	North Hollywood West Wellhead Treatment
NL	Notification Level
NOAEL	No Observed Adverse Effects Level
PCE	Tetrachloroethene
PLC	Programmable Logic Controller
psi	Pound per Square Inch
QC	Quality Control
RI	Remedial Investigation
RWQC	Raw Water Quality Characterization
RWQCB	Regional Water Quality Control Board
SA	Source Assessment
sf	square-foot
SFB	San Fernando Basin
SVOCs	Semi-Volatile Organic Compounds
SWRCB	State Water Resources Control Board
TCE	Trichloroethene
Temp	Temperature
TOCC	Treatment Operations Control Center

Acronym/Abbreviation	Term
TSS	Total Suspended Solids
TTHM	Total Trihalomethanes
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
UV AOP	Ultraviolet Advanced Oxidation Process
UVT	Ultraviolet Transmittance
VOCs	Volatile Organic Compounds
WOD-M ERP	Water Operations Division – Metro Emergency Response Plan
WQSP	Water Quality Surveillance Plan

1. INTRODUCTION

The Division of Drinking Water (DDW) 97-005 evaluation process consists of 11 steps (also referred to as 'elements') for assessing proposals, establishing appropriate permit conditions, and approving the use of an extremely impaired drinking water source. This report documents Step 4 of the 97-005 evaluation process, i.e., "Effective Treatment and Monitoring" for the Los Angeles Department of Water and Power's (LADWP's) owned and operated North Hollywood West (NHW) Well Field. Key components of this report includes:

- Treated Water Goals Evaluation;
- Treatability Assessment;
- Performance Standards;
- Operations Plan;
- Reliability Features;
- Compliance Monitoring and Reporting Program;
- Notification Plan; and
- Water Quality Surveillance Plan.

1.1 Purpose

The purpose of this report (Step 4) is to document the treated water goals in order to set forth the treatment selection. The report also outlines the best available technologies to be considered for contaminant treatment to non-detectable concentrations or appropriate levels as required by DDW.

1.2 Background

As groundwater in the vicinity of the NHW Well Field is impaired by contamination, LADWP is required to demonstrate compliance with the California State Water Resources Control Board (SWRCB), DDW 97-005 Process Memo for Extremely Impaired Sources (DDW Process Memo 97-005) (DDW, 2015). DDW considers a source to be "extremely impaired" if it meets two or more of 10 DDW-developed criteria. Based on available water quality data, groundwater in the vicinity of the NHW Well Field meets up to four criteria as described in the Raw Water Quality Characterization (RWQC) report for the NHW Well Field (Step 2 of 97-005 Evaluation). **It is imperative that the precursor Step 2 (Raw Water Quality Characterization) report is read prior to, or in conjunction with this report, "*as each step lies upon the findings and conclusions of the prior step*" (DDW, 2015).**

LADWP, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), has selected the NHW Interim Remedial Action (IRA) to address hazardous substances dissolved in groundwater entering the NHW Well Field under active pumping conditions. LADWP's selected IRA is a groundwater pump and treatment system intended to reduce the toxicity, mobility, and volume of contaminated groundwater through treatment and help restore the beneficial uses of groundwater in the vicinity of the NHW Well Field. The NHW IRA involves extracting and treating impacted groundwater from up to five wells (i.e., three Remediation Wells with a design that allows expansion to enable treatment of five Remediation Wells to avoid the need for new or amended permitting in the event that a future response action involves pumping two additional remediation wells and conveying water from those wells to the NHW treatment plant, following compliance with the NCP). The treated water will be used as a source of potable water supply. The associated planned treatment facility is referred to as the North Hollywood West Wellhead Treatment (NHWWT). Further information regarding the NHW IRA is documented in the NHW Well Field RWQC report (Step 2 of 97-005 Evaluation).

Figure 1-1 DDW Eleven-Step 97-005 Evaluation Process for an Extremely Impaired Drinking Water Source

1.3 Document Organization

This document is organized into the following sections:

Section 1 – Introduction: This section provides relevant background information, including an overview of this proposal in the context of previous evaluation steps that have been completed, and the organization of this document.

Section 2 – Treated Water Goals: This section provides a summary of the NHWWT treated water goals evaluation. The complete evaluation is provided in Appendix A.

Section 3 – Treatability Assessment: This section discusses the treatment process and removal of constituents observed during bench-scale testing.

Section 4 – Performance Standards: This section describes the level of treatment performance to assure compliance with the treatment goals.

Section 5 – Treatment System Design: This section presents a treatment process overview and basis of design.

Section 6 – Operations Plan: The operations plan identifies monitoring and optimization procedures, failure response triggers, and routine inspection procedures.

Section 7 – Reliability Features: This section discusses treatment reliability for treatment uncertainties.

Section 8 – Compliance Monitoring and Reporting: This section presents the compliance monitoring and reporting plan for effective treatment of constituents, and delivery of reliable safe drinking water.

Section 9 – Notification Plan: This section presents a decision tree for emergency notifications.

Section 10 – Source Water Quality Surveillance: This section provides an overview discussion of the main components of the Water Quality Surveillance Plan (WQSP). The complete WQSP is provided in Appendix B.

Appendix A - NHWWT Treated Water Goals Report: This report documents the treated water goals evaluation for the NHWWT.

Appendix B - NHW Well Field Water Quality Surveillance Plan (WQSP): The WQSP will serve as a guide for LADWP to undertake groundwater quality monitoring between the origin of contamination and the NHWWT facility to provide early warning of any unexpected increases in contaminant concentration or detection of additional contaminants.

Appendix C - Bench-scale Ultraviolet Advanced Oxidation Process (UV AOP) Testing Report: This report documents the technical evaluation for using UV light and hydrogen peroxide (UV/peroxide) to treat groundwater from the SFB NHW Well Field.

Appendix D – NHW Reporting Forms: The forms will be used by LADWP Ops staff to record data.

Appendix E – Water Quality Emergency Notification Plan: The Emergency Notification Plan (ENP) contains LADWP and DDW contact information in case of a water quality emergency.

2. TREATED WATER GOALS

LADWP conducted a treated water goals evaluation for the planned NHWWT facility that established treated water goals consistent with Section 4, Part C of the DDW Draft Process Memo 97-005 (DDW 2015). This section provides a summary of the evaluation, with the complete (documented) evaluation provided in Appendix A.

The purpose of establishing treated water goals is to ensure the cumulative risk of multiple contaminants under normal plant operation has been addressed (DDW 2015). For the purposes of the NHWWT treated water goals evaluation, DDW's Maximum Contaminant Level (MCL)-equivalent approach was adopted. As stated in the memo, it is DDW's perspective that the MCL-equivalent approach is a prudent and practical approach that if implemented accordingly, provides extra caution in the protection of public health (DDW 2015).

As described herein, the NHWWT facility will comprise treatment of three Remediation Wells, designed to permit future expansion to enable treatment of five Remediation Wells. Therefore, the following two Treated Water flows were considered in this evaluation to represent the bracketed treatment options of the NHWWT (referred to as "*book-ends*"):

- **Three Remediation Well Treatment** - NHWWT effluent based on the collective flow from three Remediation Wells: NH-34, NH-37 and NH-45; and
- **Five Remediation Well Treatment -** NHWWT effluent based on the collective flow from five NHW Remediation Wells: NH-34, NH-37, NH-43A, NH-44 and NH-45.

In addition, assessments were conducted for two additional NHW Well Field flows:

- ***Untreated Water*** flow which comprises the collective flow from eight untreated NHW production wells; and
- ***Combined Flow*** which comprises the collective flow of Untreated Water plus Treated Water (NHWWT effluent).

The purpose of these additional assessments was to establish a holistic and robust understanding of the potential risks posed by constituents of potential concern (COPCs) in individual and combined NHW flows which will be sent to the North Hollywood Pump Station once the NHWWT facility is operational.

The list of COPCs (Table 2-1) considered for the treated water goals evaluation includes:

- All COPCs identified in the Raw Water Quality Characterization (RWQC) for NHW Well Field (Step 2 of 97-005 Evaluation) for both production and monitoring wells;
- Constituents which exceeded 10% of their Maximum Contaminant Level (MCL) or Notification Level (NL) in production wells and fall into one or more of the following categories:
    - Semi-Volatile Organic Compounds (SVOCs);
    - Volatile Organic Compounds (VOCs);
    - Inorganic constituents which:
        - Are known contaminants in the San Fernando Basin (SFB); and

- Were identified as COPCs with anthropogenic source(s) within the NHW Well Field Study Area, as described in the Drinking Water Source Assessment and Contaminant Assessment (SA/CA; Step 1 of the 97-005 Evaluation). For example, Hewitt Pit Landfill, which is located within the NHW Study Area, is an identified contamination site.

Table 2-1 NHW Well Field RWQC COPCs

Contaminant Risk Group	Mode of Action[(1)]	COPC	Detection Limit for Reporting (DLR) [µg/L]	Regulated or Unregulated
Acute	Hematological	Nitrate as Nitrogen (N)	400	Regulated
Chronic	Hepatic (Liver)	1,1-Dichloroethene (1,1-DCE)	0.5	Regulated
		1,2,3-Trichloropropane (1,2,3-TCP)	0.005	Regulated
		1,2-Dichloroethane (1,2-DCA)	0.5	Regulated
		1,4-Dioxane	1.0	Unregulated
		Di(2-ethylhexyl)phthalate (DEHP)	3	Regulated
		Hexavalent Chromium (Cr[VI])	1	Unregulated[(2)]
	Immunological	Benzene	0.5	Regulated
	Neurological	Tetrachloroethene (PCE)	0.5	Regulated
	Renal (Kidneys)	1,1-Dichloroethane (1,1-DCA)	0.5	Regulated
		Cis-1,2-Dichloroethene (cis-1,2,-DCE)	0.5	Regulated
	Reproductive/ Developmental	Trichloroethene (TCE)	0.5	Regulated

Notes:

[(1)] *Mode of action only applies to **non-cancer** risks (refer to Section 2.2 in Appendix A)*

(2) *As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks (currently undefined) associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation.*

Estimated COPC concentrations were taken from the NHW RWQC study (Step 2 of 97-005 Evaluation). The RWQC report evaluated COPC concentrations based on production well and monitoring well statistics, estimating anticipated COPC concentrations for two treated water flows (i.e., the collective flow from Three or Five Remediation Wells).

The evaluation results, presented in Table 2-2 and Table 2-3 below, show that the overall MCL-equivalents for the Treated Water, under normal NHWWT operations, for both Three Remediation Well Treatment and Five Remediation Well Treatment, are below the DDW guidance of ≤1 for both acute and chronic risk COPCs. Therefore, the level of treatment provided by planned NHWW for both Three Remediation Well Treatment and Five Remediation Well Treatment, would be acceptable.

Table 2-2 Three Remediation Well Treatment: Summary of NHHWT Effluent MCL-Equivalent Assessment

Contaminant Risk Group	Based on Production Well Sample Data		Based on Monitoring Well Sample Data	
	Normal Anticipated	Maximum Anticipated	Normal Anticipated	Maximum Anticipated
	Sum of MCL-Equivalent	Sum of MCL-Equivalent	Sum of MCL-Equivalent	Sum of MCL-Equivalent
Acute Effect Endpoint COPCs	**0.35**	0.48	0.27	0.37
Chronic Effect Endpoint and Non-Regulated COPCs	**0.43**	0.44	0.13	0.58

Note: *Final MCL-equivalents for acute and chronic risk contaminants (under normal operation) are **bolded** and **underlined**.*

Table 2-3 Five Remediation Well Treatment: Summary of NHWWT Effluent MCL-Equivalent Assessment

Contaminant Risk Group	Based on Production Well Sample Data		Based on Monitoring Well Sample Data	
	Normal Anticipated	Maximum	Normal Anticipated	Maximum
	Sum of MCL-Equivalent	Sum of MCL-Equivalent	Sum of MCL-Equivalent	Sum of MCL-Equivalent
Acute Effect Endpoint COPCs	**<u>0.35</u>**	0.50	0.27	0.37
Chronic Effect Endpoint and Non-Regulated COPCs	**<u>0.37</u>**	0.39	0.13	0.58

Note: *Final MCL-equivalents for acute and chronic risk contaminants (under normal operation) are* ***<u>bolded</u>*** *and* ***<u>underlined</u>****.*

The treated water goals, under normal NHWWT operation, are presented in Table 2-4. The Treated Water (NHWWT effluent) MCL-equivalent assessment results (Table 2-2 and Table 2-3) were used to establish the NHWWT treated water goals as the results of the MCL-equivalent assessment demonstrated that the level of treatment that will be provided by planned NHWWT are deemed 'appropriate'. It is DDW's belief that the MCL-equivalent approach is a prudent and practical approach which, if implemented accordingly, provides extra caution in the protection of public health (DDW 2015).

Table 2-4 Treated Water Goals for the NHWWT

COPC Type	COPC	Proposed Treated Water Goal
VOCs	TETRACHLOROETHENE (PCE)	<DLR (<0.5 µg/L)
	TRICHLOROETHENE (TCE)	<DLR (<0.5 µg/L)
	1,1-DICHLOROETHENE (1,1-DCE)	<DLR (<0.5 µg/L)
	CIS-1,2-DICHLOROETHENE (CIS-1,2,-DCE)	<DLR (<0.5 µg/L)
NON-REGULATED	1,4-DIOXANE	<DLR (<0.25 µg/L)

3. TREATABILITY ASSESSMENT

The Interim Remedial Investigation / Feasibility Study Report (RIFS) (LADWP 2016) included a screening of groundwater organic compounds (VOCs) to achieve the proposed treated water goals (Table 2-4). Technologies considered included: UV AOP, air stripping, carbon adsorption, carbon quenching pre-filtration, and resin adsorption. The RIFS determined that the groundwater treatment facility would include a pre-filtration system, an UV AOP system consisting of UV and hydrogen peroxide, and a GAC system for peroxide quenching. While air stripping (aeration) and carbon adsorption are DDW Best Available Technologies (BATs) for treatment of many VOCs, they are ineffective at removing 1,4-dioxane. Resin adsorption technology is available to remove 1,4-dioxane from water; however, has not been adequately proven in the Southern California region and for direct domestic use.

AOP technologies use UV light or ozone and a chemical oxidant, which react to form hydroxyl radicals. Hydroxyl radicals, which are powerful oxidizers, oxidize (break down) organic contaminants. Hydroxyl radicals can oxidize 1,4-dioxane, PCE, TCE, 1,1-DCE and cis 1,2-DCE, and have been proven to be effective and reliable in Southern California region potable water applications and at other locations throughout the United States (EPA 2006)[1]. The AOP that is proposed for the project involves use of hydrogen peroxide with exposure to UV light (UV AOP). The reliability of this process has been proven at the regulatory level, and it is an effective technology for 1,4-dioxane treatment. EPA has found UV AOP to be effective at removing 1,4-dioxane with up to greater than 99% effectiveness (EPA 2011b)[2].

As part of the treatability assessment, LADWP conducted testing to evaluate UV AOP treatment using NHW well water to provide data for 1,4-dioxane and VOCs treatment. The testing studied removal efficiencies for 1,4-dioxane, 1,1-DCE, and TCE removal by UV AOP treatment at varying fluences and hydrogen peroxide concentrations, examined byproduct formation, and assessed blending viability via simulated distribution system testing. Two types of lamps were tested: low pressure high output (LPHO) and medium pressure (MP). The LPHO lamps resulted in higher performance compared to the MP lamps. The testing confirmed that UV AOP can achieve 1.9 log reduction of 1,4-dioxane (Figure 3-1), and VOCs can be removed simultaneously (TCE removal is illustrated in Figure 3-2). PCE and cis-1,2-DCE were not directly tested but have similar or better hydroxyl radical rate constants that indicate reductions will be similar to, or greater than 1,4-dioxane (Table 3-1). Testing also showed that minimal disinfectant byproduct formation occurred; nitrite formation was <0.04 mg/L, and total trihalomethanes (TTHMs) and haloacetic acids 5 (HAA5) were both well below regulatory limits. Appendix C includes the bench-scale AOP testing report.

[1] EPA (Environmental Protection Agency). 2006. Treatment Technologies for 1,4-Dioxane: Fundamentals and Field Applications. EPA-542-R-06-009. December 2006.

[2] EPA (Environmental Protection Agency). 2011b. “1,4-Dioxane/Ultraviolet Irradiation + Hydrogen Peroxide.” June 2011. Accessed September 2, 2015.

Table 3-1 Hydroxyl Radical Rate Constants

Contaminant	Hydroxyl Radical Rate Constant (L mol^{-1} s^{-1})
1,4-Dioxane	$2.3 - 3.1 \times 10^9$
TCE	$2.9 – 4.3 \times 10^9$
PCE	$2.0 – 2.8 \times 10^9$
1,1-DCE	6.8×10^9
cis 1,2-DCE	3.8×10^9

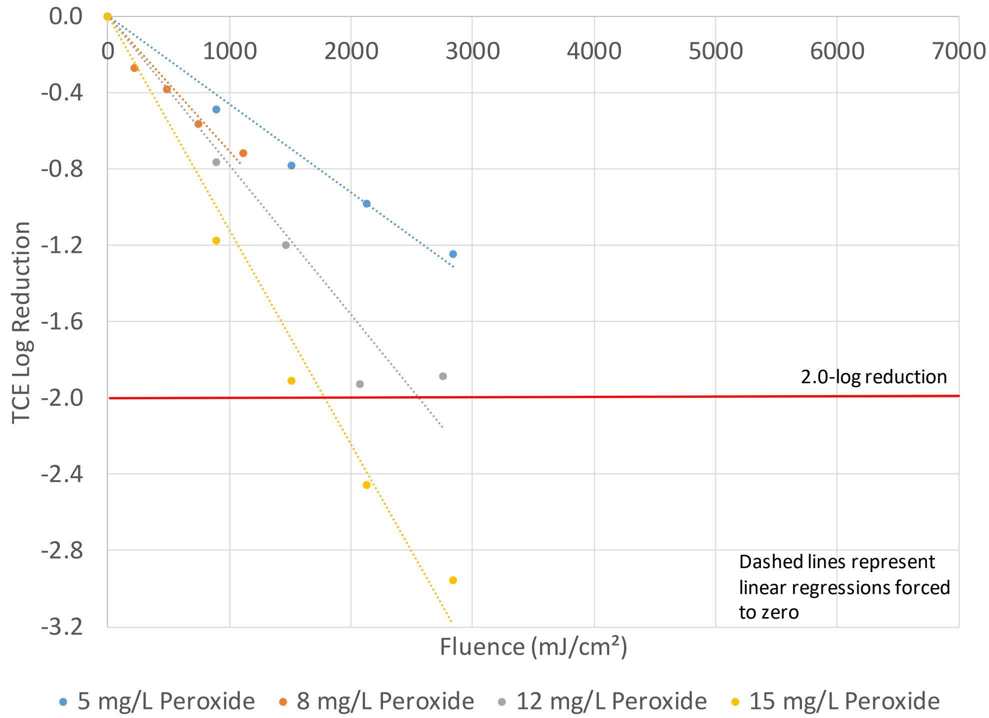

Figure 3-1 1,4-Dioxane Removal by LPHO/Peroxide AOP from LADWP Bench-Scale Testing

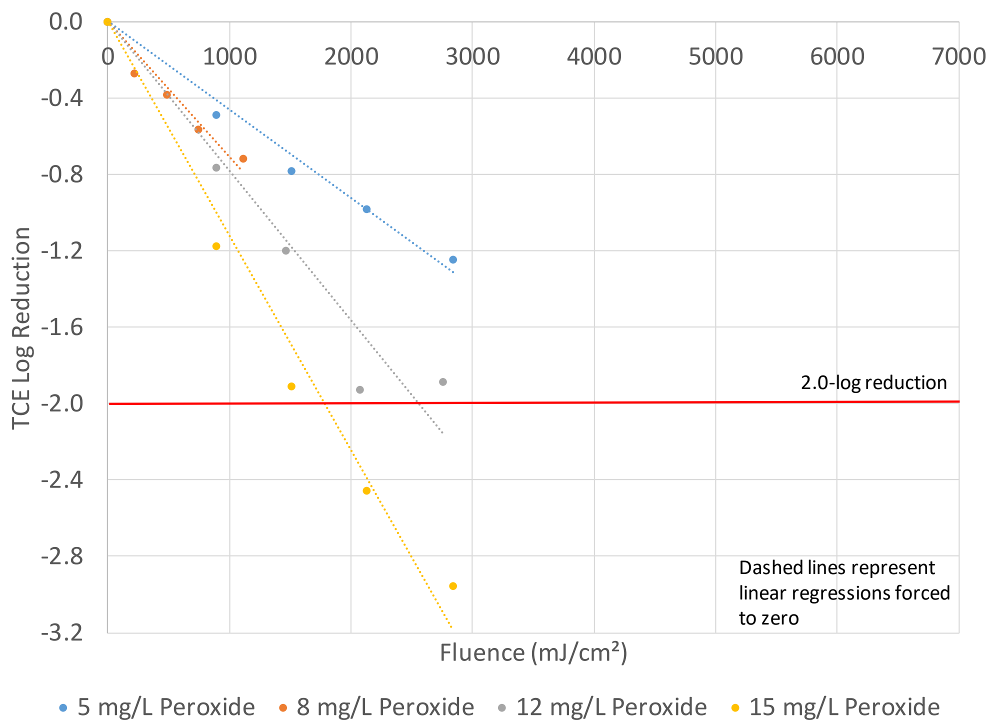

Figure 3-2 TCE Removal by Low-Pressure High Output/Peroxide AOP from LADWP Bench-Scale Testing

4. PERFORMANCE STANDARDS

The NHWWT is designed to treat up to 12,750 gpm to accommodate the well flow (discussed in Section 5.2.9). The facility will treat 1,4-dioxane and other VOCs that are present in the remediation wells (i.e., PCE, TCE, 1,1-DCE, and cis-1,2-DCE) to concentrations outlined in the treated water goals evaluation (Appendix A) and summarized in Table 2-4.

Performance standards for the proposed NHWWT are outlined in Table 4-1 and represent the maximum anticipated log reductions that will be achieved for each contaminant. Treatment is based on achieving 1.9-log reduction of 1,4-dioxane at the maximum flow rate. VOC reductions shown are the calculated reductions that will be simultaneously achieved, based on the 1,4-dioxane target. Actual treatment levels may vary depending on the measured influent 1,4-dioxane and VOC concentrations during operation. Section 7 discusses the reliability of the facility to treat variations in influent concentrations and flow rates. Actual treatment levels will be selected to achieve the treated water goals (Table 2-4).

Table 4-1 Performance Standards for NHWWT

Parameter	Performance Criteria
Design Condition(1)	
Flow	9,750 gpm (21.7 cfs) for 3 well flow 12,750 gpm (28.4 cfs) for 5 well flow
Redundancy	1 train
UV Transmittance	97%
Expected Peroxide Dose under Normal Conditions	16 mg/L
Design Peroxide Dose	21 mg/L
1,4-Dioxane	1.9-log reduction
TCE[1]	2.0-log reduction
PCE[1]	1.7-log reduction
1,1-DCE[1]	4.3-log reduction
cis-1,2-DCE[1]	2.0-log reduction

Note:

(1) *Modeled reduction based on targeting 1,4-dioxane*

5. TREATMENT SYSTEM DESIGN

This section presents a treatment process overview and basis of design.

5.1 Treatment Overview

Advanced oxidation using UV AOP was the treatment process selected for the NHWWT and is a proven treatment technology for 1,4-dioxane removal from drinking water. The complete process consists of pre-filtration (consisting of sand separators and cartridge filters) to protect downstream equipment by removing sand and other particulate from the wells, UV AOP, and GAC vessels to remove excess hydrogen peroxide. Disinfection will occur off-site, using existing chemical facilities, and will not be considered further in this report. Figure 5-1 presents a process flow diagram for the NHWWT with design flows provided in Table 5-1.

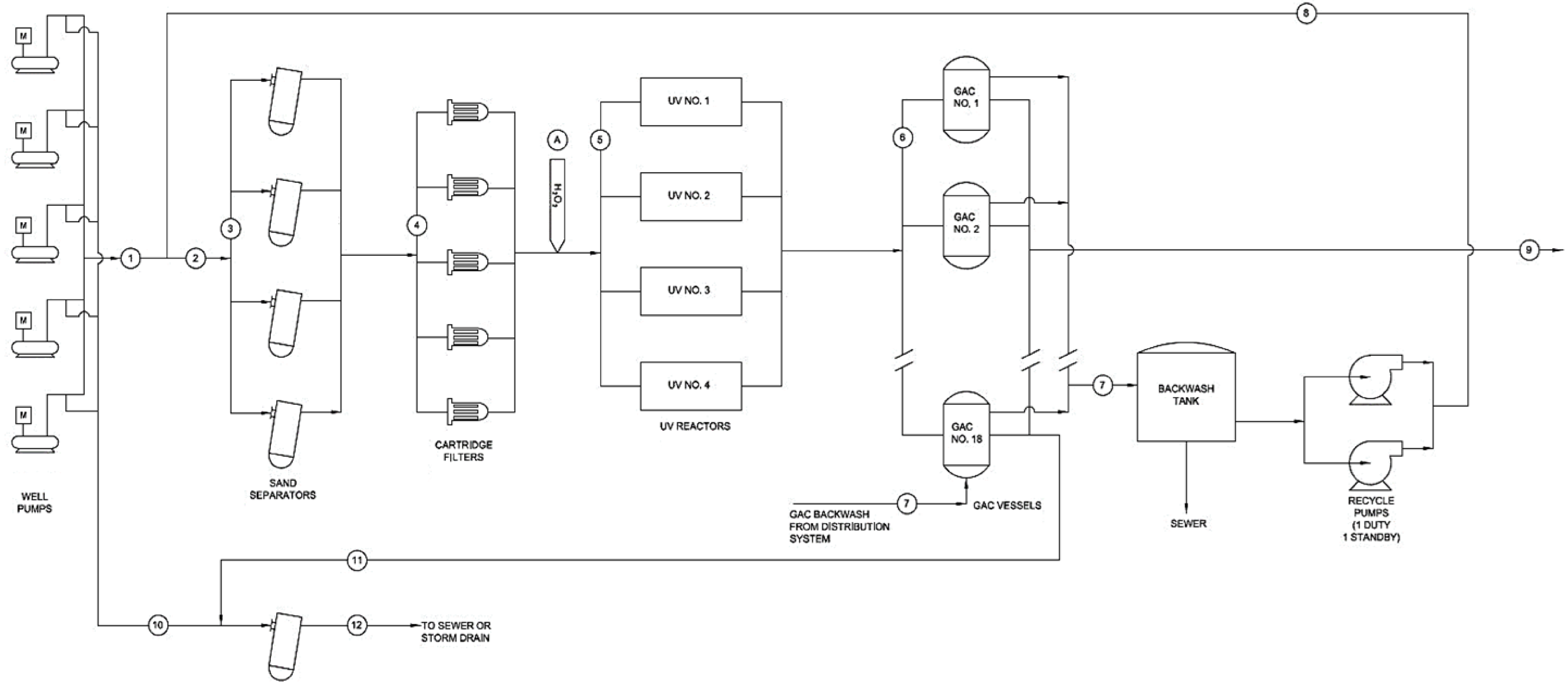

Figure 5-1 NHWWT Process Diagram

Table 5-1 NHWWT Design Specifications

	1	2	3	4	5	6	7	8	9	A
	Raw Water	Total Feed	Sand Separators (EA)	Cartridge Filters (EA)	UV (EA)	GAC Feed (EA)	GAC BW (EA)	BW Recycle Pump	Finished Water	Hydrogen Peroxide
Normal Operation										
<u>Three Well Flow</u>										
Operating Units	-	-	2	3	3	13	1	1	-	-
Flow (gpm)	9,750	9,850	4,925	3,283	2,283	758	789	100	9,850	-
Flow (cfs)	21.7	21.9	11.0	7.3	7.3	1.7	1.8	0.2	21.9	-
Chemical Dosing (mg/L)	-	-	-	-	-	-	-	-	-	16
<u>Five Well Flow</u>										
Operating Units	-	-	3	4	4	17	1	1	-	-
Flow (gpm)	12,750	12,850	4,283	3,213	3,213	756	789	100	12,850	-
Flow (cfs)	28.4	28.6	9.5	7.2	7.2	1.7	1.8	0.2	28.6	-
Chemical Dosing (mg/L)	-	-	-	-	-	-	-	-	-	16

5.2 Basis of Design

This section describes the NHWWT system basis of design including the purpose of each major unit process, hydraulic loading rate, and other important design criteria needed for effective performance. It should be noted that if any untreated well exceeds an MCL or NL, the well will not be operated without treatment and/or a new 97-005 evaluation.

5.2.1 Well Pumps

There are existing submersible supply pumps in the NHW production wells; however, these pumps are undersized and require replacement to accommodate the additional headloss associated with the NHWWT. Table 5-2 presents the specifications and capacities of the pumps that are planned. The combined flow rate from three wells (NH-34, NH-37, and NH-45) is 7,900 gallons per minute (gpm) or 11 MGD, and the combined flow rate from five wells (NH-34, NH-37, NH-45, NH43A, and NH-44) is 12,500 gpm or 18 MGD.

Table 5-2 NHWWT Well and Well Pump Information

Parameter	Value
Design Discharge Pressure	49 psi
Pump Type	Submersible
Motor Type	Constant speed
Motor Voltage	4,160 volts (V)
Pump Capacities[(1)]	
NH-34	2,300 gpm
NH-37	2,800 gpm
NH-45	2,800 gpm
NH-43A	2,300 gpm
NH-44	2,300 gpm

Note:

(1) Pump capacities based on procurement specification and assumed water levels.

5.2.2 Treatment Capacity

The entire flow from the five wells will be able to be treated at the NHWWT, which will be sized to accommodate up to 12,750 gpm raw water flow. To accommodate the GAC vessel flow rates, the treatment plant size was rounded up to 12,750 gpm. The treated water from the NHWWT is subsequently blended with water from other wells in the NHW Well Field in the collector line and conveyed to the North Hollywood Pump Station where it mixes with Rinaldi-Toluca Well Field water, then surface water. A schematic of the NHW Well Field flows is shown in Figure 5-2.

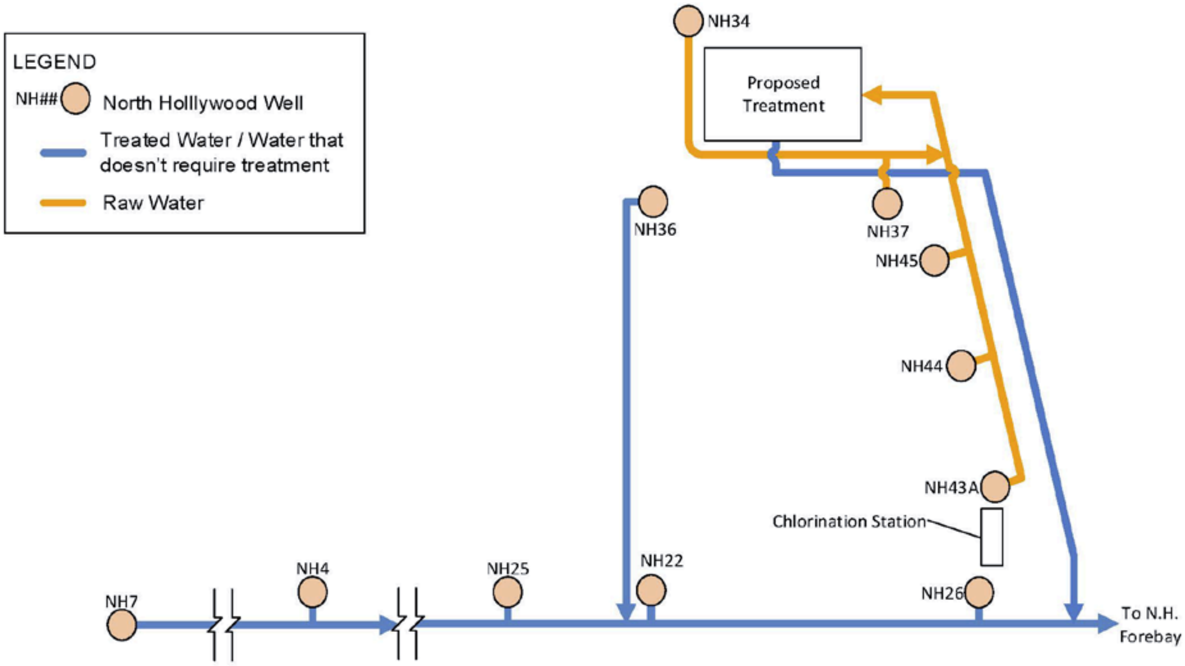

Figure 5-2 Current NHW Well Field Flows

5.2.3 Sand Separators

Sand separators are included in the process and used to remove the larger sized particles (sediment/debris) entrained in groundwater extracted from the remediation wells and serve to protect the UV reactors and GAC vessels.

A sand separator is a fixed unit with no moving parts. The influent water containing the entrained particles is pumped into the top of the sand separator. The heavier particles are separated by centrifugal force and collect/accumulate at the bottom of the chamber. The chamber is periodically purged to remove accumulated particles. The water continues to flow through the center channel of the sand separator and discharges from the outlet located on the top of the unit. A sand separator unit can be isolated by valves that are located on inlet and outlet pipeline of the unit. When operating under recommended conditions, the unit can achieve up to 98% removal of 74 microns or larger particles, and 75% removal of 5 microns and larger particles. The wetted materials are NSF 61 certified for drinking water application.

Table 5-3 summarizes the sand separator operating conditions. Due to the centrifugal mechanism of operation, maintaining an optimal flow rate is critical for effective performance of the sand separators. The optimal flow rate is defined as the higher end of the specified operating flow range. Four units will be in operation to accommodate the feed flow. If a unit is taken offline for maintenance, the remaining units will be operating slightly below their normal maximum operating capacity of 4,350 gpm. Any sand that passes through the units under these conditions will be removed by the cartridge filters.

Table 5-3 NHWWT Sand Separator Information

Parameter	Value
Operating Flow Rate	4,283 gpm per unit for five well treatment
Number of Units	4 (3 duty, 1 standby during cleanout)
Purge Valve	4 (1 per unit)
Pressure Gauge	6 (1 inlet and 1 outlet for each of 6 units)

5.2.4 Cartridge Filters

As a second step of pre-filtration, cartridge filters are used to remove smaller and lighter particles that are not captured by the sand separator. Five-micron (5 µm) nominal-rated filter elements are planned for use, which can achieve 90% removal of 5 µm or larger particles.

A cartridge filter unit consists of filter elements and a vessel that houses these elements. The filter vessel has inlet and outlet connections equipped with isolation valves. An air release valve is located at the feed side of the vessel, and a drain valve is located at filtrate side of the vessel. All the valves on the cartridge filters are manually controlled. The body of the cartridge filters are made of 316L stainless steel that meets NSF 61 compliance for drinking water applications.

Table 5-4 summarizes the cartridge filter operating conditions. Four units are necessary to treat the design flow rate. An additional unit is available to avoiding reducing the operating flow of the facility during a changeout of cartridge filters. Pressure loss through the cartridge filters will vary from 5 psi to 15 psi depending on the state of cleanliness of the cartridges. An average headloss of 10 psi is expected for a flow of 3,000 gpm per unit. A common differential pressure sensor is provided to measure the loss through the cartridge filters. Individual pressure gauges are provided for each unit to allow maintenance workers to verify that units taken offline for maintenance have been depressurized before they are opened.

Table 5-4 NHWWT Cartridge Filter Information

Parameter	Value
Operating Flow Rate	3,213 gpm per unit for five well treatment
Number of Units	5 (4 duty, 1 standby during changeout)
Elements	5 micron; 2.5” diameter, 40” length
Pressure Gauge	8 (1 inlet and 1 outlet per unit)
Differential Pressure Sensor	1 common across all vessels
Clean element maximum headloss	5 psi
Filter Element Changeout Trigger	15 psi

5.2.5 Hydrogen Peroxide (H_2O_2) Feed

Hydrogen peroxide is injected upstream of the UV reactors in order to form hydroxyl radicals within the UV reactor. The hydrogen peroxide storage and feed system consist of two peroxide storage tanks, with adequate capacity to accept a full truck delivery of hydrogen peroxide. Combined, the tanks have capacity of at least 30 days of storage under average flow and peroxide dose conditions. Peristaltic metering pumps in a duty/standby configuration are used for hydrogen peroxide injection to ensure continuous and consistent dosing.

Table 5-5 presents the design information for the hydrogen peroxide feed system. A hydrogen peroxide solution of 27.5% was used for chemical storage and feed system design. Peroxide injection will be accomplished via two pumps (one duty and one standby). Two peroxide storage tanks, each with a 9,000-gallon capacity, will be provided. All components are designed to handle peroxide concentrations up to 50%.

Table 5-5 NHWWT H_2O_2 Feed System Information

Parameter	Value
H_2O_2 Solution Concentration	Up to 50%
Initial Fill Concentration	27%
Number of H_2O_2 Feed Pumps	2 (1 duty, 1 standby)
Pump Type	Peristaltic
Minimum H_2O_2 Feed Rate*	7 gallons per hour (gph)
Maximum H_2O_2 Feed Rate*	42 gph
Number of H_2O_2 Storage Tanks	2
Minimum Volume per Tank*	9,000 gallons

Note:

**May be adjusted according to the selected hydrogen peroxide solution concentrations*

5.2.6 UV Reactors

UV reactors photolyze hydrogen peroxide to generate hydroxyl radicals that oxidize the contaminants being treated.

The UV system consists of four trains of UV reactors. UV system information is shown in Table 5-7. Each UV train consists of isolation valves, a magnetic flow meter, and one UV reactor. The UV reactors also include power distribution panels and a programmable logic controls for adjusting lamp power and the number of lamps energized. A UV master control panel is to be provided by the UV manufacturer to determine the required number of online trains and hydrogen peroxide dose required to meet treatment goals (Section 2). The number of trains and peroxide dose will be calculated based on the facility flow rate, UV transmittance (UVT), and target 1,4-dioxane log reduction. Higher log reductions can be achieved at lower flow rates or higher peroxide doses. The expected hydrogen peroxide dosage under normal conditions is 16 mg/L. The peroxide feed system can deliver a peroxide dose up to 25 mg/L, if required for higher levels of treatment. The major components of the UV reactors and associated equipment are shown in Table 5-8.

The design UVT was selected based on historical data (99% UVT254 with a 2% safety margin) and sampling during the design phase. The lowest measured UVT sample is 98% (Table 5-6), however, the table is a small subset of data used for the 97% UVT selection. Additional information on bench testing is found in Appendix C. When AOP reactors are in operation, an online UVT analyzer will provide real time UVT measurement in response to water quality variation. UVT was also analyzed during bench-scale testing.

Table 5-6 UVT Samples

Well	Date	UVT_{254} (%)
NH-34	10/26/2016	98.0
NH-34	12/7/2016	98.0
NH-34	2/4/2015	98.3
NH-37	6/3/2016	98.6
NH-37	10/26/2016	98.0
NH-37	2/4/2015	98.3
NH-44	12/7/2016	98.9

Table 5-7 NHWWT UV System Information

Parameter	Value
Maximum Flow Rate	9,750 gpm (21.7 cfs) for three wells 12,750 gpm (28.4 cfs) for five wells
UV Transmittance (UVT)	97%
1,4-Dioxane Log Reduction	1.9-log
Expected Peroxide Dose under Normal Conditions	16 mg/L
Design Peroxide Dose	25 mg/L
Number of Duty UV Trains	3
Number of UV Reactors per Train	1
Redundancy	1 train

Table 5-8 Major Components of UV Reactors and Associated Equipment

Component / Instrument	Number of Components	Notes
1. UV Reactors	4	1 reactor minimum for treatment
2. On-line Mechanical Cleaning System	4	1 per reactor
3. Local Control Panel (LCP) and Power Distribution Center	4	1 per reactor
4. UV Master Control Panel	1	Including redundancy modules
5. Plant Master Control Panel	1	Including redundancy modules
6. UVT Analyzer	1	Not applicable
7. Bench Top UVT analyzer	1	Not applicable

5.2.7 GAC Vessels

Peroxide is added in excess and is not completely photolyzed by the UV light. GAC vessels are used for residual hydrogen peroxide quenching. Hydrogen peroxide reacts with the GAC media in a catalytic reaction that breaks down the hydrogen peroxide into oxygen and water. As such, the GAC adsorption sites are not used up in the reaction and the GAC media lasts longer than with typical adsorption applications. A media changeout is triggered when the GAC is no longer effective at quenching the hydrogen peroxide residual, which is reflected by peroxide breakthrough. Peroxide concentrations can be monitored at 25%, 50%, 75%, 100% GAC vessel sampling ports and GAC effluent. Once peroxide is detected above the 0.2 mg/L at the 100% port, new carbon can be ordered for changeout. Chlorine could also oxidize peroxide; post treatment chlorination also serves as a secondary barrier if peroxide does break through. If chlorine demand increase is observed, GAC grab sampling will be monitored more frequently.

Table 5-9 summarizes the design criteria for the GAC system. Eighteen GAC vessels are operated in parallel and a minimum of five minutes of Empty Bed Contact Time (EBCT) is required. Each vessel will include a flow meter. There will be a differential pressure sensor/transmitter on the feed header and the outlet header. Only one vessel is backwashed at a time, while the remaining seventeen vessels are in service. Note that while the GAC vessels will initially be filled with 15,500 lbs. of carbon, the vessels have a 20,000 lb. capacity. A design surface loading rate of 8.8 gpm/square-foot is provided when all 18 vessels are online, which will increase to 9.4 gpm/sf when one unit is out of service for backwashing.

The raw water entering the NHWWT facility contains nitrate. Nitrate is known to loosely adsorb to GAC. If the GAC facility has been off-line for an extended period (>24 hr.) with stagnant water, nitrate peaking (i.e., higher levels of nitrate in the GAC treated water than the influent water) can occur. The NHWWT will include on-line nitrate monitoring for the GAC treated water. Several options will be available for high nitrate water, including blending with lower nitrate water.

Table 5-9 NHWWT GAC System Information

Parameter	Value
Number of Vessels	18
Vessel Diameter	10 feet
Maximum GAC Fill	20,000 lbs
Design GAC Fill	15,500 lbs per vessel
Maximum EBCT	7.1 minutes (with 20,000 lbs/vessel installed)
Minimum EBCT at Design GAC Fill with One Out of Service	5.1 minutes
GAC Media Type	Catalytic Coconut
GAC Media Mesh Size	12x40
GAC Media Effective Size	Effective size of 0.5 – 0.7 mm
Design Flow Rate per Vessel	694 gpm
Design Surface Loading Rate	8.8 gpm/ft^2
Flow per vessel with One Out of Service	735 gpm
Surface Loading Rate with One Out of Service	9.4 gpm/ft^2
Minimum Flow Rate per Vessel	200 gpm

5.2.8 GAC Backwash System

During installation, each 20,000 lb vessel of GAC will be backwashed according to vendor's recommendation using treated water. The process removes GAC fines and stratifies the media. Backwash water from the initial installation will be collected in a storage tank and metered to the sewer. Due to peroxide breakdown that may lead to GAC air binding, the contactor may undergo a reduced backwash (backflush). For periodic backflush, LADWP plans for the backflush water to normally be collected in the same storage tank and then sent to the sewer. The system design includes the ability to recycle the flow to the head of the treatment process (i.e. upstream of the sand separators), as an option, however, the facility is not intended to recycle at this time. The GAC backflush duration is approximately 15 minutes, with the goal to fluff the bed to release entrapped air using treated water at the proper flow rate and duration to ensure the media will re-stratify properly, which minimally disturb the mass transfer zone. The storage tank will be periodically cleaned if solids accumulate.

Table 5-9 summarizes the design information for the backflush recycle system. The waste water is stored in a 40,000-gallon storage tank. The backflush water can be recycled to the head of the treatment system using two backwash recycle pumps. Recycled water will go through the same treatment as the plant influent in the following treatment process order: sand separator, cartridge filter, UV AOP, and GAC.

Table 5-10 NHWWT GAC Backwash Recycle System Information

Parameter	Value
Wastewater Generated per Backwash	Approximately 9,000 gallons
Backwash Tank Design Capacity	40,000 gallons
Backwash Recycle Pumps	2 (1 duty, 1 standby)
Backwash Recycle	Intermittent
Maximum Backwash Recycle Flow Rate	590 gpm

5.2.9 Treatment of Five Wells vs Three Wells

The NHWWT design will be able to treat up to 5 wells for a total treatment capacity of up to 12,750 gpm. At 12,750 gpm, it is expected the 1,4-dioxane concentrations will decrease based on the results of the hydraulic modeling. This results in a higher flow but a lower target log reduction to achieve the water quality goals. The expected target log reduction will be 1.6-log 1,4-dioxane reduction. A 1.6-log 1,4-dioxane log reduction can be achieved with all 3 UV AOP trains in service at a hydrogen peroxide dose of approximately 25 mg/L. Alternatively, all 4 UV AOP trains could be placed in service with a hydrogen peroxide concentration of approximately 16 mg/L. However, a redundant UV train will not be available in this case. In the event of required maintenance, the hydrogen peroxide dose can be increase or a well can be removed from service to reduce the flow rate to what can be treated with three UV reactor trains.

5.3 Redundancy

Unit process redundancy was incorporated in the NHWWT design as such:

- **Sand Separator:** Four sand separators will be installed at this facility. During normal operation, four units are available for service. The fourth unit allows one separator to be serviced at any given time without impeding the treatment process. In addition to solids purging, other maintenance such as; purge valve and pressure gauge inspection, and hand hole clean out, will be performed on a regular basis.
- **Cartridge Filter:** Five cartridge filters will be installed at this facility. When in normal operation, five units are in service. Four filters can handle the design plant flow for NHWWT, allowing the additional unit to be serviced at any given time without impeding the treatment process.
- **Hydrogen Peroxide Storage and Feed:** The NHWWT uses hydrogen peroxide for advanced oxidation. The hydrogen peroxide is stored in two 9,000-gallon bulk storage tanks. At the normal usage rate and operational parameters, the combined tank capacity provides greater than 30 days' supply. Hydrogen peroxide is typically delivered in 3,000- to 4,500-gallon deliveries. One transfer pump is available to move peroxide between storage tanks, if required. Two hydrogen peroxide

peristaltic feed pumps (1 duty, 1 standby) provide chemical feed to the diffusers in the UV AOP influent pipeline. The standby pump is provided for redundancy.

- **UV Reactors:** During normal operations, the entire flow can be treated through two or three UV reactor trains. Operators may choose to use all 4 trains at a reduced flow per train or put one or more UV trains into standby mode. Hydrogen peroxide concentrations can be increased to facilitate higher levels of treatment, regardless of the number of UV reactors that are in service.
- **GAC Vessels:** The GAC vessels will be taken out of service periodically for backwashing or media changeout. Actual backwash frequency will be determined during operation. The GAC facility was designed with an extra GAC vessel to allow for one vessel to be taken out of service while maintaining full quenching capacity within the surface loading rate limitations for GAC. If more than one vessel is required to be taken out of service at one time, the flow through the facility can be reduced by taking one well out of service. It is anticipated that the GAC media will have to be replaced every two to three years.

6. OPERATIONS PLAN

The Operations Plan identifies operational procedures, failure response triggers, monitoring and optimization procedures, staffing requirements, and routine inspection procedures.

6.1 Operational Procedures

The NHWWT is intended to operate 24 hours a day, seven days a week, on a near year-round basis. Planned shutdowns and startups may occur occasionally. Full plant shutdowns can be minimized through partial plant shutdowns and utilizing redundant equipment provided for all treatment processes. Emergency shutdowns are expected to be rare, and when they do occur, are generally short. For shorter temporary shutdowns, the raw well water will be sent directly into the treatment system upon start-up. For extended shutdowns (>24 hours), the raw well water will be purged prior to sending water to the WTP. Operational procedures summary is presented below:

- **Full-plant Startup after an Extended Shutdown.** During a full-plant startup following a shutdown of more than 24 hours, the first water from the wells will be sent to waste through the purge lines and ultimately disposed in the sanitary sewer.
    - If equipment was drained during the shutdown, refill prior to start-up to prevent water hammer. Potable water will be used to refill all equipment, as required.
    - Open inlet and outlet valves to a sufficient number of sand separators, cartridge filters and GAC vessels to treat the anticipated flow. Verify nitrate analyzer is online.
    - Confirm the quantity of blend water available for nitrate peaking based on the other wells in operation. Calculate the target nitrate value for GAC effluent based on the blended values from the other operating wells.
    - Open the filter to waste (FTW) valve from the GAC vessels and close the valve to distribution system.
    - Turn on one well with water directed to purge tanks. After 15-20 minutes of purging, start UV reactors. Once UV reactors are online, slowly open the well discharge isolation valve to send water to treatment and slowly close the purge valve.
    - The hydrogen peroxide feed system will automatically start when flow to the UV reactors is registered.
    - Monitor the nitrate concentration in the GAC effluent. If nitrate as nitrogen (N) is below the target value, treated water can be sent to distribution and the FTW line can be closed. Continue to monitor nitrate until it returns to below 8 mg/L as N.
    - Drain the purge tanks to the sewer or the storm drain (if permitted). Once the purge tanks are empty, additional wells can be brought online. Repeat steps above as necessary to achieve desired total plant flow rate.
- **Full-plant Startup after a Temporary Shutdown.** During a startup after a shutdown of less than 24 hours, the first water from the wells is sent directly to the treatment system instead of purge lines:
    - Start sand separators, cartridge filters, and GAC vessels.

- Put the UV reactors in automatic operation mode and initiate reactor warm-up.
- Once UV reactors are online, start the plant with one well in operation.
- The hydrogen peroxide feed system will automatically start when flow to the UV reactors is registered.
- Once flow through the facility has stabilized, bring additional wells online.

- **Full-Plant Shutdown.** A full-plant shutdown can be used to conduct more extensive plant maintenance:
    - Shut off the water supply wells. As the water flow into the plant decreases, the flow-paced chemical feed rate will start slowing down to maintain the target peroxide residual.
    - When the flow stops, shut off the UV reactors and chemical feed pumps from the System Control Center and UV PLC.
    - Purge and drain sand separators.
    - Shutdown GAC vessels and power down UV unit.

6.2 Failure Response

The NHWWT will be highly automated and designed to operate with minimal operator attention. The plant features automatic responses to several failure situations. A failure will signal an alarm at the NHWWT control room. Trouble signals will also be transmitted to the Treatment Operations Control Center (TOCC) system where operations can remotely monitor the system. Examples of the automatic responses include alarms for:

- **Wells:** Each well is equipped with a high-pressure switch. If the high-pressure switch is activated, the well will shutdown to prevent over-pressurization of the NHWWT facility.
- **UV System:** The UV treatment system will calculate predicted 1,4-dioxane reductions based on the flow, UVT, power input, and H_2O_2 dose. If the calculated value is lower than the required value, alarms will be triggered. These calculations are verified by routine monitoring. Additionally, alarms will be triggered by detectable H_2O_2 levels after the GAC vessels and equipment failures (UV lamps, ballast, etc.). Each UV reactor has alarms associated with UV reactor operation, control, and monitoring.
- **GAC System**: Monitoring of the GAC vessels is limited to differential pressure, flow rate, and the combined GAC effluent hydrogen peroxide concentration. An increase in differential pressure will require vessel backwashing. Headloss cut-off for backwashing will be determined during operation. As headloss builds up, flow split between vessels will vary. If the flow per vessel exceeds the maximum recommended value of 750 gpm, an alarm will be generated. Flow split will be modified through throttling of the effluent valves. If hydrogen peroxide is detected in the combined GAC effluent, an alarm will be generated to alert the operators to collect grab samples and verify calibration of the hydrogen peroxide analyzer. If hydrogen peroxide is confirmed, the facility will be shut down.

No standby generator will be available at the site. A power failure at the site will shut the wells and treatment facility off because they share a common power feed. If the treatment facility fails but the wells are still online, SCADA will shut down the wells to avoid serving untreated water. Normal start-up procedures will be followed to bring the system back online when power resumes, which will be included in the system Operations Maintenance and Monitoring Manual (OMMP).

6.3 Monitoring and Optimization

Proper operation of the water treatment plant will be maintained through process monitoring. Process monitoring points and sample collection are discussed in detail in Section 7. These results will also be used calibrate online analyzer results. Key control parameters monitored by online analyzers are listed in Table 6-1.

Table 6-1 System Control Parameters

System	Parameter	Analyzer Location
UV Control	UVT*	UV influent
	UV Intensity	Each UV reactor
	Flow Rate	Each UV reactor
	H_2O_2	UV influent
GAC Control	Differential Pressure	Pressure sensor at influent and effluent of each GAC vessel
	Flow Rate	Each GAC vessel
	H_2O_2	GAC treated water

Note:

**UVT is the most important water quality parameter for UV reactor monitoring and control. One online UVT analyzer will be installed to provide real-time measurement of UVT. A spare UVT analyzer will also be in storage for rapid replacement if required. In the event of a UVT analyzer failure, a manual UVT entry with confirmation grab sample can be used as the UVT for groundwater supplies is typically constant.*

Plant optimization is the process of fine-tuning operation of each unit process to obtain maximum performance to (1) meet and exceed performance standards, and (2) provide the most efficient method for treatment. Optimization will likely focus on adjustments to the number of UV trains online and hydrogen peroxide dose for the given influent water quality of the wells being treated.

The UV AOP portion, consisting of UV trains and hydrogen peroxide dosing, will be operated at contaminant design log reduction based on maximum modeled concentrations. Since the dominating contaminant pertains to 1,4-dioxane, the log reductions will be based on this target. The operator selected target log reduction will depend on the number of wells operated as follows:

- 3 wells operating – 1.9- Log reduction
- 4 wells operating – 1.8- Log reduction
- 5 wells operating – 1.7- Log reduction

Since monthly sampling will be imposed, the data will be evaluated and help determine if the target log reductions need to be optimized for fine tuning.

6.4 Staffing Requirements

The NHWWT is designed to be a fully automated, unmanned facility, with approximately 2 hours per day of operator visitation time. The facility is equipped with remote monitoring and control performed by the Water Treatment Operators through the TOCC system. Operator duties include:

- **Chief Plant Operator (CPO):** The required certification for CPO is State of California Water Treatment Operator T4. The duties of the Chief Plant Operator, who oversees the NHWWT, include:
    - Schedule, coordinate, assign, and review the work of the NHWWT Water Treatment Operators.
    - Communicate with the NHWWT Plant Engineer and Superintendent.
    - Schedule and coordinate the major maintenance of all equipment with maintenance personnel.
    - Order chemicals and equipment.
    - Recommend and direct implementation of improvements to treatment activities and resources.
    - Conduct interviews, provide training, and administer LADWP policies and procedures, and discipline and reward employees.
- **NHWWT Operator:** The required certification is State of California Water Treatment Operator T3. The duties of NHWWT Operator include:
    - Operate automatic and manually controlled equipment and systems.
    - Monitor and coordinate all routine and emergency activities of all employees and persons on site.
    - Read and evaluate instruments, charts, and recorders and process control computer outputs to monitor plant operations.
    - Adjust dosages of treatment chemicals and monitor storage levels.
    - Place chemical orders and receive chemical deliveries.
    - Perform physical and chemical tests using laboratory equipment and automated instruments to monitor the effectiveness of the treatment.
    - Investigate operating problems and determine causes.
    - Recommend process changes and equipment repairs.
    - Coordinate with maintenance personnel for repair or installation of equipment and systems.
    - Transport, load, connect, and handle all water treatment chemicals.

6.5 Routine Inspection Procedures

Manufacturer's recommendations for inspection and maintenance of moving parts and rotating equipment will be followed and an operations and maintenance manual (OMMP) will be updated based on the first-year operations experience. A summary of the anticipated inspection and maintenance frequency for the facilities includes:

Sand Separators

- Inspect purge valve (daily), hand-hole clean out (annually), and pressure gauges to ensure proper functioning (weekly). For automatic purge valve inspection, physically observe that water is clear when the purge valve closes.
- Clean out hand-hole (annually) to remove particles and debris collected in the chamber when the separator is not in service.

Cartridge Filters

- Inspect pressure gauges to ensure proper functioning (weekly).
- Inspect gaskets and replace (as needed) to ensure an effective seal prior to putting the filter back into service.

UV System

- **Duty UV Sensor:** Verify calibration of duty UV sensor against a reference sensor based on UV reactor control strategy and replace or recalibrate duty UV sensors that fail calibration.
- **Reference UV Sensor:** Calibrate reference UV sensor (annually by qualified facility).
- **UVT Analyzer:** Verify calibration of online UVT analyzer against a reference bench-top UV spectrophotometer (weekly) and clean UVT analyzer and replace parts (when "FAULT: Lamp Low" alarm is generated).
- **UV Spectrophotometer:** Verify calibration of reference bench-top UV spectrophotometer (annually or per manufacturer's recommendations).
- **Flow Meters:** Verify calibration (annually by manufacturer or instrument supplier).
- **UV Lamps:** Replace lamp when low UV intensity caused by low lamp output, or lamp failure alarm is verified.
- **Lamp Sleeves:** Inspect UV sleeves for fouling (bi-annually) and replace sleeve when damage, cracks, or irreversible fouling significantly decreases UV intensity of an otherwise acceptable lamp to the minimum validated intensity level. Check reactor housing, sleeves and wiper seals for leaks (monthly).
- **Mechanical Cleaning System:** Inspect mechanical cleaning system drive mechanism (semi-annually) and check cleaning efficiency of mechanical cleaning system by monitoring the actual vs. calculated UV sensor values. Inspect wipers (annually).
- **Ballast Cooling:** Inspect ballast cooling fan (annually).

Metering Pumps

- Wash down the external surfaces (prior to carrying out any maintenance operations).
- Replace hose (annually or if flow drop by 25% observed).
- Check pump-housing and rotor internals (annually or with hose replacement).
- Replace bearings (per manufacturer's recommendation or when damage is suspected).
- Replace shaft seal (upon replacing bearings or when damage is suspected).
- Replace shaft (upon replacing bearings or when damage is suspected).

GAC Vessels

- Inspect internals (concurrent with scheduled changeout).
- Backwash vessels (after each GAC changeout or if pressure drop in vessel).

7. RELIABILITY FEATURES

The NHWWT system design criteria included several reliability features to account for potential future changes to the contaminant plume or treatment requirements. These include:

- Safety factor on influent concentrations;
- Treated water goal less than DLR;
- Conservative design criteria for water quality;
- Hydrogen peroxide feed capacity; and
- Equipment redundancy.

These design features allow for flexibility should influent concentrations or treatment flow rate increase. The AOP controls will automatically adjust for changes in flow and the operator selected target log reduction. If the treatment goals cannot be met with all UV trains online at the maximum hydrogen peroxide dose, the flow rate to the plant will be reduced or a manual plant shutdown will be triggered.

1,4-Dioxane was the target contaminant for equipment sizing. The influent concentration was selected based on fate and transport modeling of the contaminant plume. Modeling requires assumptions to be made regarding the plume characteristics and movement. To account for potential deviations during operation, the maximum modeled influent concentration was selected as the basis of the design influent concentration and a safety factor of 2 was applied to account for uncertainties. The modeling predicted an influent concentration of up to 7.8 µg/L; the AOP system will be sized to treat up to 20 µg/L of 1,4-dioxane. The treated water quality goal for 1,4-dioxane was selected to be 0.25 µg/L, which is less than the DLR for 1,4-dioxane. This goal was adopted in the event a lower regulatory limit is established in the future based on lower risk assessment levels. The resulting 1,4-dioxane treatment goal was 1.9-log reduction.

Table 7-1 summarizes the maximum 1,4-dioxane and simultaneous VOC concentrations that can be treated through the AOP system under the design conditions. Higher levels of treatment can be achieved if the water quality is better than design, flow is less than design, or the hydrogen peroxide dose is greater than design.

Table 7-1 Maximum Influent Contaminant Concentrations that can be Treated by the AOP System

Contaminant	Estimated Log Reduction	Maximum Influent Concentration [1],[2]
1,4-dioxane	1.9-log	20 µg/L
TCE[3]	>2.0-log	50 µg/L
PCE[3]	>1.7-log	25 µg/L
1,1-DCE[3]	>3.7-log	2,500 µg/L
cis-1,2-DCE[3]	>3.4-log	1,200 µg/L

Notes:

[1] *Assumed treated water concentration of 0.25 µg/L for 1,4-dioxane and 0.5 µg/L for VOCs. The 1,4-dioxane concentration is based on modeling with a safety factor applied; other COC maximum influent concentrations are based on relative removal capacity of the system designed for 1,4-dioxane removal.*

[2] *Assumes treatment under design conditions. Higher concentrations can be treated at expected UVT of >98%, hydrogen peroxide dose increased to 25 mg/L, or use of redundant UV train.*

[3] *Log reduction is based on targeting 1,4-dioxane treatment.*

The UVT is one factor that determines the treatment capacity. All UVT samples to date have been greater than 98%. However, a design UVT value of 97% was selected for equipment sizing. Treatment capacity will be greater than design if the UVT is greater than 97% during operation. Hydroxyl radical scavenging demand is another water quality parameter that determines system sizing. The design hydroxyl radical scavenging demand was based on the most conservative sample that was collect for any of the production wells to date. The hydroxyl radical scavenging demand will be monitoring during the first year of operation to confirm the hydroxyl radical scavenging demand during operation. If the scavenging demand is lower than the design value, the treatment capacity will be increased.

UV AOP treatment capacity is a function of the amount of UV energy delivered and the hydrogen peroxide dose. The UV AOP reactors were designed assuming the lamps were operating at near 100% power and a hydrogen peroxide dose of approximately 20 mg/L. For added treatment capacity, the hydrogen peroxide feed system was designed to dose hydrogen peroxide up to 25 mg/L at the maximum flow rate.

UV reactors will require routine maintenance and must be taken out of service. To account for equipment maintenance, a redundant train would be operated, or the treatment plant flow rate must be reduced. The NHWWT facility includes a redundant UV train. The facility includes three duty UV reactor trains and one redundant UV train. The redundant UV train can be used during normal operation to minimize the hydrogen peroxide dose or increase treatment capacity.

The NHWWT UV AOP facility was designed with a range of reliability features to account for potential uncertainties associated with the future influent contaminant concentrations, treated water goals, and treatment flow rates. Figure 7-1 illustrates the treatment flexibility that is provided with the system as designed. The evaluated uncertainties can all be addressed with the duty UV reactor trains with added treatment capacity provided by the redundant UV reactor train if it is available.

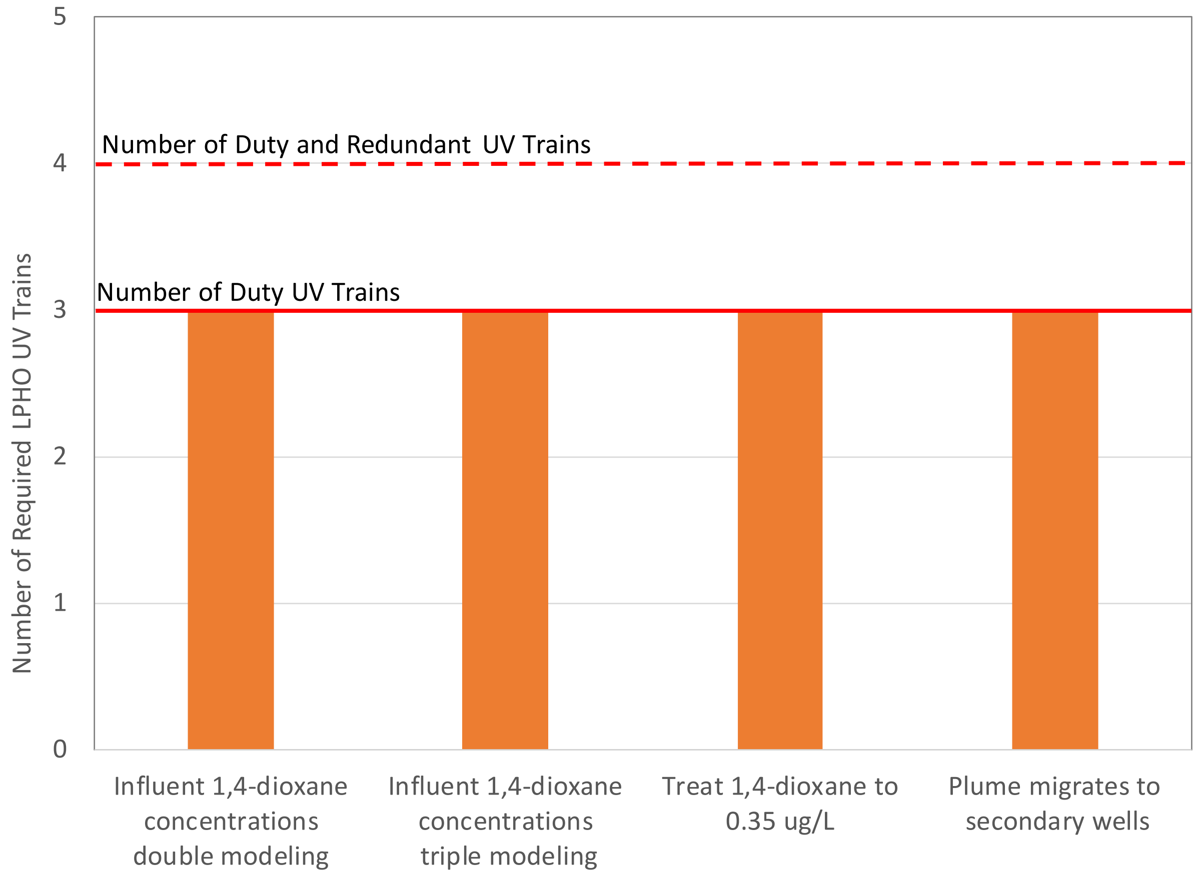

Figure 7-1   Treatment Flexibility for Project Uncertainties

After plant start-up is completed and the treatment plant is in operation, contaminant concentrations for all remediation well will be monitored on a weekly basis to characterize influent water quality. Since the safety factor was applied for sizing the AOP reactor, influent contaminant concentrations will likely be lower than the design value; therefore, treatment may be optimized by adjusting log reduction while maintaining the treated water goals. After NHWWT start-up, water samples will be collected from Remediation Wells and analyzed for each contaminant. Once an appropriate dataset has been generated, the maximum flow weighted concentration for each contaminant will be used for treatment optimization.

8. COMPLIANCE MONITORING AND REPORTING

This section describes the manual and online sampling and analysis plan for treatment monitoring at the NHWWT. The treatment process includes pre-filtration (sand separation and cartridge filtration), UV AOP with hydrogen peroxide, and GAC for hydrogen peroxide quenching. GAC backwash water is designed to be stored and settled in a backwash tank and then recycled back to the head of the treatment process (i.e. prior to sand separators). Figure 5-1 shows the process flow diagram.

8.1 Sampling Locations

The sampling locations are shown in Figure 8-1. Each unit treatment process has sampling locations at the influent and treated water. Treated water from individual UV reactors will be monitored in addition to the combined treated water from the UV reactors. Treated water from individual GAC vessels will be monitored in addition to the combined treated water from the GAC vessels (the treated water from the NHWWT). GAC backwash water will be monitored at various locations, including fresh backwash water, spent backwash water and recycled backwash water (after settling in the backwash tank). Disinfection with chlorine and ammonia additions will occur off-site (at the existing NHW chlorination station). Chlorine and ammonia monitoring are not included in this plan. Sample ports are tentatively coded in this document for convenience, which may be revised closer to commissioning.

8.2 Analytes

The following analyte groups will be monitored for the treatment process (Table 8-1):

- 1,4-Dioxane for monitoring removal by UV AOP.
- VOCs for monitoring removal by UV AOP.
- Hydrogen peroxide for monitoring the dose as a part of UV AOP and quenching as part of GAC.
- General physical characteristics (e.g., pH, temperature, turbidity, alkalinity, hardness, calcium, iron, manganese, and UVT) for water quality monitoring, which also include parameters that may affect the UV lamp fouling thus UV performance.
- Other contaminants with regulatory limits that require routine monitoring as well as potential contaminants that DDW suggests adding to the monitoring program.

In addition to the water quality analytes above, operational parameters will be monitored throughout the treatment process, including but not limited to flow rate, water pressure, and parameters for UV performance (e.g., UV lamp status) and GAC operation (e.g., backwash frequency).

All active wells in the NHW Well Field will be sampled for the analysis detailed in Table 8-2.

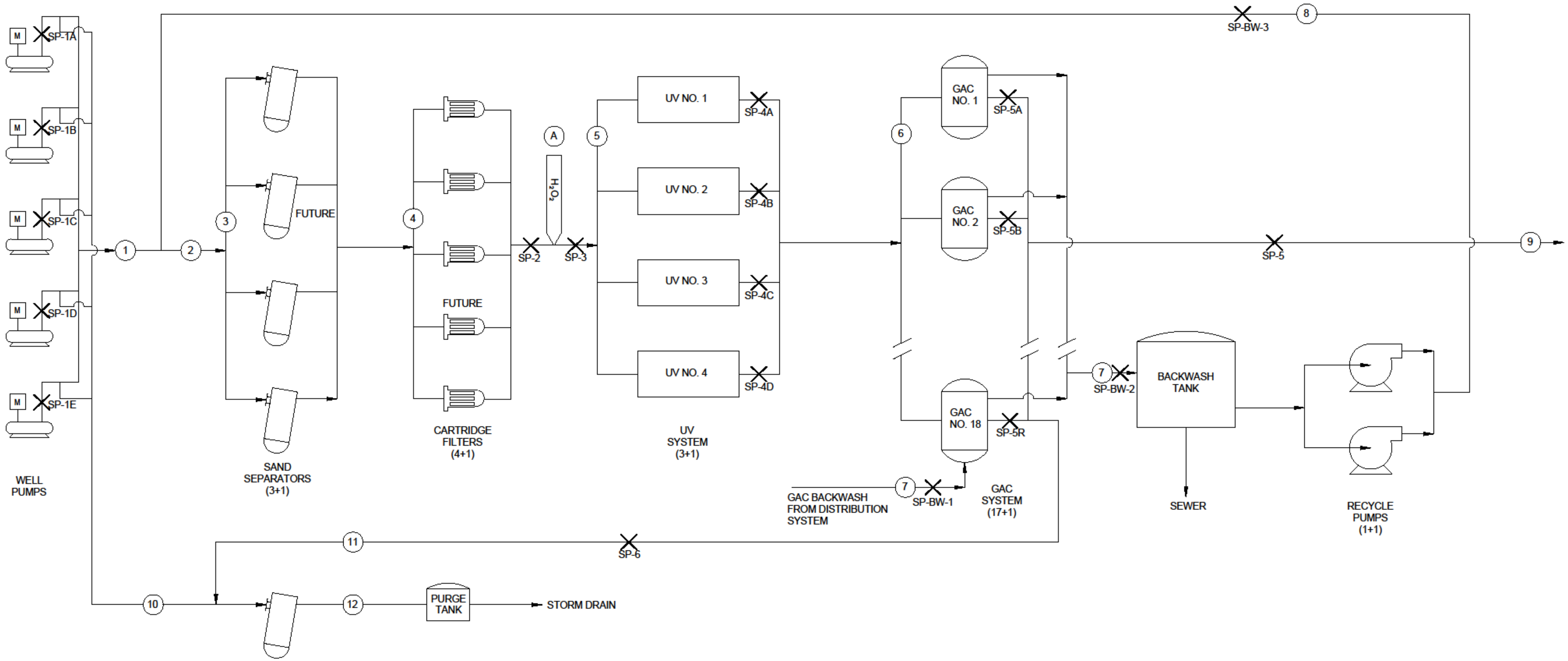

Figure 8-1 Sampling Locations for NHWWT

Note:

Sampling locations are marked as "SP"

Table 8-1 Sampling Locations and Analytes

Sample Port Designation	Sample Type	Sample Location	Field or Online Analytes	Lab Analytes
SP-1A through 1E	Well Water	NH-34, NH-37, NH-45 NH-43A, and NH44	pH, Temp, Turbidity	VOCs, 1,4-dioxane, Ca, alkalinity, hardness, Fe, Mn
SP-2	Raw Water	UV reactor influent before H_2O_2 addition	Turbidity	1,4-Dioxane, VOCs
SP-3	Raw Water	UV reactor influent after H_2O_2 addition	UVT, Hydrogen Peroxide	--
SP-4A through 4D	Treated Water	Individual UV reactor effluents	Hydrogen Peroxide	1,4-Dioxane, VOCs
SP-5A through 5R	Treated Water	Individual GAC vessel effluents	Hydrogen Peroxide	--
SP-5	Treated Water	Combined GAC effluent	Hydrogen Peroxide, Nitrate	1,4-Dioxane, VOCs, Nitrate
SP-6	Purge Tank	Sewer Discharge line	To comply with City of LA Waste Industrial Permit	To be determined
SP-BW-1	Raw water	GAC fresh backwash water	Turbidity	TSS
SP-BW-2	Spent Water	GAC spent backwash water	Turbidity	TSS
SP-BW-3	Spent Water	GAC backwash recycle	Turbidity	TSS

Notes: *Ca – Calcium; Fe – Iron; Mn – Manganese; Temp – Temperature; UVT – Ultraviolet transmittance; VOCs – Volatile organic compounds (TCE, PCE, 1,1-DCE, cis-1,2-DCE); Oxidation by-products include total trihalomethanes (TTHMs), haloacetic acids (HAA5), & Assimilable organic carbon (AOC); HPC – Heterotrophic Plate Count; TSS – Total Suspended Solids.*

Table 8-2 NHW Well Field Sampling

Well	Sample Location	Field or Online Analytes	Lab Analytes
NH-04, NH-07, NH-22, NH-23, NH-25, NH-26, NH-32, NH-33, NH-36	Well Water	pH, Temp, Turbidity	VOCs, 1,4-dioxane
NH-34, NH-37, NH-45 NH-43A, and NH-44	Well Water	pH, Temp, Turbidity	VOCs, 1,4-dioxane, TSS, Ca, alkalinity, hardness, Fe, Mn

Notes: *VOCs – Volatile organic compounds; Ca – Calcium; Fe – Iron; Mn – Manganese; TSS – Total Suspended Solids.*

8.3 Sampling Frequency

Long term sampling frequencies are summarized in Table 8-3. In the event that a 1,4-dioxane or VOC detection above the DLR is observed, more frequent monitoring will be triggered:

- Detection during weekly monitoring will trigger daily sampling until seven consecutive daily samples are non-detect.
- Detection during monthly monitoring will trigger weekly monitoring until four consecutive weekly samples are non-detect.

Table 8-3 Sampling Frequency

Sample Port Designation	Sample Location	Frequency
SP-1A through 1E	NH-34, NH-37, NH-45 NH-43A, and NH44	Monthly
SP-2	UV reactor influent before H_2O_2 addition	Monthly (1,4-Dioxane, VOCs)
SP-3	UV reactor influent after H_2O_2 addition	Online (UVT, H_2O_2)
SP-4A through 4D	Individual UV reactor effluents	Monthly (1,4-Dioxane, VOCs)
SP-5A through 5R	Individual GAC vessel effluents	Monthly or as needed (H_2O_2)
SP-5	Combined GAC effluent	Monthly (1,4-Dioxane, VOCs)

Sample Port Designation	Sample Location	Frequency
		Weekly (H_2O_2)
		Online (H_2O_2)
SP-6	Purge Tank	Disposing water to sewer
SP-BW-1	GAC fresh backwash water	NS
SP-BW-2	GAC spent backwash water	NS
SP-BW-3	GAC backwash recycle	NS

Note:

NS – Not sampled as part of monitoring program for compliance purpose but available sampling location if needed for diagnostics; VOCs – Volatile organic compounds; H_2O_2 – Hydrogen peroxide; GAC – Granular Activated Carbon

8.4 Analytical Methods and Method Reporting Limits (MRLs)

Analytical methods and MRLs are summarized in Table 8-4 below.

Table 8-4 Analytical Methods and MRLs

Analyte	Analytical Method	Reporting Limit
Hydrogen Peroxide	Triiodide Method or Peroxidase Method	To be determined
1,4-Dioxane	EPA 522	0.5 µg/L
VOCs	EPA 524.2	Varies
pH	SM 4500 H+B	Not Applicable
Alkalinity	SM 2320B	20 mg/L as $CaCO_3$
Hardness	SM 2340C/EPA 200.7	5 mg/L
Calcium	EPA 200.7	2 mg/L
Iron	EPA 200.7	20 µg/L
Manganese	EPA 200.7/EPA 200.8	2 µg/L
TSS	SM 2540D	5 mg/L
Turbidity	SM 2130B/EPA 180.1	0.10 NTU
UVT	UVT Online Analyzer	Not applicable
Nitrate	EPA 353.2	0.4 mg/L

8.5 Quality Control (QC)

QC samples will be collected in the field and laboratory for evaluating precision, accuracy, representativeness, comparability and instrument sensitivity. Approximately 10% of field and laboratory samples will be collected for QC samples (which will not be identified as QC samples when submitted to the laboratory).

8.6 Reporting

Monthly reports will be prepared and submitted to DDW that will detail the amount of water treated, and the amount of water produced and delivered to the distribution system. A summary of all required analytical results for the production wells, NHWWT influent, NHWWT treatment trains, and NHWWT treated water will be included in the monthly report. The report will also state the production wells in operation, duration of operation, and pumping volume for each well. The monthly report will include the following reports.

- Daily UV AOP Reactor Operational Report
- Daily Operational Summary Report
- Monthly Operational Summary Report
- Quarterly UV Sensor Calibration Check Report
- Weekly UVT Analyzer Calibration Check Report

Draft templates for the above-listed reports are provided in Appendix D.

9. NOTIFICATION PLAN

This section provides a plan describing the emergency contacts for various emergency conditions for the NHWWT. LADWP has an Emergency Notification Plan (ENP) that provides contacts for LADWP and the regulatory agencies in the event of an emergency. The ENP is included as Appendix E.

- *In the case of injury, fire, or significant system damage, the operator should call 911.*
- *In the case of a spill or emission of untreated water outside of the containment area, spill control contractor should be contacted.*
- *In the case of a discharge violation, DDW, California Regional Water Quality Control Board, Department of Toxic Substances Control (DTSC) and EPA must be informed immediately.*

10. SOURCE WATER QUALITY SURVEILLANCE

The NHWWT Water Quality Surveillance Plan (WQSP) is provided in Appendix B. The WQSP includes monitoring groundwater quality between the origin of the contamination and the NHWWT facility. The WQSP identifies monitoring wells within the 2, 5, and 10-year capture zones of the NHW Well Field that will serve as sentinel wells to provide early warning of any unexpected increases in contaminant concentration or detection of additional contaminants. The WQSP also identifies the list of analytes to be monitored, provides analytical schedules, and sampling methodologies.

11. REFERENCES

Division of Drinking Water (DDW) (formerly California Department of Public Health), 2015. Addressing the Direct Domestic Use of Extremely Impaired Sources, Process Memo 97-005. Initially Established November 5, 1997, revised March 25, 2015 (Draft).

EPA (Environmental Protection Agency). 2006. Treatment Technologies for 1,4-Dioxane: Fundamentals and Field Applications. EPA-542-R-06-009. December 2006.

EPA (Environmental Protection Agency). 2011b. "1,4-Dioxane/Ultraviolet Irradiation + Hydrogen Peroxide." June 2011. Accessed September 2, 2015.

LADWP, 2016. Interim Remedial Investigation / Feasibility Study Report, North Hollywood West Well Field. December 2016.

Los Angeles Department of Water and Power, 2017. Raw Water Quality Characterization for North Hollywood West (Step 2 of 97-005 Evaluation). July 2017. Issued as DRAFT FINAL to DDW on July 25, 2017.

Appendices

Appendix A Treated Water Goals Evaluation

APPENDIX A: TREATED WATER GOALS EVALUATION

EFFECTIVE TREATMENT AND MONITORING

NORTH HOLLYWOOD WEST WELL FIELD

(Step 4 of 97-005 Evaluation)

Prepared for

California State Water Resources Control Board, Division of Drinking Water

Prepared on Behalf of

Los Angeles Department of Water & Power

Water Quality Division, Groundwater Remediation Group

Prepared by

Owner's Agent Team led by Hazen and Sawyer (Hazen) with primary input from Worley

December 2020

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LIST OF ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Term
%	Percent
µg	Microgram
µg/L	Microgram(s) Per Liter
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2,3-TCP	1,2,3-Trichloropropane
1,2-DCA	1,2-Dichloroethane
CalEPA	California Environmental Protection Agency
cis-1,2-DCE	cis-1,2-Dichloroethene
COPC	Constituent of Potential Concern
Cr(VI)	Hexavalent Chromium
DDW	Division of Drinking Water
DEHP	Di(2-ethylhexyl)phthalate
DLR	Detection Limit for Reporting
EPC	Exposure Point Concentrations
Hazen	Hazen and Sawyer
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
L	Liters
LADWP	Los Angeles Department of Water and Power
MCL	Maximum Contaminant Level
MOA	Mode of Action
N	Nitrogen
NDMA	N-Nitrosodimethylamine
NH	North Hollywood
NHW	North Hollywood West

Acronym/Abbreviation	Term
NHWWT	North Hollywood West Wellhead Treatment
NL	Notification Level
NOAEL	No-Observed-Adverse-Effect Level
OEHHA	Office of Environmental Health Hazard Assessment
PCE	Tetrachloroethene
PHG	Public Health Goal
RAA	Running Annual Average
RfC	Reference Concentration
RfD	Reference Dose
RL	Response Level
RWQC	Raw Water Quality Characterization
SA	(Drinking Water) Source Assessment
SFB	San Fernando Basin
SVOCs	Semi-Volatile Organic Compounds
SWRCB	State Water Resources Control Board
TCE	Trichloroethene
THMs	Trihalomethanes
TRV	Toxicity Reference Value
UCL95	95 Percent Upper Confidence Level of the Arithmetic Mean
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1. INTRODUCTION

This report documents the treated water goals evaluation for the City of Los Angeles Department of Water and Power's (LADWP's) North Hollywood West (NHW) Well Field. LADWP proposes to remediate groundwater contamination and restore the beneficial uses of groundwater in the vicinity of the NHW Well Field by extracting and treating impacted groundwater from three wells, with the design that would allow for future expansion of the treatment facility to allow for the treatment of up to five wells[1]. The treated water will be used as a source of potable water supply. The treatment facility is referred to as the North Hollywood West Wellhead Treatment (NHWWT) facility for the purposes of this evaluation. Figure 1-1 presents the NHW Well Field Study Area, the locations of the NHW production and monitoring wells, as well as the approximate footprint of the NHWWT facility.

LADWP conducted the evaluation of treated water goals in accordance with Section 4, Part C of the Division of Drinking Water (DDW)'s 97-005 Process Memo for Direct Domestic Use of Extremely Impaired Sources, issued in 1997 and updated in draft form in March 2015 (hereafter referred to as "DDW Process Memo 97-005"). As stated in DDW Process Memo 97-005 (DDW, 2015):

> "*The purpose of establishing treated water goals is to ensure the cumulative risk of multiple contaminants under normal operation has been addressed.*"

DDW considers extremely impaired sources to be those that contain, or are likely to contain, high concentrations of contaminants, multiple contaminants, or unknown contaminants. Because the Policy Memo (DDW, 1997) was issued to address proposals to reuse water generated from large remediation projects such as Superfund sites, it addresses the potential for cumulative risks from a number of contaminants that would be expected from such cleanups. The DDW Process Memo 97-005 outlines a method for evaluating treatment goals for extremely impaired sources. One of the key objectives of this approach is to set treated water goals to the lowest concentrations feasible while ensuring protection of human health.

The treated water goals developed herein apply to the effluent produced by the NHWWT facility. As discussed above, NHWWT will comprise treatment of three Remediation Wells, designed to permit future expansion to enable treatment of five Remediation Wells. Therefore, the following two Treated Water flows have been considered in this evaluation to represent the bracketed treatment options of the NHWWT (referred to as "*book-ends*"):

- **Three Remediation Well Treatment** - NHWWT effluent based on the collective flow from three Remediation Wells: NH-34, NH-37 and NH-45; and
- **Five Remediation Well Treatment** - NHWWT effluent based on the collective flow from five NHW Remediation Wells: NH-34, NH-37, NH-43A, NH-44 and NH-45.

The locations of the Remediation Wells are shown in Figure 1-1.

In addition, assessments were conducted for two additional NHW Well Field flows:

---

[1] The five well alternative is evaluated to avoid the need for a new or amended permitting, in the event that a future response action involves pumping wells NH-43A and NH-44 and conveying water from those wells to an expanded NHWWT, following compliance with the National Contingency Plan.

- ***Untreated Water*** flow which comprises the collective flow from eight untreated NHW production wells; and
- ***Combined Flow*** which comprises the collective flow of Untreated Water plus Treated Water (NHWWT effluent).

The purpose of these additional assessments was to establish a holistic and robust understanding of the potential risks posed by constituents of potential concern (COPCs) in individual and combined NHW flows which will be sent to the North Hollywood Pump Station once the NHWWT facility is operational. A diagram showing the different NHW Well Field flows is presented in Figure 1-2.

It is imperative that the Step 2 report for the NHW Well Field 97-005 Evaluation (i.e. Full Characterization of the Raw Water Quality [Step 2]) is read prior to, or in conjunction with this report.

1.1 Purpose

In accordance with the DDW Process Memo 97-005, the purpose of this evaluation is to establish treated water goals for the NHWWT facility to ensure the cumulative risk of multiple contaminants under normal operation has been addressed.

1.2 List of COPCs

The list of COPCs adopted for the treated water goals assessment comprises:

- All COPCs identified in the Raw Water Quality Characterization (RWQC) for NHW Well Field (Step 2 of 97-005 Evaluation) for both production and monitoring wells;
- Constituents which exceeded 10% of their Maximum Contaminant Level (MCL) or Notification Level (NL) in production wells and fall into one or more of the following categories:
    - Semi-Volatile Organic Compounds (SVOCs);
    - Volatile Organic Compounds (VOCs);
    - Inorganic constituents which:
        - Are known contaminants in the San Fernando Basin (SFB); and
        - Were identified as COPCs with anthropogenic source(s) within the NHW Well Field Study Area, as described in the Drinking Water Source Assessment and Contaminant Assessment (SA/CA; Step 1 of the 97-005 Evaluation). For example, Hewitt Landfill, which is located within the NHW Study Area, is an identified contamination site.

The list of COPCs is further discussed in Section 2. In accordance with DDW Draft Policy Memo 97-005, MCL-equivalents for the COPCs were evaluated separately for acute and chronic effect endpoints.

1.3 Treated Water Goals Evaluation Approach

For the purposes of treated water goals evaluation, DDW's MCL-equivalent approach was adopted. DDW developed the MCL-equivalent approach for assessing the appropriateness of treatment for an extremely impaired source with multiple COPCs. This approach evaluates the COPCs in terms of MCL-equivalents, or when MCLs are not available, surrogate values for MCL-surrogate-equivalents.

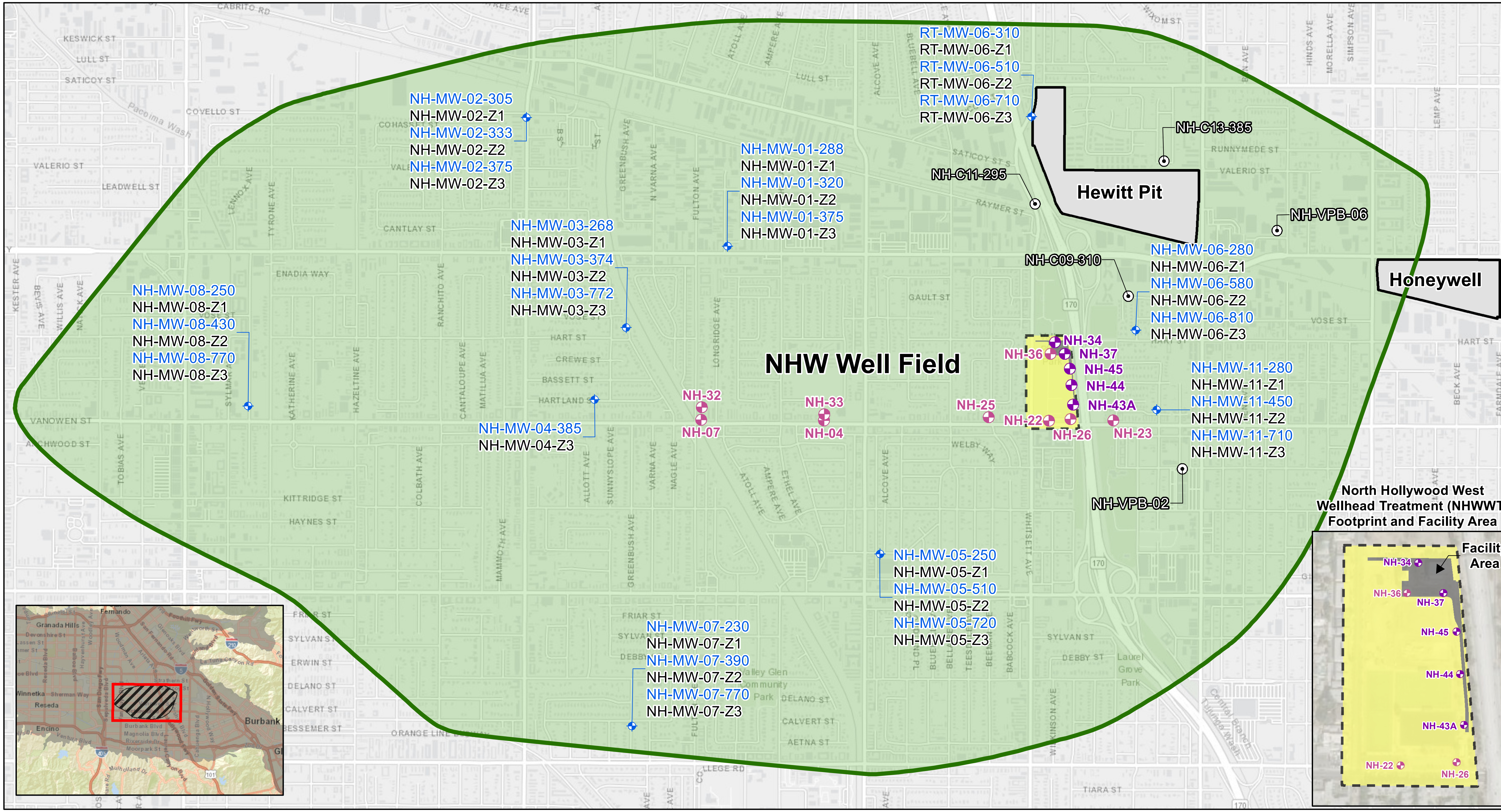
It is DDW's belief that the MCL-equivalent approach is a prudent and practical approach which, if implemented accordingly, provides extra caution in the protection of public health (DDW, 2015).

Further discussion as to the MCL-equivalent methodology is provided in Section 2.

1.4 Determination of COPC Concentrations

For the development of treated water goals, estimated COPC concentrations were adopted from the NHW RWQC (Step 2 of 97-005 Evaluation). The RWQC report evaluated COPC concentrations based on production well and monitoring well statistics, estimating anticipated COPC concentrations for two treated water flows (i.e., the collective flow from three[2] or five[3] Remediation Wells).

[2] NH-34, NH-37 and NH-45
[3] NH-34, NH-37, NH-43A, NH-44 and NH-45



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Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Note:
Features shown on this figure are approximate and should be used for indicative purposes.

Legend

- USEPA MONITORING WELLS
- REMEDIATION WELLS
- NHW PRODUCTION WELLS
- GSIS MONITORING WELLS
  - NH-MW-08-270 Well ID (Former)
  - NH-MW-08-Z1 LADWP Well ID
- NHW STUDY AREA BOUNDARY (10 YR CAPTURE ZONE)

LA DWP Los Angeles Department of Water & Power

Hazen ARCADIS Advisian

SWL	SB	10/30/2020

NORTH HOLLYWOOD WEST (NHW) WELL FIELD STUDY AREA

308038-13235
302 DDW 97-005

1-1

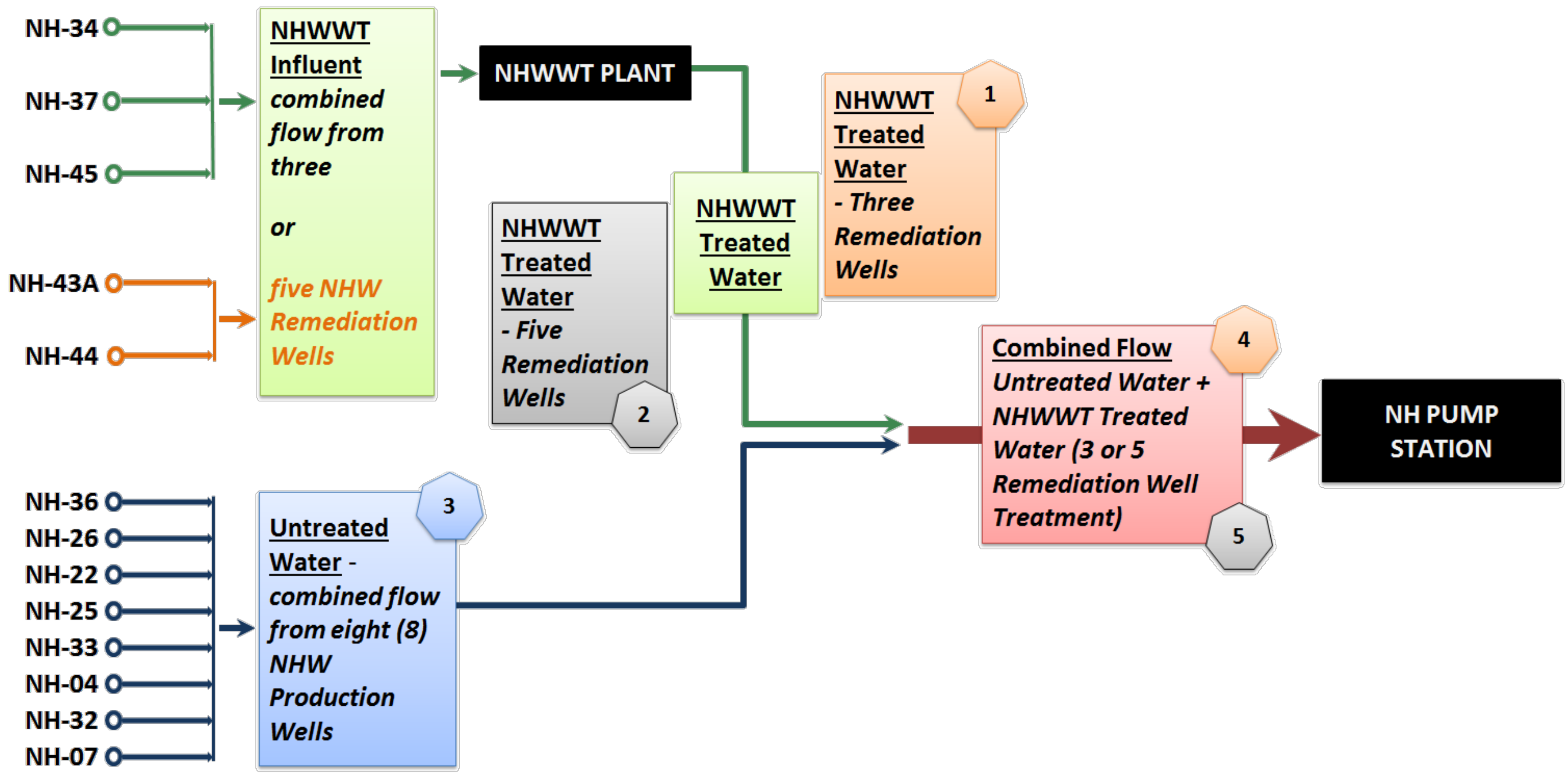

Figure 1-2 NHW Well Field Flows Diagram

2. METHODOLOGY

For the purposes of this treated water goals assessment, DDW's MCL-equivalent approach was adopted to assess the cumulative risk from multiple COPCs as described in the following subsections.

2.1 MCL-Equivalent Approach

As stated above, DDW developed the MCL-equivalent approach for assessing the appropriateness of treatment for an extremely impaired source with multiple COPCs. This approach comprises the evaluation of COPCs in terms of MCL-equivalents, or when MCLs are not available, surrogate values for MCL-surrogate-equivalents. Potential surrogates include the following:

- For non-regulated contaminants with DDW Notification Levels (NLs[4]), the surrogate value is equal to one-tenth of the contaminant's Response Level (0.1 RL[5]).
    - Note - the only non-regulated COPC with a DDW NL included in the NHW MCL-equivalent assessment is 1,4-dioxane, and in accordance with DDW guidance, the adopted MCL-surrogate was 3.5 µg/L (0.1 x 35 µg/L [RL]). Furthermore, the only non-regulated COPC (with no DDW NL) included in this evaluation is Cr(VI). As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent, the former MCL (10 µg/L) was adopted as an MCL-surrogate for the purposes of the MCL-equivalent assessments.
- For non-regulated contaminants without DDW NLs, but with United States Environmental Protection Agency (USEPA) Health Advisory Levels, the surrogate value is equal to 10^{-5} cancer risk level (that is, one tenth of the contaminant's Health Advisory Level for a carcinogen). For non-carcinogens, the Lifetime Health Advisory Level may be used as the MCL-surrogate.
    - Note - none of the COPCs evaluated in this assessment were in this category.
- Where NLs/RLs or USEPA Health Advisory Levels do not exist, a risk assessment following standard procedures can enable the determination of the surrogate MCL-equivalent values for this evaluation.
    - Note - none of the constituents evaluated in this assessment were in this category.

The approach to evaluating MCL-equivalents uses the ratio of anticipated COPC concentration to MCL (or MCL-surrogate) for each COPC. The MCL-equivalent for each COPC is calculated as follows:

$$MCL\ equivalent\ (unitless\ [ratio]) = \frac{\text{COPC Concentration}}{\text{MCL (or MCL surrogate)}}$$

The overall MCL-equivalent of the flow evaluated (i.e., Treated Water, Untreated Water and Combined Flow) is the sum of individual COPC MCL-equivalents for each applicable risk group (i.e., acute and chronic effect endpoints). For the treatment to be deemed '*appropriate*', the sum of the MCL-equivalents needs to be less than or equal to 1. If known COPCs can be reduced to an overall

[4] Notification Level (NL) – this is a health-based advisory levels established by DDW for chemicals in drinking water that lack maximum contaminant levels (MCLs). (http://www.swrcb.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.shtml).

[5] Response Level (RL) – this is the level at which DDW recommends removal from service of the source that contains the contaminant. The RL is equal to a 10^{-4} risk level for contaminants considered to pose a carcinogenic risk, and 10 times the NL for non-carcinogens.

MCL equivalent of 1 or lower (or even 0) for the mixture of COPCs, it is DDW's belief that a prudent and practical approach has been implemented in providing extra caution in the protection of public health (DDW, 2015).

If the anticipated treated water concentration of a COPC is estimated to be 'non-detect' at the applicable DDW detection limit for the purposes of reporting (DLR[6]), its MCL-equivalent is 0. If the anticipated treated water concentration of a COPC is below the DDW DLR then the concentration is described as 'non-detect' and its MCL-equivalent is also 0.

Thus, in accordance with DDW Draft Policy Memo 97-005, the treated water goals evaluation presented herein includes the following:

- A list of constituents that will be or are likely to be present in water delivered to consumers under normal anticipated operations and the maximum concentrations.
- For each constituent listed, its MCL or MCL-surrogate (0.1 RL or similar concentration determined from an USEPA Health Advisory Level[7] or other appropriate risk assessment for the contaminant), and its DLR as applicable.
- The normal anticipated and maximum constituent concentrations.
- The MCL-equivalent (ratio) of the concentration of each COPC to its MCL or MCL-surrogate. In accordance with DDW guidance, constituents were separated by the primary health concern (i.e., acute or chronic health risk groups; Section 2.2).

2.2 Mode of Action Analysis

In performing a human health risk assessment (HHRA), COPCs are evaluated for the potential to belong to two major groups: carcinogens - constituents with the capability of inducing cancer via one or more exposure pathways (ingestion, inhalation or dermal contact); and non-carcinogens -- constituents that at sufficient concentrations may induce effects to an organ (e.g., liver) or organ system (e.g., nervous system). Mathematically speaking, the ratio of exposure concentration to a threshold reference dose (RfD) or reference concentration (RfC) is called the hazard quotient (HQ). If the HQ (or HI, the hazard index, which is the sum of all HQs) is greater than unity or one, i.e., the exposure level exceeds the threshold RfD or RfC, a potential may exist for adverse non-carcinogenic health effects. Conversely, if the HQ or HI is equal to or less than one, exposures to the COPCs are not expected to result in a systemic toxic response.

[6] DLRs are established limits for contaminants monitored by public water systems under the California Safe Drinking Act. DLRs are the lowest concentration of a regulated chemical that needs to be reported by a laboratory for regulatory compliance purposes.

[7] Lifetime Health Advisory Level (Lifetime HA) – the concentration of a constituent in drinking water that is not expected to cause any adverse non-carcinogenic effects for a lifetime of exposure, calculated using the oral Reference Dose and incorporating a drinking water Relative Source Contribution factor of contaminant-specific data or a default of 20 percent of total exposure from all sources.

If HIs are found to be greater than 1.0, applicable HHRA methodology (both Federal and State[8&9]) recommends summing exposure to all media for chemicals that have the same toxic mechanism or affect the same target organ system (e.g., hepatic [liver], renal [kidneys], hematological etc.). This is called a mode of action (MOA) analysis. In this case, if the MCL-equivalent (which can be thought of as being analogous to the HI), is greater than 1.0, a MOA analysis can be conducted.

Table 2-1 presents the relevant organ/systems potentially affected by exposure to COPCs in NHW groundwater. The effects cited are those that correspond to the most conservative toxicity reference values (TRV(s)) used in the HHRA conducted for the NHW Well Field (Hazen and Sawyer, 2016). However, it is important to note that some of the COPCs have multiple toxic endpoints. Thus, the following were selected:

- Trichloroethene (TCE): Although TCE affects multiple organ systems, Proposition 65 lists it as a developmental and reproductive toxicant.
- Tetrachloroethene (PCE): Also affects multiple organ systems; the RfD's principle study is based on neurotoxicity (USEPA, online).

2.3 List of COPCs Considered

The list of COPCs considered for the treated water goals assessment is provided Table 2-1. This list was determined based on the criteria outlined in Section 1.2. It should be noted that chlorate was identified as a COPC in the NHW RWQC (Step 2 of 97-005 Evaluation) but was omitted from the MCL-equivalent assessment as it is considered a disinfection by-product.

[8] CalEPA (California Environmental Protection Agency), 2015. Department of Toxic Substances Control (DTSC) Preliminary Endangerment Assessment (PEA) Guidance Manual. Revised October 2015.
[9] USEPA (United States Environmental Protection Agency), 1989. Risk Assessment Guidance for Superfund (RAGS): Volume 1 - Human Health Evaluation Manual (Part A). EPA/540/1 89/002. December.

Table 2-1 NHW Well Field COPCs Considered for MCL-Equivalent Assessment

Contaminant Risk Group	Mode of Action	COPC	Detection Limit for Reporting (DLR) [µg/L]	Regulated or Unregulated	COPC Identified In
Acute	Hematological	Nitrate as Nitrogen (N)	400	Regulated	Production and Monitoring Well(s)
Chronic	Hepatic (Liver)	1,1-Dichloroethene (1,1-DCE)	0.5	Regulated	Production Well(s)
		1,2,3-Trichloropropane (1,2,3-TCP)	0.005	Regulated	Production Well(s)(1)
		1,2-Dichloroethane (1,2-DCA)	0.5	Regulated	Monitoring Well(s)
		1,4-Dioxane	1.0	Unregulated	Production and Monitoring Well(s)
		Di(2-ethylhexyl)phthalate (DEHP)	3	Regulated	Monitoring Well(s)
		Hexavalent Chromium (Cr[VI])	1	Refer to Note(2)	Refer to Note(3)
	Immunological	Benzene	0.5	Regulated	Monitoring Well(s)
	Neurological	Tetrachloroethene (PCE)	0.5	Regulated	Production and Monitoring Well(s)
	Renal (Kidneys)	1,1-Dichloroethane (1,1-DCA)	0.5	Regulated	Monitoring Well(s)
		Cis-1,2-Dichloroethene (cis-1,2,-DCE)	0.5	Regulated	Monitoring Well(s)
	Reproductive/Developmental	Trichloroethene (TCE)	0.5	Regulated	Production and Monitoring Well(s)

Notes:

(1) *As noted in Step 2 of the 97-005 Evaluation (RWQC) for NHW Well Field, although 1,2,3-TCP exceeded its MCL (or NL as was applicable at the time of reporting for the RWQC), it was not included as a primary COPC due to the limited number of detections for this constituent in production wells. However, this constituent is included in the MCL-equivalent assessment as it is a VOC which exceeds 10% of the MCL in production wells. This constituent was also identified in Step 1 of 97-005 Evaluation as a primary COPC for Hewitt Landfill (a known contamination source within the NHW Study Area).*

(2) *As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation.*

(3) *Hexavalent Chromium (Cr[VI]) is included in the MCL-equivalent assessment as it is an inorganic constituent which exceeds 10% of the MCL (see note 3 above) in production wells and was identified in Step 1 of 97-005 Evaluation as a primary COPC for Hewitt Landfill (a known contamination source within the NHW Study Area). The other primary COPCs identified for Hewitt Landfill but not considered in the MCL-equivalent assessment were perchlorate and n-nitrosodimethylamine (NDMA); these constituents were not considered as they were non-detect for all samples in production wells (as summarized in Step 2 of the 97-005 Evaluation (RWQC) for NHW Well Field).*

2.4 Determination of COPC Concentrations for MCL-Equivalent Assessments

For the development of treated water goals, estimated COPC concentrations in NHWWT influent were taken from the NHW RWQC (Step 2 of the 97-005 Evaluation). This report provides comprehensive tables summarizing the expected range of concentrations of COPCs in the raw water at the NHWWT inlet (influent) based on various statistics to account for the uncertainty in estimating future concentrations. Influent concentrations were evaluated based on production well and monitoring well statistics, estimating the anticipated range in COPC concentrations in NHWWT influent comprising the collective flow from three or five Remediation Wells at NHW Well Field. A full description of the methodology and results of statistical analysis are provided in the NHW RWQC (Step 2) report.

COPC concentrations for normal anticipated NHWWT operation, as well as maximum concentrations were determined as follows:

- **Normal Anticipated Concentrations:** adopted COPC concentrations from production wells statistics based on the 95 Percent Upper Confidence Level of the Arithmetic Mean (UCL95) or maximum detection where UCL95 is not available, as presented in the NHW RWQC.
- **Maximum Concentrations:** adopted COPC concentrations from production well statistics based on maximum detected concentrations, as presented in the NHW RWQC.

Production well data is considered the primary data source for this evaluation. However, further assessment of the potential future COPC concentrations was conducted through an evaluation of monitoring well statistics (these were also presented in the NHW RWQC). The purpose of that evaluation was to ascertain potential unforeseen future conditions (e.g., additional COPCs in plant influent etc.). As discussed in the NHW RWQC (Step 2) report, the approach adopted for estimating future COPC concentrations based on monitoring well data was considered to be conservative as it did not consider any transport mechanisms which may act to reduce or retard plume migration such as attenuation, retardation or degradation as constituents travel from the monitoring well to the receptors (i.e., production wells). In addition, estimates of future COPC concentrations based on monitoring well data did not consider any improvements to groundwater quality as a result of planned remediation activities associated with water flowing towards the production wells supplying water to the NHWWT.

3. NHWWT EFFLUENT MCL-EQUIVALENT ASSESSMENT RESULTS

As described in Section 1, the treated water goals developed herein apply to the effluent (Treated Water) produced by the NHWWT.

The NHWWT comprises treatment of three Remediation Wells with the design that would allow for future expansion to enable the treatment of five Remediation Wells [10].

Therefore, the following two Treated Water flows have been considered in this evaluation to represent the bracketed treatment options of the NHWWT ("*book-ends*"):

- **Three Remediation Well Treatment** - NHWWT effluent based on the collective flow from three Remediation Wells: NH-34, NH-37 and NH-45; and
- **Five Remediation Well Treatment** - NHWWT effluent based on the collective flow from five NHW Remediation Wells: NH-34, NH-37, NH-43A, NH-44 and NH-45.

As shown in Figure 1-2, the collective flow from the Remediation Wells (three or five) enter into the NHWWT facility where it is treated and discharged as Treated Water (NHWWT effluent). This Treated Water mixes with the Untreated Water to produce the Combined Flow.

The locations of the Remediation Wells (previously operational NHW production wells) are shown in Figure 1-1.

In the following subsections, the results of the MCL-equivalent assessments for the NHWWT effluent (Treated Water) are presented for the two Treated Water flows (three and five well treatment). In accordance with the DDW Process Memo 97-005, normal anticipated and maximum COPC concentrations were calculated and included in the MCL-equivalent assessment.

3.1 Three Remediation Well Treatment

Three Remediation Well Treatment comprises the collective flow (*influent*) from three Remediation Wells (NH-34, NH-37 and NH-45), which will be treated at the NHWWT. The locations of the wells are shown in Figure 1-1.

Table 3-1 presents the MCL-equivalent assessment results for Three Remediation Well Treatment based on production well data. A summary of these MCL-equivalent assessment results is provided in Table 3-3. This table also includes a summary of the overall MCL-equivalent assessment results obtained from using monitoring well data (full MCL-equivalent assessment results are provided in Attachment A).

In summary, based on production well data, the overall MCL-equivalent for the acute risk COPCs is 0.35 under normal anticipated NHWWT operation and 0.48 when maximum COPC concentrations are considered. The overall MCL-equivalent for the chronic risk COPCs is 0.43 under normal anticipated NHWWT operations and 0.44 when maximum COPC concentrations are adopted. The only COPCs that contributed to the Treated Water overall MCL-equivalent were nitrate, 1,1-DCA and Cr(VI) (Table 3-4).

[10] It is still to be determined whether the influent from wells NH-43A and NH-44 will feed to the NHWWT plant or the North Hollywood Central (NHC) plant, hence 3 and 5 remediation well treatment were considered in this evaluation.

As discussed in Section 2.4, the same MCL-equivalent assessments were conducted using monitoring well data. As presented in Table 3-3, the overall MCL-equivalent for the acute risk COPCs is 0.27 under normal anticipated NHWWT operation and 0.37 when maximum COPC concentrations are adopted. The overall MCL-equivalent for the chronic risk COPCs is 0.13 under normal anticipated NHWWT operations and 0.58 when maximum COPC concentrations are adopted in MCL-equivalent calculations. As discussed in the NHW RWQC (Step 2 of 97-005 Evaluation), the approach adopted for estimating future COPC concentrations based on monitoring well data is considered to be very conservative as it did not incorporate any transport mechanisms which may act to reduce or retard plume migration such as attenuation, retardation or degradation as constituents travel from the monitoring well to the receptors (i.e., production wells). The rationale for adopting this conservative approach was to support the development of a robust water quality surveillance plan which considers not only COPCs identified in production wells, but also those present within the entire NHW Study Area (Figure 1-1).

As the overall MCL-equivalents for both acute and chronic risks COPCs is below the DDW draft guidance threshold of ≤1.0, the level of treatment provided by the three remediation well NHWWT would be acceptable.

3.2 Five Remediation Well Treatment

Five Remediation Well Treatment comprises the collective flow (*influent*) from five Remediation Wells (NH-34, NH-37, NH-43A, NH-44 and NH-45), which will be treated at the NHWWT. The locations of the wells are shown in Figure 1-1. This alternative is evaluated to avoid the need for a new or amended permitting, in the event that a future response action involves pumping wells NH-43A and NH-44 and conveying water from those wells to an expanded NHWWT, following compliance with the National Contingency Plan.

Table 3-2 presents the MCL-equivalent assessment results for the Five Remediation Well Treatment based on production well data. A summary of these MCL-equivalent assessment results is provided in Table 3-4. This table also includes a summary of the overall MCL-equivalent assessment results obtained from using monitoring well data (full MCL-equivalent assessment results are provided in Attachment B).

In summary, based on production well data, the overall MCL-equivalent for the acute risk COPCs is 0.35 under normal anticipated NHWWT operation and 0.50 when maximum COPC concentrations are adopted. The overall MCL-equivalent for the chronic risk COPCs is 0.37 under normal anticipated NHWWT operations and 0.39 when maximum COPC concentrations are adopted.

Using monitoring well data, the overall MCL-equivalent for the acute risk COPCs is 0.27 under normal anticipated NHWWT operation and 0.37 when maximum COPC concentrations are adopted. The overall MCL-equivalent for the chronic risk COPCs is 0.13 under normal anticipated NHWWT operations and 0.58 when maximum COPC concentrations are adopted in MCL-equivalent calculations.

The only COPCs that contributed to the Treated Water overall MCL-equivalent were nitrate, 1,1-DCA and Cr(VI) (Table 3-4).

As the overall MCL-equivalents for both acute and chronic risks COPCs is below the DDW draft guidance of ≤1.0, the level of treatment provided by the five remediation well NHWWT is considered to be acceptable.

Table 3-1 Three Remediation Well Treatment: Treated Water (NHHWT Effluent) MCL-Equivalent Assessment Results for Normal Anticipated and Maximum Concentrations

Risk Group	Mode of Action[(1)]	Constituent	Regulated or Unregulated	Units	MCL	NL	Response Level (RL)	0.1 RL (Surrogate for MCL)	DLR	MCL (or Surrogate MCL)	Normal Anticipated		Maximum	
											Concentration	MCL-Equivalent (Concentration /MCL)	Concentration	MCL-Equivalent (Concentration /MCL)
Acute	Hematological	NITRATE (AS N)	Regulated	µg/L	10,000	NA	NA	NA	400	10,000	3,497	0.35	4,812	0.48
Chronic	Hepatic (Liver)	**1,1-DICHLOROETHENE (1,1-DCE)**	**Regulated**	**µg/L**	**6**	**NA**	**NA**	**NA**	**0.5**	**6**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
		1,2,3-TRICHLOROPROPANE (1,2,3-TCP)	Regulated	µg/L	0.005	NA	NA	NA	0.005	0.005	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,2-DICHLOROETHANE (1,2-DCA)	Regulated	µg/L	0.5	NA	NA	NA	0.5	0.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,4-DIOXANE	**Unregulated**	**µg/L**	**NA**	**1**	**35**	**3.5**	**1**	**3.5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
		DI(2-ETHYLHEXYL)PHTHALATE) (DEHP)	Regulated	µg/L	4	NA	NA	NA	3	4	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		HEXAVALENT CHROMIUM (CR[VI])	Refer to Note[(2)]	µg/L	NA	NA	NA	NA	1	10*	3.25	0.33	3.25	0.33
	Immunological	BENZENE	Regulated	µg/L	1	NA	NA	NA	0.5	1	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Neurological	**TETRACHLOROETHENE (PCE)**	**Regulated**	**µg/L**	**5**	**NA**	**NA**	**NA**	**0.5**	**5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
	Renal (Kidneys)	1,1-DICHLOROETHANE (1,1-DCA)	Regulated	µg/L	5	NA	NA	NA	0.5	5	0.50	0.10	0.54	0.11
		CIS-1,2-DICHLOROETHENE (CIS-1,2-DCE)	**Regulated**	**µg/L**	**6**	**NA**	**NA**	**NA**	**0.5**	**6**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
	Reproductive/ Developmental	**TRICHLOROETHENE (TCE)**	**Regulated**	**µg/L**	**5**	**NA**	**NA**	**NA**	**0.5**	**5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
									Sum of Equivalents		Acute	0.35	Acute	0.48
											Chronic + Unregulated	0.43	Chronic + Unregulated	0.44

Notes:

COPCs that will be treated by the NHWWT are ***bolded***

NA: Not Applicable

[(1)] *Mode of action only applies to non-cancer risks (refer to Section 2.2).*

[(2)] *As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation.*

Table 3-2 Five Remediation Well Treatment: NHHWT Effluent MCL-Equivalent Assessment Results for Normal Anticipated and Maximum Concentrations

Risk Group	Mode of Action(1)	Constituent	Regulated or Unregulated	Units	MCL	NL	Response Level (RL)	0.1 RL (Surrogate for MCL)	DLR	MCL (or Surrogate MCL)	Normal Anticipated Concentration	Normal Anticipated MCL-Equivalent (Concentration /MCL)	Maximum Concentration	Maximum MCL-Equivalent (Concentration /MCL)
Acute	Hematological	NITRATE (AS N)	Regulated	µg/L	10,000	NA	NA	NA	400	10,000	3,533	0.35	4,990	0.50
Chronic	Hepatic (Liver)	**1,1-DICHLOROETHENE (1,1-DCE)**	**Regulated**	**µg/L**	**6**	**NA**	**NA**	**NA**	**0.5**	**6**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
		1,2,3-TRICHLOROPROPANE (1,2,3-TCP)	Regulated	µg/L	0.005	NA	NA	NA	0.005	0.005	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,2-DICHLOROETHANE (1,2-DCA)	Regulated	µg/L	0.5	NA	NA	NA	0.5	0.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,4-DIOXANE	**Unregulated**	**µg/L**	**NA**	**1**	**35**	**3.5**	**1**	**3.5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
		DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	Regulated	µg/L	4	NA	NA	NA	3	4	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		HEXAVALENT CHROMIUM (CR[VI])	Refer to Note(2)	µg/L	NA	NA	NA	NA	1	10	2.74	0.27	2.74	0.27
	Immunological	BENZENE	Regulated	µg/L	1	NA	NA	NA	0.5	1	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Neurological	**TETRACHLOROETHENE (PCE)**	**Regulated**	**µg/L**	**5**	**NA**	**NA**	**NA**	**0.5**	**5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
	Renal (Kidneys)	1,1-DICHLOROETHANE (1,1-DCA)	Regulated	µg/L	5	NA	NA	NA	0.5	5	0.51	0.10	0.60	0.12
		CIS-1,2-DICHLOROETHENE (CIS-1,2-DCE)	**Regulated**	**µg/L**	**6**	**NA**	**NA**	**NA**	**0.5**	**6**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
	Reproductive/ Developmental	**TRICHLOROETHENE (TCE)**	**Regulated**	**µg/L**	**5**	**NA**	**NA**	**NA**	**0.5**	**5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
									Sum of Equivalents		Acute	0.35	Acute	0.50
											Chronic + Unregulated	0.37	Chronic + Unregulated	0.39

Notes:

COPCs that will be treated by the NHWWT are ***bolded***

NA: Not Applicable

(1) Mode of action only applies to non-cancer risks (refer to Section 2.2)

(2) As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation.

Table 3-3 Three Remediation Well Treatment: Summary of NHHWT Effluent MCL-Equivalent Assessment

Contaminant Risk Group	Based on Production Well Sample Data		Based on Monitoring Well Sample Data	
	Normal Anticipated	Maximum	Normal Anticipated	Maximum
	Sum of MCL-Equivalent	Sum of MCL-Equivalent	Sum of MCL-Equivalent	Sum of MCL-Equivalent
Acute Effect Endpoint COPCs	0.35	0.48	0.27	0.37
Chronic Effect Endpoint and Non-Regulated COPCs	0.43	0.44	0.13	0.57

Table 3-4 Five Remediation Well Treatment: Summary of NHWWT Effluent MCL-Equivalent Assessment

Contaminant Risk Group	Based on Production Well Sample Data		Based on Monitoring Well Sample Data	
	Normal Anticipated	Maximum	Normal Anticipated	Maximum
	Sum of MCL-Equivalent	Sum of MCL-Equivalent	Sum of MCL-Equivalent	Sum of MCL-Equivalent
Acute Effect Endpoint COPCs	0.35	0.50	0.27	0.37
Chronic Effect Endpoint and Non-Regulated COPCs	0.37	0.39	0.13	0.58

4. TREATED WATER GOALS

The treated water goals for the NHWWT under normal operation are presented in Table 4-1. The Treated Water (NHWWT effluent) MCL-equivalent assessment results (Section 3), incorporate these treated water goals as listed below. The MCL-equivalent assessment results indicate that the level of treatment provided by the NHWWT is considered to be acceptable and appropriate since the overall MCL-equivalent for the three remediation well Treated Water flows is below the DDW draft guidance of ≤1.0 for both acute and chronic risk groups under normal anticipated NHWWT operation. Similarly, if there is a decision to operate NH-43A and 44 as part of a future action and plumb those wells to the treatment system, Treated Water flows would continue to be below the DDW draft guidance of ≤1.0 for both acute and chronic risk groups under normal anticipated NHWWT operation. Thus, with reference to the DDW Process Memo 97-005 (DDW, 2015), the treated water goals presented in Table 4-1 are deemed ‘appropriate’ for current and potential future operations.

Table 4-1 Treated Water Goals for the NHWWT Facility

COPC Type	COPC	Treated Water Goal
VOCs	TETRACHLOROETHENE (PCE)	<DLR (<0.5 µg/L)
	TRICHLOROETHENE (TCE)	<DLR (<0.5 µg/L)
	1,1-DICHLOROETHENE (1,1-DCE)	<DLR (<0.5 µg/L)
	CIS-1,2-DICHLOROETHENE (CIS-1,2,-DCE)	<DLR (<0.5 µg/L)
NON-REGULATED	1,4-DIOXANE	<DLR (<1 µg/L)

5. ADDITIONAL ASSESSMENTS

LADWP conducted additional MCL-equivalent assessments for the Untreated Water flow from NHW production wells, and the Combined Flow, which is the combined Treated Water (NHWWT effluent) and the Untreated Water flow.

5.1 Purpose

The purpose of these additional assessments was to establish a holistic and robust understanding of the potential risks posed by COPCs in individual and combined NHW flows which will be sent to the North Hollywood Pump Station once the NHWWT is operational, under both currently planned operations and potential future operations. A diagram showing the different NHW Well Field flows is presented in Figure 1-2 and includes:

- ***Treated Water*** (NHWWT effluent) – these results were presented in Section 3;
- ***Untreated Water*** flow which comprises the collective flow from eight untreated NHW production wells – these results are presented in Section 5.2; and
- ***Combined Flow*** which comprises Treated Water (NHWWT effluent) plus Untreated Water – these results are presented in Section 5.3.

5.2 Untreated Water MCL-Equivalent Assessment

Untreated Water comprises the collective flow from eight NHW production wells which is not being treated as part of the NHWWT (NH-04, NH-07, NH-22, NH-25, NH-26, NH-32, NH-33 and NH-36). The locations of these production wells are shown in Figure 1-1. Untreated Water is not affected by changes to the number of Remediation Wells (three versus five) entering the NHWWT (i.e., the MCL-equivalent contribution of Untreated Water to the Combined Flow is the same for both the three and five remediation well Treated Water flows). Table 5-1 presents the MCL-equivalent assessment results for the Untreated Water, with a summary of the overall results being provided in Table 5-4.

The approach to calculating the MCL-equivalents is the same as that presented in Section 2.4, with normal anticipated and maximum COPC concentrations adopting the UCL95 and maximum detected concentrations respectively based on production wells statistics as presented in the NHW RWQC (Step 2 of 97-005 Evaluation). However, an exception to this was made for the evaluation of 1,2,3-TCP in untreated wells, due to a combination of factors which prohibited the computation of a robust UCL95 value for the Untreated Water flow. These factors included:

- The large number of non-detect samples which were analyzed with a reporting limit of 0.5 µg/L within the 1,2,3-TCP data set. This is two orders of magnitude above the MCL and DDW DLR of 0.005 µg/L (which became enforceable in October 2017). These non-detect samples with a higher reporting limit of 0.5 µg/L were removed from the data set prior to any calculations as they are not appropriate when considering an MCL and DLR of 0.005 µg/L. However, this comprised the majority of the available data (of the samples available for 1,2,3-TCP, 577 were non-detect at a reporting limit of 0.5 µg/L, leaving only 84 with a reporting limit of 0.005 µg/L. Of these 84 samples:

- Five detections were from production well NH-22 in 2012 (including one duplicate sample) which all occurred when the production well was not pumping. This production well has subsequently had eight non-detect samples at the lower reporting limit of 0.005 µg/L since the last detection.

- One detection was from production well NH-36 in 2014. This production well has subsequently had two non-detect samples at the lower reporting limit of 0.005 µg/L since the last detection.

- No detections of 1,2,3-TCP above the DDW DLR occurred in any of the other untreated production wells (NH-04, NH-07, NH-25, NH-26, NH-32 and NH-33).

- No detections of 1,2,3-TCP above the DDW DLR occurred in any of the five Remediation Wells (NH-34, NH-37, NH-43A, NH-44 and NH-45); hence the collective flow (influent) from the Remediation Wells (three or five) was non-detect (<0.005 µg/L) as presented in Section 3.

- The low number of detections within each production well data set which prohibited UCL95 calculations for all but one of the production wells (greater than four detected values are required to provide reliability for UCL95 statistics; USEPA, 2015).

Further to this, guidance from USEPA's *ProUCL Version 5.1.002 Technical Guide - Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations* (2015, p. 31) states:

> *"When the number of detected values is small, it is preferable to use ad hoc methods rather than using statistical methods to compute EPCs* [Exposure Point Concentrations] *and other upper limits* [e.g. UCL95s]*. Specifically, for data sets consisting of < 4 detects and for small data sets (e.g., size < 10) with low detection frequency (e.g., < 10%), the project team and the decision makers should decide, on a site-specific basis, how to estimate the average exposure (EPC) for the constituent and area under consideration. For data sets with low detection frequencies, other measures such as the median or mode represent better estimates (with lesser uncertainty) of the population measure of central tendency.*
>
> *Additionally, when most (e.g., > 95%) of the observations for a constituent lie below the DLs* [Detection Limits]*, the sample median or the sample mode (rather than the sample average) may be used as an estimate of the EPC."*

Due to the aforementioned factors and based on the above guidance, the median value for 1,2,3-TCP was adopted as an appropriate measure for the estimating the concentration of this COPC in Untreated Water. After removal of non-detects at the higher reporting limit (0.5 µg/L), the median concentrations for all untreated wells was non-detect at the DDW DLR (<0.005 µg/L). This value was carried forward in the MCL-equivalent assessment for 1,2,3-TCP in Untreated Water.

In summary, the overall MCL-equivalent for the acute risk COPCs is 0.24 for normal anticipated concentrations, and 0.33 when adopting maximum COPC concentrations for untreated production wells. The overall MCL-equivalent for the chronic risk COPCs is 0.30 for normal anticipated concentrations and 0.80 when maximum COPC concentrations are adopted. In summary, the MCL-equivalents for both acute and chronic risks COPCs at normal and maximum anticipated concentrations for the Untreated Water Flow are below the DDW draft guidance of ≤1.0.

5.3 Combined Flow MCL-Equivalent Assessment

The Combined Flow comprises Treated Water (NHWWT effluent) plus Untreated Water flows. The following two Combined Flows were assessed:

- **Three Remediation Well Treatment** - *Combined Flow* comprising:
  - Treated Water (NHWWT effluent) generated from three Remediation Wells (NH-34, NH-37 and NH-45), as presented in Section 3.1; plus
  - Untreated Water (NH-04, NH-07, NH-22, NH-25, NH-26, NH-32, NH-33 and NH-36), as presented in Section 5.2.
- **Five Remediation Well Treatment (if system is expanded and two additional wells are plumbed to the system following remedy selection consistent with the National Contingency Plan)** - *Combined Flow* comprising:
  - Treated Water (NHWWT effluent) generated from five Remediation Wells (NH-34, NH-37, NH-43A, NH-44 and NH-45), as presented in Section 3.2; plus
  - Untreated Water (NH-04, NH-07, NH-22, NH-25, NH-26, NH-32, NH-33 and NH-36), as presented in Section 5.2.

5.3.1 Three Remediation Well Treatment

Table 5-2 presents the Three Remediation Well Treatment - Combined Flow MCL-equivalent assessment results, with a summary provided in Table 5-5.

In summary, the overall MCL-equivalent for the acute risk COPCs is 0.32 for normal anticipated concentrations, and 0.43 when adopting maximum COPC concentrations. The overall MCL-equivalent for the chronic risk COPCs is 0.44 for normal anticipated concentrations and 0.69 when maximum COPC concentrations are adopted. The overall MCL-equivalents for both acute and chronic risks COPCs for the Combined Flow were below the DDW draft guidance of ≤1.0 which indicates that the level of treatment provided by the three remediation wells when considered in tandem with Untreated Water would be acceptable.

5.3.2 Five Remediation Well Treatment

Table 5-3 presents the Five Remediation Well Treatment - Combined Flow MCL-equivalent assessment results, with a summary provided in Table 5-6. This scenario is presented to evaluate whether the system would be protective if wells NH-43A and 44 are operated as part of the treatment system.

The overall MCL-equivalent for the acute risk COPCs is 0.33 when adopting normal anticipated COPC concentrations, and 0.46 when maximum COPC concentrations are adopted. The overall

MCL-equivalent for the chronic risk COPCs is 0.42 when adopting normal anticipated concentrations and 0.63 when adopting maximum COPC concentrations.

The overall MCL-equivalents for both acute and chronic risks COPCs for the Combined Flow were below the DDW draft guidance of ≤1.0 which indicates that the level of treatment provided by the five remediation wells when considered in tandem with Untreated Water would be acceptable.

Table 5-1 Untreated Water MCL-Equivalent Assessment Results for Normal Anticipated and Maximum Concentrations

Risk Group	Mode of Action[1]	Constituent	Regulated or Unregulated	Units	MCL	NL	Response Level (RL)	0.1 RL (Surrogate for MCL)	DLR	MCL (or Surrogate MCL)	Normal Anticipated Concentration	Normal Anticipated MCL-Equivalent (Concentration / MCL)	Maximum Concentration	Maximum MCL-Equivalent (Concentration/ MCL)
Acute	Hematological	NITRATE (AS N)	Regulated	µg/L	10,000	NA	NA	NA	400	10,000	2,383	0.24	3,275	0.33
Chronic	Hepatic (Liver)	1,1-DICHLOROETHENE (1,1-DCE)	Regulated	µg/L	6	NA	NA	NA	0.5	6	0.71	0.12	1.34	0.22
		1,2,3-TRICHLOROPROPANE (1,2,3-TCP)	Regulated	µg/L	0.005	NA	NA	NA	0.005	0.005	Non-Detect[2] (<DLR)	0.00	Non-Detect* (<DLR)	0.00
		1,2-DICHLOROETHANE (1,2-DCA)	Regulated	µg/L	0.5	NA	NA	NA	0.5	0.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,4-DIOXANE	Unregulated	µg/L	NA	1	35	3.5	1	3.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	Regulated	µg/L	4	NA	NA	NA	3	4	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		HEXAVALENT CHROMIUM (CR[VI])	Refer to Note[3]	µg/L	NA	NA	NA	NA	1	10**	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Immunological	BENZENE	Regulated	µg/L	1	NA	NA	NA	0.5	1	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Neurological	TETRACHLOROETHENE (PCE)	Regulated	µg/L	5	NA	NA	NA	0.5	5	Non-Detect (<DLR)	0.00	0.90	0.18
	Renal (Kidneys)	1,1-DICHLOROETHANE (1,1-DCA)	Regulated	µg/L	5	NA	NA	NA	0.5	5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		CIS-1,2-DICHLOROETHENE (CIS-1,2-DCE)	Regulated	µg/L	6	NA	NA	NA	0.5	6	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Reproductive/ Developmental	TRICHLOROETHENE (TCE)	Regulated	µg/L	5	NA	NA	NA	0.5	5	0.88	0.18	2.00	0.40
										Sum of Equivalents	Acute	0.24	Acute	0.33
											Chronic + Unregulated	0.30	Chronic + Unregulated	0.80

Notes:

NA: Not Applicable

[1] Mode of action only applies to non-cancer risks (refer to Section 2.2).

[2] A median value for 1,2,3-TCP was adopted as an appropriate measure for the estimating the concentration of this COPC in Untreated Water, as discussed in Section 5.2.

[3] As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation

Table 5-2 Three Remediation Well Treatment: Combined Flow MCL-Equivalent Assessment Results for Normal Anticipated and Maximum Concentrations

Risk Group	Mode of Action[1]	Constituent	Regulated or Unregulated	Units	MCL	NL	Response Level (RL)	0.1 RL (Surrogate for MCL)	DLR	MCL (or Surrogate MCL)	Normal Anticipated		Maximum	
											Concentration	MCL-Equivalent (Concentration / MCL)	Concentration	MCL-Equivalent (Concentration / MCL)
Acute	Hematological	NITRATE (AS N)	Regulated	µg/L	10,000	NA	NA	NA	400	10,000	3,162	0.32	4,350	0.43
Chronic	Hepatic (Liver)	1,1-DICHLOROETHENE (1,1-DCE)	Regulated	µg/L	6	NA	NA	NA	0.5	6	0.56	0.09	0.75	0.13
		1,2,3-TRICHLOROPROPANE (1,2,3-TCP)	Regulated	µg/L	0.005	NA	NA	NA	0.005	0.005	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,2-DICHLOROETHANE (1,2-DCA)	Regulated	µg/L	0.5	NA	NA	NA	0.5	0.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,4-DIOXANE	Unregulated	µg/L	NA	1	35	3.5	1	3.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	Regulated	µg/L	4	NA	NA	NA	3	4	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		HEXAVALENT CHROMIUM (CR[VI])	Refer to Note[2]	µg/L	NA	NA	NA	NA	1	10*	2.27	0.23	2.51	0.25
	Immunological	BENZENE	Regulated	µg/L	1	NA	NA	NA	0.5	1	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Neurological	TETRACHLOROETHENE (PCE)	Regulated	µg/L	5	NA	NA	NA	0.5	5	Non-Detect (<DLR)	0.00	0.62	0.12
	Renal (Kidneys)	1,1-DICHLOROETHANE (1,1-DCA)	Regulated	µg/L	5	NA	NA	NA	0.5	5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		CIS-1,2-DICHLOROETHENE (CIS-1,2-DCE)	Regulated	µg/L	6	NA	NA	NA	0.5	6	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Reproductive/ Developmental	TRICHLOROETHENE (TCE)	Regulated	µg/L	5	NA	NA	NA	0.5	5	0.61	0.12	0.95	0.19
									Sum of Equivalents		Acute	0.32	Acute	0.43
											Chronic + Unregulated	0.44	Chronic + Unregulated	0.69

Notes:

NA: Not Applicable

[1] Mode of action only applies to non-cancer risks (refer to Section 2.2).

[2] As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation.

Table 5-3 Five Remediation Well Treatment: Combined Flow MCL-Equivalent Assessment Results for Normal Anticipated and Maximum Concentrations

Risk Group	Mode of Action[1]	Constituent	Regulated or Unregulated	Units	MCL	NL	Response Level (RL)	0.1 RL (Surrogate for MCL)	DLR	MCL (or Surrogate MCL)	Normal Anticipated Concentration	Normal Anticipated MCL-Equivalent (Concentration / MCL)	Maximum Concentration	Maximum MCL-Equivalent (Concentration / MCL)
Acute	Hematological	NITRATE (AS N)	Regulated	µg/L	10,000	NA	NA	NA	400	10,000	3,272	0.33	4,601	0.46
Chronic	Hepatic (Liver)	1,1-DICHLOROETHENE (1,1-DCE)	Regulated	µg/L	6	NA	NA	NA	0.5	6	0.55	0.09	0.69	0.11
		1,2,3-TRICHLOROPROPANE (1,2,3-TCP)	Regulated	µg/L	0.005	NA	NA	NA	0.005	0.005	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,2-DICHLOROETHANE (1,2-DCA)	Regulated	µg/L	0.5	NA	NA	NA	0.5	0.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,4-DIOXANE	Unregulated	µg/L	NA	1	35	3.5	1	3.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	Regulated	µg/L	4	NA	NA	NA	3	4	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		HEXAVALENT CHROMIUM (CR[VI])	Refer to Note[2]	µg/L	NA	NA	NA	NA	1	10*	2.12	0.21	2.30	0.23
	Immunological	BENZENE	Regulated	µg/L	1	NA	NA	NA	0.5	1	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Neurological	TETRACHLOROETHENE (PCE)	Regulated	µg/L	5	NA	NA	NA	0.5	5	Non-Detect (<DLR)	0.00	0.59	0.12
	Renal (Kidneys)	1,1-DICHLOROETHANE (1,1-DCA)	Regulated	µg/L	5	NA	NA	NA	0.5	5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		CIS-1,2-DICHLOROETHENE (CIS-1,2-DCE)	Regulated	µg/L	6	NA	NA	NA	0.5	6	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Reproductive/ Developmental	TRICHLOROETHENE (TCE)	Regulated	µg/L	5	NA	NA	NA	0.5	5	0.59	0.12	0.84	0.17
									Sum of Equivalents		Acute	0.33	Acute	0.46
											Chronic + Unregulated	0.42	Chronic + Unregulated	0.63

Notes:

NA: Not Applicable

(1) Mode of action only applies to non-cancer risks (refer to Section 2.2).

(2) As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation.

Table 5-4 Summary of Untreated Water MCL-Equivalent Assessment Results (the same for both 3 and 5 Well Treatment)

Contaminant Risk Group	Based on Production Well Sample Data	
	Normal Anticipated	Maximum
	Sum of MCL-Equivalent	Sum of MCL-Equivalent
Acute Effect Endpoint COPCs	0.24	0.33
Chronic Effect Endpoint and Non-Regulated COPCs	0.30	0.80

Table 5-5 Three Remediation Well Treatment: Summary of Combined Flow MCL-Equivalent Assessment Results

Contaminant Risk Group	Based on Production Well Sample Data	
	Normal Anticipated	Maximum
	Sum of MCL-Equivalent	Sum of MCL-Equivalent
Acute Effect Endpoint COPCs	0.32	0.43
Chronic Effect Endpoint and Non-Regulated COPCs	0.44	0.69

Table 5-6 Five Remediation Well Treatment: Summary of Combined Flow MCL-Equivalent Assessment Results

Contaminant Risk Group	Based on Production Well Sample Data	
	Normal Anticipated	Maximum
	Sum of MCL-Equivalent	Sum of MCL-Equivalent
Acute Effect Endpoint COPCs	0.33	0.46
Chronic Effect Endpoint and Non-Regulated COPCs	0.42	0.63

6. CONCLUSIONS

The MCL-equivalent assessment results, using the production and monitoring wells data sets, shows the overall MCL-equivalent for the Treated Water (NHWWT effluent) under normal anticipated operations is below the DDW draft guidance threshold of ≤1.0 for both acute and chronic risk COPCs. As such, the level of treatment provided by the NHWWT facility for both three and five remediation well Treated Water flows is considered to be acceptable and appropriate.

Furthermore, the Combined Flow comprising the Untreated Water and Treated Water (NHWWT effluent) is also below the DDW draft guidance of ≤1.0 for both risk groups, and for both three and five remediation well Treated Water flows under normal operation.

Even where the influent concentrations are unrealistically assumed to be the maximum concentrations detected in production wells or monitoring wells, the overall MCL-equivalents were below the DDW draft guidance of ≤1.0.

Using the results of the Treated Water MCL-equivalent assessment, the treated water goals comprise treatment of the following COPCs to their applicable DDW DLRs: 1,4-dioxane, PCE, TCE, 1,1-DCE and cis-1,2-DCE.

7. REFERENCES

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Attachments

Attachment A Three Remediation Well Treatment - MCL-Equivalent Assessment Results - Monitoring Well Sample Data

Risk Group	Mode of Action[1]	Constituent	Regulated or Unregulated	Units	MCL	NL	Response Level (RL)	0.1 RL (Surrogate for MCL)	DLR	MCL (or Surrogate MCL)	Normal Anticipated Concentration	Normal Anticipated MCL-Equivalent (Concentration / MCL)	Maximum Concentration	Maximum MCL-Equivalent (Concentration / MCL)
Acute	Hematological	NITRATE (AS N)	Regulated	µg/L	10,000	NA	NA	NA	400	10,000	2,667	0.27	3,720	0.37
Chronic	Hepatic (Liver)	**1,1-DICHLOROETHENE (1,1-DCE)**	**Regulated**	**µg/L**	**6**	**NA**	**NA**	**NA**	**0.5**	**6**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
		1,2,3-TRICHLOROPROPANE (1,2,3-TCP)	Regulated	µg/L	0.005	NA	NA	NA	0.005	0.005	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,2-DICHLOROETHANE (1,2-DCA)	Regulated	µg/L	0.5	NA	NA	NA	0.5	0.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,4-DIOXANE	**Unregulated**	**µg/L**	**NA**	**1**	**35**	**3.5**	**1**	**3.5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
		DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	Regulated	µg/L	4	NA	NA	NA	3	4	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		HEXAVALENT CHROMIUM (CR[VI])	Refer to Note[2]	µg/L	NA	NA	NA	NA	1	10*	Non-Detect (<DLR)	0.00	1.62	0.16
	Immunological	BENZENE	Regulated	µg/L	1	NA	NA	NA	0.5	1	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Neurological	**TETRACHLOROETHENE (PCE)**	**Regulated**	**µg/L**	**5**	**NA**	**NA**	**NA**	**0.5**	**5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
	Renal (Kidneys)	1,1-DICHLOROETHANE (1,1-DCA)	Regulated	µg/L	5	NA	NA	NA	0.5	5	0.65	0.13	2.08	0.42
		CIS-1,2-DICHLOROETHENE (CIS-1,2-DCE)	**Regulated**	**µg/L**	**6**	**NA**	**NA**	**NA**	**0.5**	**6**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
	Reproductive/ Developmental	**TRICHLOROETHENE (TCE)**	**Regulated**	**µg/L**	**5**	**NA**	**NA**	**NA**	**0.5**	**5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
									Sum of Equivalents		Acute	0.27	Acute	0.37
											Chronic + Unregulated	0.13	Chronic + Unregulated	0.58

Notes:

COPCs that will be treated by the NHWWT are ***bolded***

NA: Not Applicable

[1] Mode of action only applies to non-cancer risks (refer to Section 2.2).

[2] As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation.

Attachment B Five Remediation Well Treatment: MCL-Equivalent Assessment Results - Monitoring Well Sample Data

Risk Group	Mode of Action[1]	Constituent	Regulated or Unregulated	Units	MCL	NL	Response Level (RL)	0.1 RL (Surrogate for MCL)	DLR	MCL (or Surrogate MCL)	Normal Anticipated Concentration	Normal Anticipated MCL-Equivalent (Concentration / MCL)	Maximum Concentration	Maximum MCL-Equivalent (Concentration / MCL)
Acute	Hematological	NITRATE (AS N)	Regulated	µg/L	10,000	NA	NA	NA	400	10,000	2,658	0.27	3,707	0.37
Chronic	Hepatic (Liver)	**1,1-DICHLOROETHENE (1,1-DCE)**	**Regulated**	**µg/L**	**6**	**NA**	**NA**	**NA**	**0.5**	**6**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
		1,2,3-TRICHLOROPROPANE (1,2,3-TCP)	Regulated	µg/L	0.005	NA	NA	NA	0.005	0.005	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,2-DICHLOROETHANE (1,2-DCA)	Regulated	µg/L	0.5	NA	NA	NA	0.5	0.5	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		1,4-DIOXANE	**Unregulated**	**µg/L**	**NA**	**1**	**35**	**3.5**	**1**	**3.5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
		DI(2-ETHYLHEXYL)PHTHALATE (DEHP)	Regulated	µg/L	4	NA	NA	NA	3	4	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
		HEXAVALENT CHROMIUM (CR[VI])	Refer to Note[2]	µg/L	NA	NA	NA	NA	1	10*	Non-Detect (<DLR)	0.00	1.61	0.16
	Immunological	BENZENE	Regulated	µg/L	1	NA	NA	NA	0.5	1	Non-Detect (<DLR)	0.00	Non-Detect (<DLR)	0.00
	Neurological	**TETRACHLOROETHENE (PCE)**	**Regulated**	**µg/L**	**5**	**NA**	**NA**	**NA**	**0.5**	**5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
	Renal (Kidneys)	1,1-DICHLOROETHANE (1,1-DCA)	Regulated	µg/L	5	NA	NA	NA	0.5	5	0.65	0.13	2.07	0.41
		CIS-1,2-DICHLOROETHENE (CIS-1,2-DCE)	**Regulated**	**µg/L**	**6**	**NA**	**NA**	**NA**	**0.5**	**6**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
	Reproductive/ Developmental	**TRICHLOROETHENE (TCE)**	**Regulated**	**µg/L**	**5**	**NA**	**NA**	**NA**	**0.5**	**5**	**Treated to <DLR**	**0.00**	**Treated to <DLR**	**0.00**
									Sum of Equivalents		Acute	0.27	Acute	0.37
											Chronic + Unregulated	0.13	Chronic + Unregulated	0.57

Notes:

*COPCs that will be treated by the NHWWT are **bolded***

NA: Not Applicable

[1] Mode of action only applies to non-cancer risks (refer to Section 2.2).

[2] As of September 11, 2017, the MCL for Cr(VI) is no longer in effect. However, due to the potential health risks associated with this constituent and intention of DDW to set a new MCL, the former MCL (10 µg/L) was adopted for the purposes of this evaluation.

Appendix B NHW Well Field Water Quality Surveillance Plan (WQSP)

APPENDIX B: WATER QUALITY SURVEILLANCE PLAN

EFFECTIVE TREATMENT AND MONITORING

NORTH HOLLYWOOD WEST WELL FIELD

(Step 4 of 97-005 Evaluation)

Prepared for

California State Water Resources Control Board, Division of Drinking Water

Prepared on Behalf of

Los Angeles Department of Water & Power

Water Quality Division, Groundwater Remediation Group

Prepared by

Owner's Agent Team led by Hazen and Sawyer (Hazen) with primary input from Worley

December 2020

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LIST OF ABBREVIATIONS AND ACRONYMS

Acronym/Abbreviation	Term
%	Percent
°C	Degrees Celsius
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2,3-TCP	1,2,3-Trichloropropane
1,2-DCA	1,2- Dichloroethane
µg/L	Micrograms per Liter
AWWA	American Water Works Association
BC	Brown and Caldwell
BNAs	Base/Neutral Acids
BOD	Biological Oxygen Demand
CCV	Continuing Calibration Verification
cis-1,2-DCE	cis-1,2-Dichloroethylene
CoC	Chain-of-Custody
COPC	Constituent of Potential Concern
Cr (VI)	Hexavalent Chromium
CTET	Carbon Tetrachloride
DDW	Division of Drinking Water
DEHP	Bis(2-ethylhexyl)phthalate
DO	Dissolved Oxygen
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
EDD	Electronic Data Deliverable
EDP	EQuIS Data Processor
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
Freon 11	Trichlorofluoromethane

Acronym/Abbreviation	Term
Freon 12	Dichlorodifluoromethane
GCMS	Gas Chromatograph Mass Spectrometry
GSIS	Groundwater System Improvement Study
GRO	Gasoline Range Organics
Hazen	Hazen and Sawyer
HaSP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HPC	Heterotrophic Plate Count
ICAL	Initial Calibration
ID	Identification
IDW	Investigative Derived Waste
IIPP	Injury Illness and Prevention Program
L	Liter(s)
LADWP	Los Angeles Department of Water and Power
LCS	Laboratory Control Sample
LFB	Laboratory Fortified Blank
LFM	Laboratory Fortified Sample Matrix
LRB	Laboratory Reagent Blank
MDL	Method Detection Limit
mg/L	Milligrams per Liter
MRL	Method Reporting Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MTBE	Methyl tertiary butyl ether
mV	Millivolt
NDBA	N-Nitrosodi-n-butylamine
NDEA	N-Nitrosodiethylamine
NDMA	N-Nitrosodimethylamine

Acronym/Abbreviation	Term
NDPA	N-Nitrosodi-n-propylamine
NFG	National Functional Guidelines
NHW	North Hollywood West
NHWWT	North Hollywood West Wellhead Treatment
nm	Nanometer
NMEA	N-Nitrosomethylethylamine
NPIP	N-Nitrosopiperidine
NPYR	N-Nitrosopyrrolidine
NTU	Nephelometric Turbidity Units
ORP	Oxidation-Reduction Potential
OSHA	Occupational Safety and Health Administration
P	Phosphorus
PCE	Tetrachloroethylene
PDF	Portable Document Format
PE	Performance Evaluation
PFAS	Per- and Polyfluoroalkyl Substances
PO_4	Phosphate
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCS	Quality Control Sample
RPD	Relative Percent Difference
RWQC	Raw Water Quality Characterization
SD	Standard Deviation
SFB	San Fernando Basin
SM	Standard Methods
SOP	Standard Operating Procedure

Acronym/Abbreviation	Term
SVOCs	Semi-Volatile Organic Compounds
TBA	Tertiary-Butyl Alcohol
TCE	Trichloroethylene
TCDD	Tetrachlorodibenzodioxin
TCP	Trichloropropane
TDS	Total Dissolved Solids
TEM	Transmission Electron Microscopy
TICs	Tentatively Identified Compounds
TOC	Total Organic Carbon
VOCs	Volatile Organic Compounds
UV	Ultraviolet
WQD	Water Quality Division
WQSP	Water Quality Sampling and Analysis Plan
ZIST™	Zone Isolation Sampling Technologies

1. INTRODUCTION

This document presents the North Hollywood West (NHW) Water Quality Surveillance Plan (NHW WQSP; Appendix C to the Step 4 report for the 97-005 Evaluation) that will serve as a guide for the Los Angeles Department of Water and Power (LADWP) to undertake groundwater quality and elevation monitoring within the modeled 2, 5 and 10-year capture zones for the NHW Well Field. The location of the NHW Well Field is shown in Figure 1-1.

As groundwater in the vicinity of the NHW Well Field is impaired by contamination, LADWP is required to demonstrate compliance with the Division of Drinking Water (DDW)'s 97-005 Process Memo for Direct Domestic Use of Extremely Impaired Sources, issued in 1997 and updated in draft form in March 2015 (hereafter referred to as "DDW Process Memo 97-005"). One of the requirements outlined in Step 4 of the DDW Process Memo 97-005 (i.e., Effective Treatment and Monitoring) is to develop a water quality surveillance plan (WQSP).

The NHW Well Field is one of LADWP's production well fields within the San Fernando Basin (SFB) and is located along Vanowen Street just west of the Hollywood Freeway (SR-170). The NHW Well Field comprises 14 production wells; however, one production well (NH-23) is non-operational and will be destroyed in the future. The NHW Well Field production wells are generally situated in an L-shaped pattern, with eight wells in an east-west orientation along Vanowen Street and six wells located in the general vicinity of Whitsett Sports Field Park in a north-south orientation parallel to SR-170. The well field setting and approximate NHW production well locations are shown in Figure 1-1.

At the time of generating this WQSP, groundwater monitoring for the NHW Well Field is being conducted under the DDW Interim Sampling Plan. The purpose of the interim sampling plan is to establish baseline groundwater conditions prior to full-scale operation of the North Hollywood West Wellhead Treatment (NHWWT) facility. The interim plan was developed in 2015 through a combined effort between DDW and LADWP and is provided in **Attachment A** for reference.

This NHW WQSP is intended to take effect upon start-up of NHWWT which simultaneously marks the end of the DDW Interim Sampling Plan.

It is imperative that the precursor Steps 1, 2 and 4 reports for the NHW Well Field 97-005 Evaluation are read prior to, or in conjunction with this WQSP, "*as each step lies upon the findings and conclusions of the prior step*" (DDW Process Memo 97-005).

1.1 Purpose

In accordance with DDW Process Memo 97-005, this WQSP was developed to establish a groundwater monitoring program that LADWP will implement to monitor and evaluate groundwater quality between known contamination sources and the NHW Well Field production/remediation wells to provide early warning of any unexpected increases in contaminant concentration or detection of additional contaminants. The NHW WQSP monitoring network also includes sentinel monitoring wells located outside of known contamination source areas to provide sufficient coverage of the NHW Field, thereby providing the opportunity to identify potential unexpected changes to groundwater quality outside of known contamination source areas.

1.2 Document Organization

This Report is organized into the following sections:

Section 1 - Introduction: This section provides the introductory, purpose of the plan, regulatory requirements, background information, and organization of the document.

Section 2 - Monitoring Well Selection: This section outlines the monitoring wells selected as sentinel wells which will comprise the monitoring network used to implement the WQSP.

Section 3 - Analytical and Monitoring Schedules: This section provides information pertaining to the development and establishment of the NHW WQSP analytical schedule.

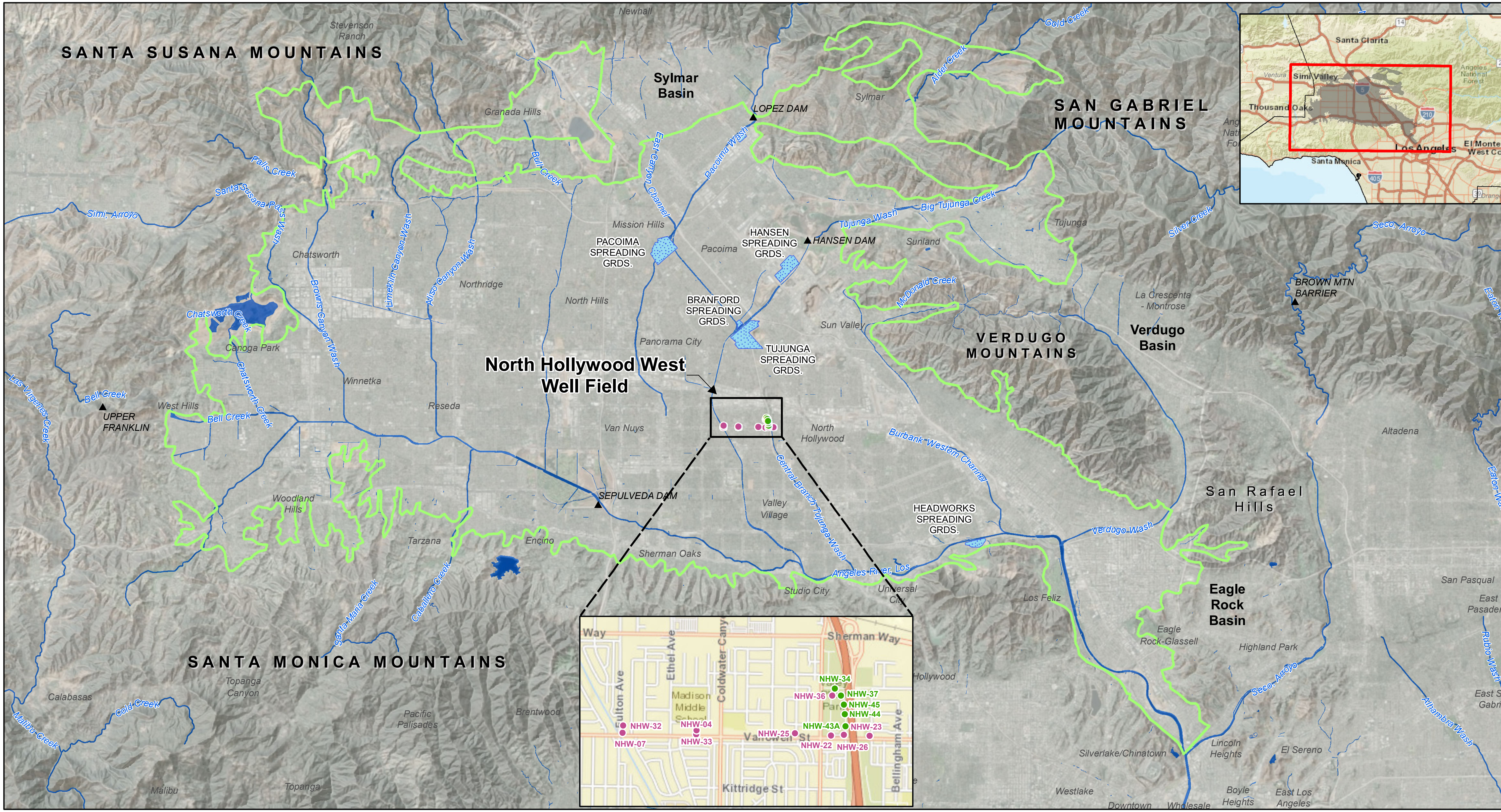
Section 4 - Project Data Quality Objectives: This section contains the problem definition, project team, and Data Quality Objectives (DQOs) developed for the NHW WQSP program.

Section 5 - Field Sampling Plan: This section describes field documentation, methods and procedures.

Section 6 - Quality Assurance Project Plan: This section comprises the Quality Assurance Project Plan (QAPP) developed for the NHW WQSP program.

Section 7 - Reporting: This section describes the reporting requirements for the WQSP.

Section 8 - References: This section lists the documents referenced in this document.



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. CA DWR - B118_BasinBoundaries_v4.1, LA County GIS, LADWP, NHD.

Note:
Features shown on this figure are approximate and should be used for indicative purposes only.

N
W E
S

0 5
Miles

Legend

- NHW PRODUCTION WELLS
- NHW REMEDIATION WELLS
- RIVERS/WASHES
- SPREADING GROUNDS
- SAN FERNANDO VALLEY GROUNDWATER BASIN

LA DWP Los Angeles Department of Water & Power

Hazen ARCADIS Worley

NORTH HOLLYWOOD WEST (NHW) WELL FIELD
SETTING AND PRODUCTION WELL LOCATIONS

SWL	SB	3/25/2020
308038-13284		1-1

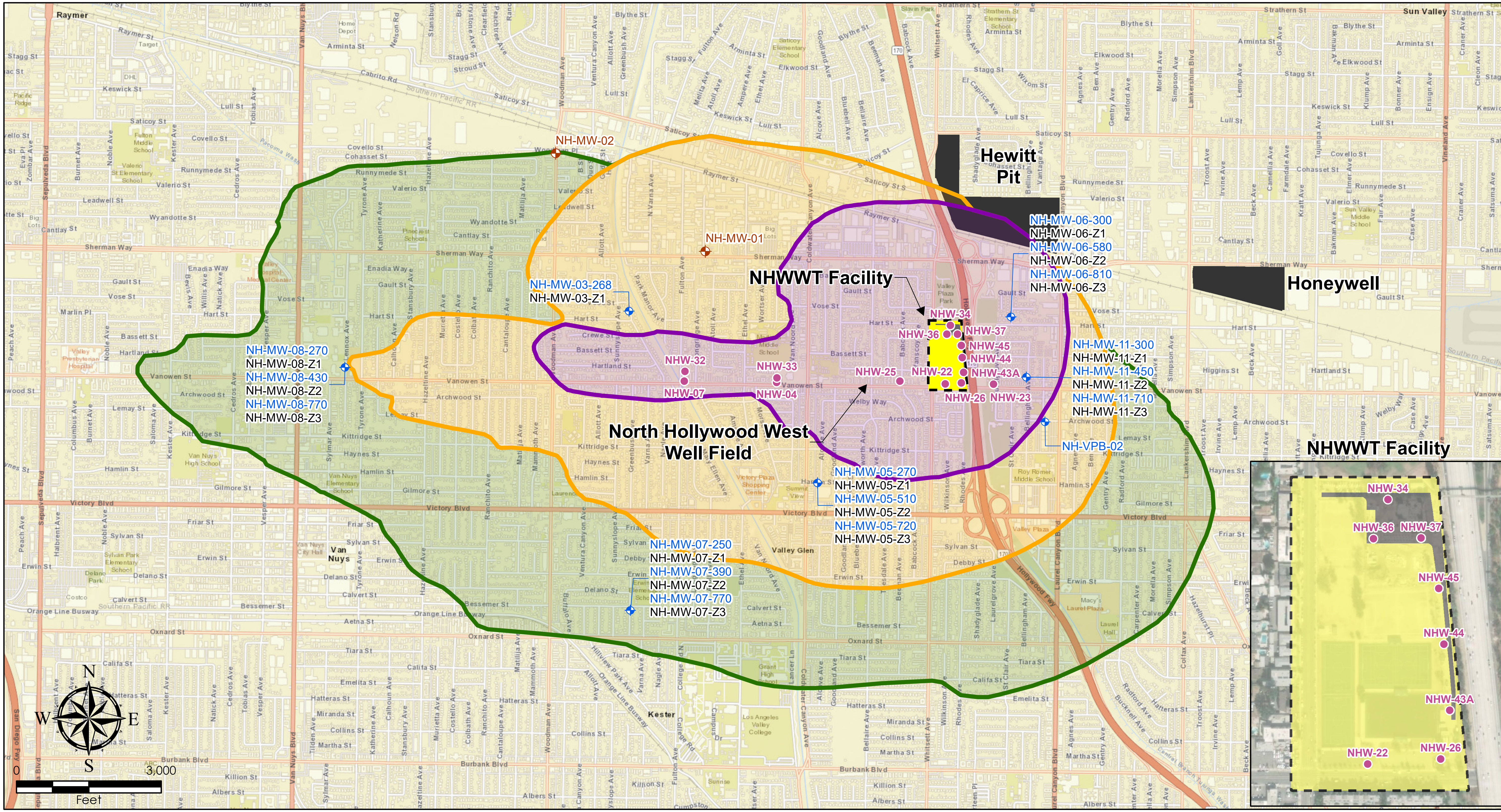
2. MONITORING WELL SELECTION

The groundwater monitoring wells selected for WQSP monitoring are located within the modeled 2, 5 and 10-year capture zones for NHW Well Field (refer to Figure 2-1). The 2-year capture zone for the WQSP represents average projected pumping for first two years of full plant operation, 2021 to 2022 (Water Year [WY] 2020-21 to WY 2021-22); the 5-year capture zone represents average projected pumping for the first five years of operation, 2021 to 2026; and the 10-year capture zone represents average projected pumping for the first ten years of operation, 2021 to 2031. These capture zones represent the portion of the SFB that is expected to contribute water to the NHW Well Field during the first two, five and ten years of NHWWT operation.

The monitoring wells selected for inclusion in the WQSP monitoring network will provide early detection of contaminants and inform future contaminant concentration trends during NHWWT operation, building on the data collected as part of the DDW Interim Sampling Plan (**Attachment A**). The monitoring wells selected for inclusion in the WQSP monitoring network, as well as the rationale for the selection of each well, are provided in Table 2-1.

It is expected that minimum travel time from the closest monitoring wells to any NHW production well is more than one year. As such, the proposed sampling program minimum annual frequency is appropriate to achieve the purpose of early detection of unexpected increases in contaminant concentrations or detection of additional contaminants before reaching the production wells.

Groundwater monitoring well construction details, well owners, sample identification numbers, locations, sampling methods and estimated purge volumes for each monitoring well in the WQSP monitoring network are provided in Table 2-2. Topographic survey information are presented in Table 2-3, and well construction diagrams and other pertinent well information are provided in **Attachment B**.



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. LADWP Capture Zones from DDW Interim MW Sampling Plan Presentation pg 6- April 2015. Treatment Plant footprint and facility area from "North Hollywood West Wells 1,4-Dioxane Remediation Site Plan, Figure 1." USEPA 2017 TCE, PCE, 1,4-Dioxane Plumes ≥MCL (TCE ≥ 5.0, PCE ≥ 5.0, 1,4-Dioxane ≥1.0).

Notes: Non-operational monitoring wells are currently being evaluated by LADWP. Future plans include the removal of existing pumping systems installed in these wells, and replacing them with bladder pumps for low-flow sampling purposes. Features shown on this figure are approximate and should be used for indicative purposes only

Legend

- NHW PRODUCTION WELLS
- MONITORING WELLS
- NH-MW-08-270 Well ID (Former)
- NH-MW-08-Z1 LADWP Well ID
- NON-OPERATIONAL MONITORING WELLS
- PRELIMINARY IDENTIFIED SOURCE AREAS
- 2 YR CAPTURE ZONE
- 5 YR CAPTURE ZONE
- 10 YR CAPTURE ZONE
- NHW WELLHEAD TREATMENT (NHWWT) FOOTPRINT

LA DWP Los Angeles Department of Water & Power

Hazen ARCADIS WorleyParsons resources & energy

NORTH HOLLYWOOD WEST (NHW)
WATER QUALITY SURVEILLANCE PLAN
GROUNDWATER MONITORING NETWORK

SWL	SB	2/19/2020
308038-13284		2-1

Table 2-1: Groundwater Monitoring Well Selection Rationale

Well ID	Well ID (Alternative)	Capture Zone	Well Selection Rationale
NH-MW-06-Z1	NH-MW-06-300	2	Located within 2-year NHW Well Field capture zone and EPA mapped VOCs aggregate plume. Well is also situated between the NHW Well Field and Preliminary Identified Source Areas (i.e., Hewitt Pit and Honeywell). The nested well configuration at this location provides the opportunity to monitor the vertical distribution of contamination and vertical hydraulic gradients.
NH-MW-06-Z2	NH-MW-06-580		
NH-MW-06-Z3	NH-MW-06-810		
NH-MW-11-Z1	NH-MW-11-300	2	Located within 2-year NHW Well Field capture zone and EPA mapped VOCs aggregate plume. Well is also situated between the NHW Well Field and a Preliminary Identified Source Area (i.e., Honeywell). The nested well configuration at this location provides the opportunity to monitor the vertical distribution of contamination and vertical hydraulic gradients.
NH-MW-11-Z2	NH-MW-11-450		
NH-MW-11-Z3	NH-MW-11-710		
NH-MW-03-Z1	NH-MW-03-268	5	Located within 5-year NHW Well Field capture zone and EPA mapped VOCs aggregate plume. Provides important monitoring point north of NHW Well Field for early-warning monitoring of unexpected changes contaminant concentrations.
NH-MW-05-Z1	NH-MW-05-270	5	Located within 5-year NHW Well Field capture zone. Provides important monitoring point south of NHW Well Field for early-warning monitoring. The nested well configuration at this location provides the opportunity to monitor the vertical distribution of contamination and vertical hydraulic gradients.
NH-MW-05-Z2	NH-MW-05-510		
NH-MW-05-Z3	NH-MW-05-720		
NH-VPB-02	N/A	5	Located within 5-year NHW Well Field capture zone and EPA mapped VOCs aggregate plume. Well is also situated between the NHW Well Field and a Preliminary Identified Source Area (i.e., Honeywell).
NH-MW-08-Z1	NH-MW-08-270	5/10	Located at the boundary between the 5- and 10-year NHW Well Field capture zones situated within the 2017 EPA mapped VOCs aggregate plume. Provides important groundwater monitoring point west of the NHW Well Field for early-warning monitoring. The nested well configuration at this location provides the opportunity to monitor the vertical distribution of contamination and vertical hydraulic gradients.
NH-MW-08-Z2	NH-MW-08-430		
NH-MW-08-Z3	NH-MW-08-770		

Well ID	Well ID (Alternative)	Capture Zone	Well Selection Rationale
NH-MW-07-Z1	NH-MW-07-250	10	Located within 10-year NHW Well Field capture zone. Provides an important groundwater monitoring point south of the NHW Well Field for early-warning monitoring. The nested well configuration at this location provides the opportunity to monitor the vertical distribution of contamination (if present) and vertical hydraulic gradients.
NH-MW-07-Z2	NH-MW-07-390		
NH-MW-07-Z3	NH-MW-07-770		

Notes:

N/A = Not Applicable; VOCs = Volatile Organic Compounds

Table 2-2: Monitoring Well Information for North Hollywood West Well Field

Well Type	Monitoring Well Name	Well Owner	Well ID	Well ID (Alternate)	Pump Depth (ft. bgs)	Screen Interval (ft. bgs)	Total Depth (ft. bgs)	Sampling Method	Depth to Water (ft bgs), Date	Location/ Address	Locale Description	Traffic Coordination	Estimate Duration of Well Sampling	Estimated Purge Volume
Multilevel Groundwater Monitoring Well	NH-MW-03	LADWP	NH-MW-03-Z1	NH-MW-03-268	268	230 - 270	815	Bladder Pump (Low-Flow Sampling)	235.3025 (05/2017)	6958 Varna Ave., North Hollywood CA	Street	Traffic Cone Night Before	5-8 hrs.	1 Gallon
Multilevel Groundwater Monitoring Well	NH-MW-05	LADWP	NH-MW-05-Z1	NH-MW-05-270	270	230 - 310	750	Bladder Pump (Low-Flow Sampling)	229.12 (04/2017)	12850 Hamlin St., North Hollywood CA	Sidewalk	Traffic Cone Night Before	5-8 hrs.	1 Gallon
			NH-MW-05-Z2	NH-MW-05-510	510	490 - 530		ZIST™	225.95 (04/2017)					1 Gallon
			NH-MW-05-Z3	NH-MW-05-720	720	700 - 740		ZIST™	220.83 (04/2017)					1 Gallon
Multilevel Groundwater Monitoring Well	NH-MW-06	LADWP	NH-MW-06-Z1	NH-MW-06-300	300	260 - 340	850	ZIST™	258.96 (04/2017)	7015 St. Clairs Ave., Los Angeles CA 91605	Sidewalk	Traffic Cone Night Before	5-8 hrs.	1 Gallon
			NH-MW-06-Z2	NH-MW-06-580	580	560 - 600		Bladder Pump (Low-Flow Sampling)	256.41 (04/2017)					1 Gallon
			NH-MW-06-Z3	NH-MW-06-810	810	830 - 850		Bladder Pump (Low-Flow Sampling)	253.50 (04/2017)					1 Gallon
Multilevel Groundwater Monitoring Well	NH-MW-07	LADWP	NH-MW-07-Z1	NH-MW-07-250	250	210 - 290	800	Bladder Pump (Low-Flow Sampling)	182.07 (05/2014)	6042 Greenbush Ave., Valley Glen, CA	Side/Grass	Traffic Cone Night Before	5-8 hrs.	1 Gallon
			NH-MW-07-Z2	NH-MW-07-390	390	371 - 411		ZIST™	182.57 (05/2014)					1 Gallon
			NH-MW-07-Z3	NH-MW-07-770	770	751 - 791		ZIST™	179.58 (05/2014)					1 Gallon
Multilevel Groundwater Monitoring Well	NH-MW-08	LADWP	NH-MW-08-Z1	NH-MW-08-270	270	230 - 310	800	Bladder Pump (Low-Flow Sampling)	215.14 (07/2014)	6891 Lennox Ave., Van Nuys, CA	Side/Grass	Traffic Cone Night Before	5-8 hrs.	1 Gallon
			NH-MW-08-Z2	NH-MW-08-430	430	410 - 450		ZIST™	---					1 Gallon
			NH-MW-08-Z3	NH-MW-08-770	770	750 - 790		ZIST™	---					1 Gallon

Well Type	Monitoring Well Name	Well Owner	Well ID	Well ID (Alternate)	Pump Depth (ft. bgs)	Screen Interval (ft. bgs)	Total Depth (ft. bgs)	Sampling Method	Depth to Water (ft bgs), Date	Location/ Address	Locale Description	Traffic Coordination	Estimate Duration of Well Sampling	Estimated Purge Volume
Multilevel Groundwater Monitoring Well	NH-MW-11	LADWP	NH-MW-11-Z1	NH-MW-11-300	300	260 - 340	740	Bladder Pump (Low-Flow Sampling)	247.94 (04/2017)	6821 Bellingham Ave., North Hollywood CA	Side/Grass	Traffic Cone Night Before	5-8 hrs.	1 Gallon
			NH-MW-11-Z2	NH-MW-11-450	450	431 - 471		Bladder Pump (Low-Flow Sampling)	247.7 (04/2017)					1 Gallon
			NH-MW-11-Z3	NH-MW-11-710	710	691 - 731		Bladder Pump (Low-Flow Sampling)	242.89 (04/2017)					1 Gallon
Single Level/Interval Groundwater Monitoring Well	NH-VPB-02	EPA/ LADWP	NH-VPB-02	N/A	--	241 - 261	264	Submersible (Conventional Sampling)	231.00 (3/2015)	Archwood Ave., @ Vantage St.	Street	Traffic Cone Night Before	3-4 hrs.	180 Gallons (5 x Volume)

Notes:
ft= foot or feet; ft bgs = feet below ground surface; CA =California; hrs. = Hours; --- = Information not available; N/A = Not Applicable

Table 2-3: Topographic Survey Information for NHW WQSP Monitoring Wells

Monitoring Well Name	LADWP Well ID	Well ID (Alternative)	Coordinates		Elevation – Top of 1" Tube (Piezometer)	Elevation – Top of 4" PVC Casing (Well)
			Northings	Eastings		
NH-MW-03	NH-MW-03-Z1	NH-MW-03-268	1894484.26	6432926.63	N/A	721.57
NH-MW-05[a][c]	NH-MW-05-Z1	NH-MW-05-270	1891205.24	6436776.53	705.63	705.62
	NH-MW-05-Z2	NH-MW-05-510			705.67	705.68
	NH-MW-05-Z3	NH-MW-05-720			705.73	705.71
NH-MW-06	NH-MW-06-Z1	NH-MW-06-300	1894708.97	6440774.32	731.35	731.33
	NH-MW-06-Z2	NH-MW-06-580			731.56	731.57
	NH-MW-06-Z3	NH-MW-06-810			731.82	731.85
NH-MW-07[a][c]	NH-MW-07-Z1	NH-MW-07-250	1888510.85	6432910.95	692.79	692.79
	NH-MW-07-Z2	NH-MW-07-390			692.85	692.86
	NH-MW-07-Z3	NH-MW-07-770			692.89	692.90
NH-MW-08[a][c]	NH-MW-08-Z1	NH-MW-08-270	1893501.60	6426949.54	730.89	730.87
	NH-MW-08-Z2	NH-MW-08-430			730.94	730.93
	NH-MW-08-Z3	NH-MW-08-770			730.99	731.01
NH-MW-11[a][c]	NH-MW-11-Z1	NH-MW-11-300	1893426.67	6441079.14	720.63	720.62
	NH-MW-11-Z2	NH-MW-11-450			720.68	720.71
	NH-MW-11-Z3	NH-MW-11-710			720.74	720.79
NH-VPB-02[b][d][e]	NH-VPB-02	N/A	1896226.00	6442940.00	N/A	710.00

Notes
[a] Datum = NAVD88, CCS83, Zone 5
[b] Older well installed in 1989, 4-inch diameter, single screen monitoring well, with no associated piezometer
[c] Survey data obtained from Brown and Caldwell, 2015, Groundwater System Improvement Study - Groundwater Monitoring Well Completion Report
[d] Elevation data taken from James M. Montgomery, Inc. 1992, Remedial Investigation of Groundwater Contamination in the San Fernando Valley - Remedial Investigation Report
[e] Coordinates are approximate only; coordinate projection is NAD 1983 State Plane California V FIPS 0405 (US Feet)
N/A = Not Applicable

3. ANALYTICAL AND MONITORING SCHEDULES

In the following section, the development of the analytical and monitoring schedules are documented.

3.1 Constituents of Potential Concern (COPCs)

For the purposes of the WQSP, a list of COPCs was established to ensure that the analytical schedule(s) developed as part of this WQSP captures all constituents that will be or are likely to be present in groundwater (source water) that will be captured by the proposed NHWWT. The list of COPCs was developed by combining the COPCs identified in the following documents and studies:

1) Groundwater System Improvement Study (GSIS) Remedial Investigation Update Report (Brown and Caldwell [BC] 2015) – BC identified 12 high priority constituents of concern (COCs) generally based on protocols developed by USEPA Region 8 (USEPA, 1994). These 12 priority COCs have been incorporated in the analytical suite (Table 3-1) developed for this WQSP.

2) DDW Interim Sampling Plan (LADWP 2015a) (refer to **Attachment A**) – LADWP and DDW generated on a list of COPCs to be scheduled for samples collected as part of the aforementioned plan. The list comprises 22 constituents, including nitrosamines. These 22 constituents have been incorporated in the NHW WQSP analytical suite (Table 3-1).

3) NHW Raw Water Quality Characterization (RWQC; Step 2 of the 97-005 Evaluation), which includes an assessment of the Drinking Water Source Assessment and Contaminant Assessment (SA/CA; Step 1 of 97-005 Evaluation) for the NHW Well Field. Any constituent where the maximum concentration in any NHW production or monitoring well, between January 2011 and November 2016, was above an MCL or NL is considered a COPC. The NHW WQSP analytical suite (Table 3-1) incorporated these COPCs (6 COPCs = productions wells, 12 COPCs = monitoring wells).

Combining these lists of COPCs resulted in a total of 28 COPCs. The majority of COPCs appeared on more than one list.

3.2 NHW WQSP Analytical Suite

Table 3-1 includes the NHW Well Field COPCs (total of 28 + VOC & SVOC TICs) derived from the evaluation of the above listed documents/studies. These COPCs are incorporated in the "NHW WQSP Analytical Suite". In accordance with DDW Process Memo 97-005, tentatively identified compounds (TICs) have also been included in the analytical suite. The complete NHW WQSP Analytical Suite is provided in Table 3-1 below. Information pertaining to the analytical methods summarized below are provided in **Attachment C**.

Table 3-1: NHW WQSP Identified COPCs (and TICs) and associated CAS Numbers

Analyte	CAS Number
1,1-Dichloroethane (1,1-DCA)	75-34-3
1,1-Dichloroethene (1,1-DCE)	75-35-4
1,2,3-Trichloropropane (1,2,3-TCP)	96-18-4

Analyte	CAS Number
1,2-Dichloroethane (1,2-DCA)	107-06-2
1,4-Dioxane	123-91-1
Benzene	71-43-2
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7
Carbon tetrachloride (CTET)	56-23-5
Chlorate	14866-68-3
Chromium, Total	7440-47-3
cis-1,2-Dichloroethene (cis-1,2-DCE)	156-59-2
Dichlorodifluoromethane (Freon 12)	75-71-8
Hexavalent Chromium (Cr[VI])	18540-29-9
Methyl tert-butyl ether (MTBE)	1634-04-4
Nitrate (as Nitrogen [N])	14797-55-8
N-Nitrosodiethylamine (NDEA)	55-18-5
N-Nitrosodimethylamine (NDMA)	62-75-9
N-Nitrosodi-n-butylamine (NDBA)	924-16-3
N-Nitrosodi-n-propylamine (NDPA)	621-64-7
N-Nitrosomethylethylamine (NMEA)	86-30-6
N-Nitrosomorpholine (NMOR)	59-89-2
N-Nitrosopiperidine (NPIP)	100-75-4
N-Nitrosopyrrolidine (NPYR)	930-55-2
Perchlorate	14797-73-0
SVOC TICs	--
Tetrachloroethene (PCE)	127-18-4
Total Dissolved Solids (TDS)	TDS
Trichloroethene (TCE)	79-01-6

Analyte	CAS Number
Trichlorofluoromethane (Freon 11)	75-69-4
VOC TICs	--

3.3 NHW WQSP Sampling Schedule

Water quality monitoring for the WQSP program is anticipated to commence in 2021 after the NHWWT start-up is completed. For the NHW WQSP, monitoring wells located within a 2-year capture zone are sampled annually, and monitoring wells located in the 5-year and 10-year capture zone are sampled every three years. The NHW WQSP sampling schedule is provided in Table 3-2 below.

Sample collection frequency adopted is based on previously agreed sampling frequency between LADWP and DDW for the DDW Interim Sampling Plan (**Attachment A**).

Table 3-2: NHW WQSP Sampling Schedule

Well ID	Capture Zone	Monitored Annually	Monitored Every Three Years	Analytical Suite
NH-MW-06-Z1	2	✓	--	NHW WQSP Analytical Suite
NH-MW-06-Z2	2	✓	--	
NH-MW-06-Z3	2	✓	--	
NH-MW-11-Z1	2	✓	--	
NH-MW-11-Z2	2	✓	--	
NH-MW-11-Z3	2	✓	--	
NH-MW-03-Z1	5	--	✓	
NH-MW-05-Z1	5	--	✓	
NH-MW-05-Z2	5	--	✓	
NH-MW-05-Z3	5	--	✓	
NH-VPB-02	5	--	✓	
NH-MW-07-Z1	10	--	✓	
NH-MW-07-Z2	10	--	✓	
NH-MW-07-Z3	10	--	✓	
NH-MW-08-Z1	10	--	✓	
NH-MW-08-Z2	10	--	✓	
NH-MW-08-Z3	10	--	✓	

4. PROJECT DATA QUALITY OBJECTIVES

4.1 Project Organization and Team

The chart presented in Figure 4-1 shows the critical LADWP staff members, lines of authority, as well as lines of communication. A summary of the responsibilities and contact details of Project Team members are described below.

Figure 4-1: Project Organization Chart

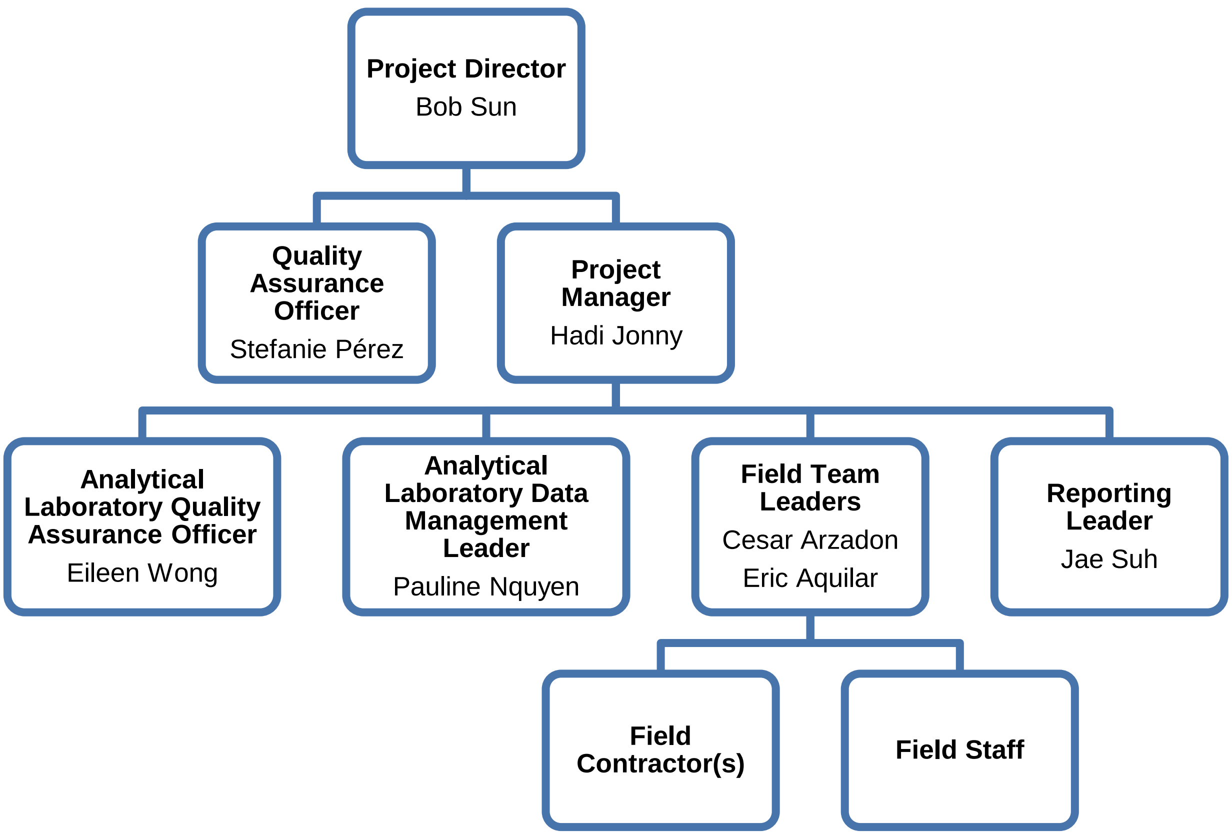


Table 4-1: Key Project Staff

Title	Name	Phone Number Email Address	Responsibilities
Project Director (PD)	Bob Sun	213-367-3419 Bob.Sun@ladwp.com	Overall responsibility for all aspects of the NHW WQSP program and communication with DDW.
Project Manager (PM)	Hadi Jonny	213- 367-0905 Hadi.Jonny@ladwp.com	Provides overall direction to task managers and project personnel necessary to accomplish all program objectives, including development and completion of technical work scope.
Quality Assurance Officer (QAO)	Stefanie A. Pérez	213-367-4135 Stefanie.Perez@ladwp.com	Responsible for overseeing the implementation of the NHW WQSP. Discusses QA issues with the Project Manager but should not be involved in the data collection / analysis / interpretation / reporting process except in a review or oversight capacity.
Field Team Leaders	Cesar Arzadon	213-367-3269 Cesar.Arzadon@ladwp.com	Responsible for leading and facilitating implementation of the field work.
	Eric Aquilar	818-771-4344 Eric.Aguilar@ladwp.com	
Laboratory Quality Assurance Officer (Laboratory QAO)	Eileen Wong	213-367-8524 Eileen.Wong@ladwp.com	Provides QA/QC oversight related to laboratory activities and reporting QA issues to Water Quality Laboratory Manager.
Laboratory Data Management Leader	Pauline Nquyen	213-367-8459 Pauline.Nguyen@ladwp.com	Responsible for managing data generated through the implementation of this WQSP and uploading data to appropriate platforms.

Title	Name	Phone Number Email Address	Responsibilities
Reporting Leader	Jae Suh	213-367-4651 Jae.suh@ladwp.com	Responsible for evaluating and interpreting data generated through the implementation of the NHW WQSP. Also responsible for generating groundwater monitoring reports per DDW requirements.

4.2 Problem Definition

Past handling and disposal of industrial compounds, primarily used as solvents in manufacturing processes, have created contaminant plumes in the SFB. In some areas these plumes have spread to LADWP's potable water wells, causing them to become contaminated. This has led to the inactivation of progressively more production (supply) wells as the contaminants migrate through the groundwater basin, which has resulted in up to a 50% reduction in LADWP's total groundwater pumping capacity from the SFB. In response to production well(s) inactivation and subsequent investigation, LADWP plans to remediate groundwater contamination and restore production of groundwater from the NHW Well Field in order to use it as a source of potable water supply.

4.3 Development of Data Quality Objectives

This section presents the DQOs for LADWP's NHW WQSP. DQOs are statements that specify the quantity and quality of the data required to support project decisions. DQOs for this project were developed using the seven-step process Guidance for the Data Quality Objectives Process (United States Environmental Protection Agency (EPA) 2000, EPA 2006), and are presented in Table 4-1.

The Quality Assurance (QA) procedures as well as the associated field sampling procedures contained in this WQSP are focused on achieving these DQOs in a timely, cost-effective, and safe manner.

Table 4-2: Seven-Step DQOs for the SFB Groundwater Monitoring Project

Step 1: State the Problem	Past handling and disposal of industrial compounds, primarily solvents used in manufacturing processes, have created contaminant plumes in the SFB. In some areas these plumes have spread to LADWP's potable water wells, causing them to become contaminated (see Section 4.2 above).
Step 2: Identify the Decision(s)	The primary goal of implementing this WQSP is to monitor groundwater quality in the modeled 2, 5 and 10-year capture zones of the NHW Well Field to provide early warning of any unexpected increases in contaminant concentration or detection of additional contaminants, so that appropriate actions can be taken. Response actions are described in the Operations Plan (refer to Section 6 of the Step 4 main report to which this WQSP is attached).
Step 3: Identify the Inputs to the Decisions	The primary data that will be generated through the implementation of this WQSP are water quality data, the constituents/analytes that will be monitored for this purpose are discussed in Sections 3.1 and 3.2, and summarized in Table 3-1. These constituents include but are not limited to volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, perchlorate, Cr(VI), TICs and nitrosamines. Implementation of the WQSP will also generate groundwater elevation data which will be used to generate groundwater elevation contours and allow for the interpretation of flow directions within the NHW Well Field capture zones.
Step 4: Define Study Boundaries	The NHW study boundaries (Figure 2-1) were delineated by generating an "aggregate capture zone" which comprises the modeled 2, 5 and 10-year capture zones developed for the NHW Well Field. This approach was adopted as a means of predicting the lateral extent to which the groundwater system will be influenced by NHW Well Field pumping activities over the next 10 years. It is expected that WQSP will be implemented for the duration of NHWWT. The DDW permit may contain a provision that allows for the adjustment of the WQSP as more information and data becomes available.
Step 5: Develop the Analytical Approach	As detailed in Section 3.1, a robust list of constituents/analytes were generated through an evaluation of available groundwater studies, existing groundwater monitoring programs for the NHW Well and/or surrounding area, and regulatory requirements. These include: • The NHW Well Field Raw Water Quality Characterization (RWQC; Step 2 of 97-005 Evaluation), which includes an assessment of the Drinking Water Source Assessment and Contaminant Assessment (SA/CA; Step 1 of 97-005 Evaluation) for the NHW Well Field. 16 COPCs were identified. • LADWP's Groundwater System Improvement Study (GSIS) which identified 12 high priority constituents of concern (COCs) generally based on protocols developed by USEPA Region 8 (USEPA, 1994).

	• The DDW Interim Sampling Plan (**Attachment A**) developed through a combined effort between DDW and LADWP and includes a list of 22 constituents for laboratory analyzes. • DDW Process Memo 97-005 (2015) (Section 4b. Monitoring, page 9) which requires that monitoring wells be tested for potential contaminants identified in the SA/CA and RWQC study (Steps 1 and 2 of the 97-005 Evaluation). • DDW Process Memo 97-005 (2015) (Section 4b. Monitoring, page 9) which requires that TICs must be assessed.
Step 6: Specify Performance or Acceptance Criteria	Data Quality Indicators (DQIs) will be assessed to evaluate the quality of data as discussed in Section 4.4.
Step 7: Optimize Sampling Design	The WQSP may be modified based on the interim groundwater monitoring conducted prior to NHWWT plant construction; based on input from DDW and ongoing WQSP sampling results. For example, monitoring wells may be added or removed from the monitoring network, the number of monitoring intervals sampled for a given monitoring well may be modified, additional constituents may be added or removed from the analytical schedule, or the frequency of sampling events may be modified.

4.4 Data Quality Indicators and Acceptance Criteria for Measurement Data

This section describes specific data quality indicators (DQIs) and measurement quality objectives (MQOs) for the groundwater data generated in the field and by the analytical laboratory(ies). DQIs provide a means to evaluate the quality of data and are generally defined in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity as described in the following sections. The DQIs were developed using the guidelines in the EPA's *Guidance for Quality Assurance Project Plans, EPA QA/G-5 Final* (EPA 2002) document.

4.4.1 Precision

Precision is the degree of mutual agreement between or among independent measurements of a similar property (usually reported as a standard deviation [SD] or relative percent difference [RPD]). Precision is assessed by replicate measurements of known standards and analysis of duplicate field samples. Site-specific Laboratory Fortified Sample Matrix/Duplicate (LFM/LFMD) [1], also called Matrix Spike/Matrix Spike Duplicate (MS/MSD), pairs will be used to assess analytical precision, and field duplicates with be used to assess both analytical and sampling precision.

[1] A Matrix Spike and Spike Duplicate (MS/MSD) are representative but randomly chosen client samples that have known concentrations of analytes of interest added to the samples prior to sample preparation and analysis. The MS/MSD are processed along with the same unspiked sample. The purpose of the MS/MSD is to document the accuracy and precision of the method for that specific sample.

For the purposes of this WQSP, field duplicates will be collected at a frequency of 1 per 10 samples collected. Groundwater field duplicates will be evaluated by determining the RPDs for the replicates, using Equation 1 below. For field duplicate precision, an acceptable RPD of ±30% will be adopted. It is important to note that although RPD can be a useful measure of precision, it should be evaluated in context, especially for very low concentration samples (EPA, 2014).

Laboratory precision is assessed through the analysis of duplicate samples including laboratory control samples / laboratory control sample duplicate (LCS/LCSD) samples and matrix spike/matrix spike duplicate (MS/MSD) samples. Laboratory duplicates, LCS/LCSD and MS/MSD will be analyzed at the frequency specified for the analytical method or the laboratory standard operating procedures detailed in **Attachment D**.

Laboratory precision (similar to field precision) is assessed through the calculation of RPDs between sample results. The RPD is calculated according to the following equation:

Equation 1: $$\text{RPD } (\%) = \frac{|\text{Sample Result} - \text{Duplicate Result}|}{(\text{Sample} + \text{Duplicate})/2} \times 100$$

Laboratory precision will be deemed acceptable if it meets the precision measurement performance criteria provided in **Attachment C**. The precision control limits provided in **Attachment C** are based on laboratory (LADWP Water Quality Laboratory and Weck Laboratories, Inc.) QC control limits detailed in **Attachment D**.

4.4.2 Accuracy

Accuracy is the degree of agreement of a measurement with a known or true value. To determine accuracy, a laboratory or field value is compared to a known or true concentration. Accuracy in the field is typically assessed using field blanks, such as trip blanks to assess the potential for cross contamination (EPA 2011a). The sampling and analytical schedules for field blanks are provided in Section 6.2.1. Field accuracy is also assessed by adherence to correct sample handling procedures (documented in the LADWP Water Quality Division’s Groundwater Monitoring Standard Operating Procedure [SOP] – **Attachment E**), preservation, and holding time criteria provided in **Attachment F**.

For the purposes of this WQSP laboratory accuracy and bias will be assessed through the analysis of method blanks, standard reference materials, LCS/LCSD, MS/MSD, surrogate compounds, and the determination of the percent recovery (%R) for these measurements.

The accuracy measurement is generally determined by the %Recovery (R) of a known value. Accuracy as %R is determined by the following equation:

Equation 2: $$\text{Recovery } (\%) = \frac{(\text{LCS/LFB Result})}{(\text{True Value})} \times 100$$

The laboratory accuracy measurement performance criteria (or control limits) are summarized in **Attachment C** and detailed in **Attachment D**.

4.4.3 Representativeness

Representativeness is the expression of the degree to which data accurately and precisely represent a characteristic of an environmental condition or a population. It relates both to the area of interest and to the method of taking the individual sample. During development of this WQSP, consideration was given to historical activities, existing analytical data, physical setting and processes. Also, using the appropriate methods (**Attachment C**) and proper analytical procedures (**Attachment D**), meeting sample holding times (**Attachment F**) and meeting QC criteria (**Attachments C & D**) for each parameter will affirm representativeness in the laboratory (EPA 2011a). While field duplicates are primarily used to assess precision, they also indicate sample homogeneity and therefore the representativeness of the data collected under this WQSP.

Groundwater sampling procedures are discussed in Section 5.3. The LADWP Groundwater Monitoring SOP is provided as **Attachment E** and will be followed to ensure representativeness of sample results by obtaining representative samples.

4.4.4 Completeness

Completeness refers to the percentage of valid data received from actual testing done in the laboratory. Completeness is calculated as shown in Equation 3:

The target completeness goal for all compounds is 90%.

Equation 3: $$\text{Completeness} = \frac{\text{Number of Measurements Judged Valid}}{\text{Total Number of Measurements}} \times 100$$

4.4.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. Comparability of data is achieved by ensuring sample collection and analyses follow standard protocols or closely similar protocols (EPA 2011a). To ensure that results are comparable, samples will be analyzed using standard EPA methods and protocols (**Attachments C** & **D**). Calibration and reference standards will be traceable to certified standards and standard data reporting formats will be employed. Data will also be reviewed to verify that precision and accuracy criteria were achieved and, if not, that data were appropriately qualified.

4.4.6 Sensitivity

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Sensitivity is usually expressed as method detection limits (MDLs) or practical quantitation limit (PQL) (EPA 2011a). The sensitivity for field measurements will be determined, in part, by the limitations of field instrumentation as described in the manufacturer's manual. Sensitivity can also be influenced by matrix interference and environmental conditions. Analytical laboratories frequently use the term Reporting Limit (RL) interchangeably with PQL. The analytical sensitivity goals (Minimum Reporting Limits [MRLs]) for the purposes of this WQSP are presented in **Attachment C**. Groundwater data will be compared to CA MCLs, DLRs and NLs, thus MRLs need to be equal to or less than these levels/limits. **Attachment C** provides the MRLs and associated (as applicable) MCLs, DLRs and NLs for all NHW WQSP analytes.

4.5 Development of the Analytical Approach

The analytical approach has been developed through the implementation of previous field sampling programs (BC 2015, LADWP 2015a), land use and previously identified contaminants in the SFB, and requirements laid out by regulators (DDW 2015). A detailed discussion is provided in Section 3.

4.6 Documents and Records

The following general types of documents and records will be maintained for individual monitoring programs:

- This WQSP;
- Injury Illness and Prevention Program (IIPP) document (**Attachment G**);
- Project field books or forms;
- Sample chain-of-custody (CoC) forms;
- General project correspondence;
- Laboratory data reports; and
- Data validation reports.

The Project Manager is responsible for delegating/maintaining the above records to meet the requirements of this WQSP. This requirement includes the maintenance of all records and data necessary for QA reports to management, corrective actions, and other associated documentation.

5. FIELD SAMPLING PLAN

Field work performed under this WQSP includes activities associated with groundwater sampling, pre-field activities (i.e., well access and background), groundwater level monitoring (well gauging), well purging and sample collection (including field parameter measurement), documentation of field activities, and handling of Investigative Derived Waste (IDW). Detailed procedures are documented in the LADWP Groundwater Monitoring SOP provided as **Attachment E**.

The purpose of a rigorous field sampling plan is to reduce uncertainty in the collection of groundwater samples, including variability in sample matrix (e.g. ensuring the water is representative of the formation), decontamination procedures, sample collection procedures, and sample handling procedures (**Attachment E**). The Field Team shall operate using unified protocols and will clearly communicate changes to sampling protocols. Such changes will be documented, assessed and validated to ensure the WQSP objectives are being met.

5.1 Health and Safety Requirements

All staff conducting work under this WQSP will comply with the requirements set forth in LADWP's Water Quality Division (WQD) Injury and Illness Prevention Program (IIPP) which is documented and provided in **Attachment G**. Updates to the program is a continuous process and before conducting activities associated with this WQSP, staff need to ensure they are considering the most up to date IIPP information. The IIPP document provided as **Attachment G** is due to be re-issued in December 2020.

5.2 Special Training/Certification

Field staff will be adequately trained in field methods and sampling procedures outlined herein. Specifically, field staff will have training to undertake the following activities: groundwater sampling, use of water-level indicators and related field equipment, and sample handling. SOPs will be used for laboratory and field activities and new employee training.

5.3 Field Documentation and Preparation

Prior to commencing field activities, the WQSP shall be reviewed. Field preparation shall be conducted by the Field Team.

5.3.1 Field Books

A controlled, permanently bound field book will be maintained by the Field Team(s). The field book will be used to record essential information such as purge volume information, field parameter readings, sample collection logs, general observations and weather conditions. At a minimum, the field book shall contain:

- Health and safety information per the requirements of the IIPP;
- Project (well field) name;
- Site/well access and contact information;
- SOPs;

- Figures/maps showing site layout and monitoring locations;
- Well specifications and historical measurements/parameters (as appropriate);
- Program analytical schedule;
- Laboratory provided CoC forms – these may be partially completed prior to commencement of field program;
- Equipment calibration forms;
- Field sheets (for recording purge information, field parameters readings, sample identification and QA sample identification); and
- Daily field report forms.

Forms and field documents shall contain the following information:

- Project name, and well number;
- Names of personnel present, including subcontractors;
- Sample date, time, location, identification number, and associated quality control samples;
- General observations (nearby activities) and weather conditions;
- Photographs taken – photographs of sample containers and any activities that may impact samples (i.e. use of generator in proximity of well [potential VOC contributor]) will be taken and recorded on the field form as appropriate;
- Equipment calibration information, including date and time of calibration check and calibration test types, i.e., three-point pH calibration etc.;
- Sample containers to be submitted to laboratory;
- Waste generated and disposal route; and
- Any deviations from the sampling plan/preferred practices.

Field books will be maintained with diligence and used as the single repository for field-collected data. If data must be recorded in a ledger other than the project-specific field book, the data will be transcribed into the field book at the earliest convenience. Errors made in the field logbook will be corrected by drawing a single line through the error and writing in the correct information. The correction will be initialed and dated. Field books will be scanned to the electronic file following each sampling event, or every two weeks for on-going activities. When the field book is completed, it will become part of the permanent project record.

5.3.2 Sample Containers

All sample containers are to be supplied by the laboratory designated for analytical services. Sample containment will follow the prescribed EPA Contract Laboratory Program (EPA 2011) procedures to provide containers free of contaminants. Preservatives, when required, will be added to the sample container by the laboratory or in the field as required. Sample containers with caps will be shipped to the user with sample coolers in protective cardboard cartons or other wrapping. Glass containers will be provided with Teflon-lined caps or Teflon septa, and all polyethylene containers will be provided with polypropylene closures. The appropriate sample container must be used as specified by the analytical method for each sample type.

Sample containers will be selected in accordance with the analyte specific method requirement. The NHW WQSP Sampling Guide is provided as **Attachment F** and includes information pertaining to required sample containers, appropriate sample preservation, and associated sample holding times.

5.4 Field Methods and Procedures

As conditions in the field vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the Field Team will notify the Project Management and a verbal approval will be obtained before implementing the changes. Modifications to the approved plan will be documented on the appropriate field form.

Detailed procedures are documented in the LADWP Groundwater Monitoring SOP provided as **Attachment E** and are summarized in the following subsections.

5.4.1 Preparation, Access and Storage

Prior to conducting groundwater monitoring and sampling events, equipment shall be inspected and tested; equipment maintenance shall be performed by the Field Team prior to mobilizing to the field.

5.4.2 Water Level Monitoring (Gauging)

The depth to water will be measured prior to initiation of all sampling activities and upon completion of sampling activities. The depth to water will be measured where downhole equipment/well access permits. The water level will be monitored using an electronic water level sounding tape with a graduated cable accurate to 0.01 feet.

5.4.3 Well Purging

Purging of wells using the traditional three casing-volume purge method will include removal of three casing volumes of water while monitoring field-measured parameters (i.e., pH, dissolved oxygen [DO], temperature, conductivity, oxidation-reduction potential [ORP] and turbidity; EPA 1996). Field parameters will be measured from the initial purge water, after the removal of each casing volume, and every five minutes after removing the third casing volume.

For low-flow applications field parameters will be monitored at intervals no smaller than one measurement per 0.5 liters purged. Field parameter monitoring is completed to confirm that water being sampled is representative of the formation surrounding the well and is not stagnant water in the casing or filter pack.

Table 5-1 shows the stabilization criteria for the field parameters.

Table 5-1: Field Parameter Stabilization Criteria

Parameter	Stabilization Criteria
pH	+/- 0.1 pH units
Temperature	+/- 1 degrees Celsius (ºC)
Conductivity	+/- 3% of reading
DO	+/- 10% of reading
ORP	+/- 10 mV
Turbidity	+/- 10% or below 10 Nephelometric Turbidity Units (NTU)

Notes: Criteria from EPA (United States Environmental Protection Agency). 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. Ground Water Issue. EPA/540/S-95/504. April 1996."

If parameters fail to stabilize during purging it will be the decision of the experienced Field Team Lead to determine whether purging will continue, or sample collection will be initiated. Justification will be recorded on the field form.

5.4.4 Groundwater Sampling

Implementation of this WQSP will require the collection of water samples from groundwater monitoring wells utilizing the following sampling techniques (well specific):

- Low-flow;
- Conventional; and
- Zone Isolation Sampling Technology (ZIST).

Each sampling system have specific procedures and requirements for purging and sampling. These procedures are documented in the LADWP Groundwater Monitoring SOP (Appendix F) provided as **Attachment E** therein.

5.4.5 Sample Labeling

A label will be affixed to every sample container. The label will include the following:

- Project number;
- Sample number;
- Collector's initials;
- Collection date and time;
- Type of preservative; and
- Analyses to be performed.

5.4.6 Sample Collection

Sample collection procedures are specific to the sample collection method. Water samples will be collected directly into laboratory-supplied containers specific to the type of analysis required. When collecting the sample, exposure to the atmosphere shall be minimized. Care is required to avoid or minimize the trapping of free bubbles (headspace) in the sample containers and to minimize turbidity during sampling, as each can notably alter apparent water chemistry. If the water is turbid following purging, consider leaving time for particles to settle out before sampling. Samples should always be stored immediately on ice to reduce potential biodegradation or volatilization losses following collection. Detailed sample collection instructions are provided in the LADWP Groundwater monitoring SOP provided as **Attachment E**.

5.4.7 Sample Identification Numbers

Unique sample identification (ID) numbers and station descriptions are assigned to each sampling location. The ID number and the station description will be recorded in the field book, on the sample label, and on the CoC record. This will be done so there is no uncertainty about the location and identity of each sample. No two samples will have the same ID number.

5.4.8 Sample Filtering

Selected water samples collected as part of this program will require field filtering prior to containerizing. Field filtering will be performed using a syringe connected to a 0.45-micron filter. To perform filtering, water from the discharge line will be directed into the syringe, and the plunger will be inserted to push the water through the filter into the sample bottle. Filters should be properly disposed of immediately after completion of sampling from the well to avoid potentially reusing them for other wells.

5.4.9 Sample Preservation

Samples will be preserved in accordance with analytical methods. Preservation requirements are documented in the NHW Sampling Guide provided as **Attachment F**. The typical approach for samples that require preservatives comprises the provision of the preservative by the laboratory and added to the sample container (**Attachment E**).

5.4.10 Decontamination

All equipment used for sampling will be decontaminated before being placed in a well, or collection of samples. Water generated during equipment decontamination will be handled in a similar fashion to purge water (refer to Section 5.4). Decontamination procedures are described in the LADWP Groundwater Monitoring SOP provided as **Attachment E**.

5.5 Field Sample Custody and Documentation

Information provided in this section was developed considering information from several sources, including the Contract Laboratory Guidance for Field Samplers document (EPA 2011). Detailed instructions pertaining to the collection of samples for analytical testing are provided in the LADWP Groundwater Monitoring SOP provided as **Attachment E**.

5.5.1 Chain-of-Custody Records

Sample identification documents will be prepared so that sample identification, disposition, and CoC are maintained. All applicable information on the CoC record, including signatures, will be filled out completely and legibly with permanent, water-proof ink.

Official custody of samples will be maintained and documented from the time of sample collection until the validation of analytical results. The CoC is the document that records the transfer of sample custody, assigns project information and analytical requirements and results distribution lists. Unused space (rows) for sample/analysis information will be crossed out. The CoC should be completed in the field and verified by the Field Team Lead. Upon completion of the CoC it shall be cross referenced with the analytical schedule, and the sample sets will be compared to the CoC to confirm that the correct bottles/preservatives were used, and sample containers were labelled correctly (also referred to as a cooler check). Samples will be submitted on regular turnaround times unless otherwise specified.

Once samples are received by the laboratory, it will be the responsibility of laboratory personnel to acknowledge receipt of samples, record the temperature within the shipping cooler, and verify that the containers have not been opened or damaged. It will also be the responsibility of laboratory personnel to maintain custody and sample tracking records throughout sample preparation and analysis. A copy of the CoC will be sent with the analytical results at completion of analytical work.

5.5.2 Sample Packaging and Transport

Samples will be placed right-side-up in coolers chilled with ice and extra space in the cooler will be filled with bubble wrap (or other appropriate inert material to fill the void space) to ensure the samples do not jostle during transport. The Field Lead is responsible for ensuring sufficient ice or ice packs have been placed with the samples to keep the samples chilled. Coolers shall stay below 10ºC, and 4ºC where possible. The Field Team will prepare all samples for transport to the laboratory.

Some analytes have hold times that can be as short as six hours, as is the case for some bacterial samples. It is the best practice to collect these samples as near to the end of the field day as practically possible to ensure holding times are met.

5.5.3 Corrections to Documentation

All original recorded data will be written in permanent ink. No documents will be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. If an error is made on an accountable document (e.g., a CoC form) assigned to an individual, that individual will make corrections by drawing a line through the error (initialed) and entering the correct information. The erroneous information will not be obliterated. Any subsequent error discovered on an accountable document will be corrected, initialed and dated by the person who made the entry.

5.6 Investigative Derived Waste

It is anticipated that IDW will be suitable for treatment at the NHWWT facility. IDW will be stored, profiled, and where possible disposed of using LADWP water treatment infrastructure.

6. QUALITY ASSURANCE PROJECT PLAN

This section comprises the QAPP. This QAPP has been prepared in accordance with the EPA Guidance for Quality Assurance Project Plans (EPA OA/G-5; EPA 2002).

6.1 Data Generation and Acquisition

6.1.1 Sampling Process Design

Groundwater wells and analytical schedule rationale is included in Sections 2 and 3 of the WQSP, and sampling methods specific to each well are included in the LADWP Water Quality Sampling SOP (**Attachment E**).

As conditions in the field vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the Field Team will notify the Project Manager and a verbal approval will be obtained before implementing the changes. Modifications to the plan will be documented on the appropriate field form.

6.1.2 Analytical Methods

Analytical methods for analytes to be tested as part of this WQSP are listed in Table 6-1, and associated laboratory analytical methods tables are provided as **Attachment D**.

Table 6-1: Parameters and Analytical Methods

Analyte	CAS Number	Analytical Method
1,1-Dichloroethane (1,1-DCA)	75-34-3	EPA 524.2
1,1-Dichloroethene (1,1-DCE)	75-35-4	EPA 524.2
1,2,3-Trichloropropane (1,2,3-TCP)	96-18-4	SRL 524M-TCP
1,2-Dichloroethane (1,2-DCA)	107-06-2	EPA 524.2
1,4-Dioxane	123-91-1	EPA 522
Benzene	71-43-2	EPA 524.2
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	EPA 525.2
Carbon tetrachloride (CTET)	56-23-5	EPA 524.2
Chlorate	14866-68-3	EPA 300.1
Chromium, Total	7440-47-3	EPA 200.8
cis-1,2-Dichloroethene (cis-1,2-DCE)	156-59-2	EPA 524.2
Dichlorodifluoromethane (Freon 12)	75-71-8	EPA 524.2

Analyte	CAS Number	Analytical Method
Hexavalent Chromium (Cr[VI])	18540-29-9	EPA 218.7
Methyl tert-butyl ether (MTBE)	1634-04-4	EPA 524.2
Nitrate (as Nitrogen [N])	14797-55-8	EPA 300.0
N-Nitrosodiethylamine (NDEA)	55-18-5	EPA 521
N-Nitrosodimethylamine (NDMA)	62-75-9	EPA 521
N-Nitrosodi-n-butylamine (NDBA)	924-16-3	EPA 521
N-Nitrosodi-n-propylamine (NDPA)	621-64-7	EPA 521
N-Nitrosomethylethylamine (NMEA)	86-30-6	EPA 521
N-Nitrosomorpholine (NMOR)	59-89-2	EPA 521
N-Nitrosopiperidine (NPIP)	100-75-4	EPA 521
N-Nitrosopyrrolidine (NPYR)	930-55-2	EPA 521
Perchlorate	14797-73-0	EPA 314
SVOC TICs	--	EPA 8270
Tetrachloroethene (PCE)	127-18-4	EPA 524.2
Total Dissolved Solids (TDS)	TDS	SM2540C
Trichloroethene (TCE)	79-01-6	EPA 524.2
Trichlorofluoromethane (Freon 11)	75-69-4	EPA 524.2
VOC TICs	--	EPA 524.2

6.1.3 Field Quality Assurance / Quality Control Protocols

Field QC samples are intended to help evaluate conditions resulting from field activities and are intended to accomplish two primary goals, (1) assessment of field contamination and (2) assessment of sampling variability. The former looks for substances introduced in the field due to environmental or sampling equipment and are assessed using blanks of different types. The latter includes variability due to sampling technique and instrument performance as well as variability possibly caused by the heterogeneity of the matrix being sampled and are assessed using replicate sample collection. Two types of field QC samples will be collected for work under this WQSP:

- field duplicates; and
- trip blanks.

Field Duplicates

A field duplicate is an independent sample collected as close as possible in time to the original sample, from the same source, and under identical conditions. Field duplicates are used to document sampling and analytical precision.

Field personnel will collect one blind field duplicate for every 10 primary groundwater samples collected (1 duplicate will be collected if less than 10 groundwater samples are collected in total). For the purpose of the WQSP, individual RPD values should be ≤30 percent, and at least 85 percent of the RPDs should comply with the criterion (i.e., ≤30 percent).

Field duplicate samples will have a unique sample ID and will be collected as a distinct (independent) sample. Sample nomenclature for a primary sample is simply "Well ID" (refer to Table 2-2). Sample nomenclature for the corresponding field duplicate sample is "Well Name-99". For example, a blind field duplicate sample collected at location NH-MW-03-Z1 will be called "NH-MW-03-99". Duplicate samples will be tested for the NHW WQSP Analytical Suite (refer to Table 3-1 and Table 6-1).

Trip Blanks

A trip blank is typically used with samples collected for volatile organic compounds (VOCs) testing. Its purpose is to detect and identify any VOC contamination of the samples from travelling to and from the laboratory. Trip blanks are created at the laboratory by completely filling a volatile vial container with laboratory grade deionized water and sealing the container. The trip blank vials are NOT to be opened until they are about to be tested at the laboratory.

One laboratory-supplied trip blank will be analyzed per sampling event. The trip blank will be analyzed for VOCs (EPA Method 524.2 - Measurement of Purgeable Organic Compounds in Water by Capillary Column GC/MS).

Trip blanks provide an indication of contamination attributable to sample collection, handling and shipment.

6.1.4 Laboratory Quality Control Samples

The quality control (QC) tests and checks conducted by the LADWP Water Quality Laboratory (WQL) for the analytical methods listed in Table 6-1 are provided in **Attachment D**.

6.1.5 Data Management

The WQL will produce electronic data deliverables (EDDs) and portable document format (PDF) certificates of analyses. Analytical data will be uploaded to LIMS for storage and retrieval.

6.2 Assessment and Oversight

Laboratories used for analytical testing of water samples collected for the WQSP will be Environmental Laboratory Accreditation Program (ELAP) accredited and participate in the drinking water performance testing program. Assessment of data validity will be conducted on an on-going basis by the WQL Data Validation group. Notice of potentially invalid data will be directed to the WQD Project Manager. Assessment of usability of the data will be done by the WQD Project Manager through evaluating the information provided from the WQL and sampling group in light of the achievement of the DQOs (Section 4).

The WQL is responsible to provide validated and approved data for the project to ensure that the procedures used to generate data comply with this QAPP. The WQD Project Manager and Quality Assurance Officer will ensure that the field sampling team is compliant with QAPP procedures and that this QAPP is implemented as prescribed.

6.3 Data Verification, Validation and Usability

Data verification, validation and usability determinations are described in this section.

6.3.1 Verification Methods

The dataset will be verified for the following.

- Completeness to ensure that all data requested is present in the deliverables.
- Compliance to check that laboratory results reported in PDF compare to those reported electronically.
- Compliance to check that the analytical QC packages including the sample related QC and the instrument related QC checks have been recorded and reported.
- Results for water samples will be reported in with units of either µg/L, e.g., VOCs; mg/L, e.g., alkalinity; picograms per liter, e.g., dioxins; or picocuries per liter, e.g., radionuclides.
- Results will be compared to historical values.

6.3.2 Data Review and Validation

Validation of analytical data will be conducted by the WQL Data Validation group in accordance with laboratory method SOPs and QA Manual guidance, when applicable. Acceptance criteria of the analytical methods or the laboratory in-house control limits (refer to **Attachments C** and **D**) will be used to validate the data results.

The following data review procedures will be conducted by the WQL:

- Laboratory analyzes the sample and enters the data into LIMS. The Laboratory Supervisor or his/her designee will review the data, following data review checklists specific to each method; the checklists include a list of procedural and/or QC requirements of the specific methods. Raw data and QC results are evaluated to determine if any out-of-control event has occurred.
- When a QC measurement is found to be outside of the acceptance limits and the associated data is to be reported, data qualifier will be used to flag the data. When an out-of-control event is determined to pose a significant impact on the reliability of the data, the Project Manager and the Sampling Group Supervisor will be notified to determine whether re-sampling is needed. The impacted data will not be reported.
- If the data and QC results are shown to be within acceptance limits, Chemistry or Microbiology staff will validate the data in LIMS. The WQ Lab Manager will then approve the data once they are entered into LIMS.

- The Reporting group prepares the lab data report and sends it to the WQD Project Manager.
- The WQD Project Manager will review the data for usability in the project.

Contract laboratory data reports are reviewed by the WQL team, and if data are acceptable, they are entered and validated in LIMS. The WQL manager then approves the data in LIMS. When an out-of-control event is determined to pose a significant impact on the reliability of the data, the Project Manager will be notified to determine whether re-sampling is needed. The impacted data will not be reported.

6.3.3 Reconciliation of Data with User Requirements

The WQD Project Manager will collaborate with the WQL to determine the usability of flagged or rejected data.

7. REPORTING

Annual reports will be generated which will provide an evaluation and technical review of the water quality data gathered from the sentinel monitoring wells (NHW WQSP monitoring wells [Table 2-2]), and a discussion pertaining to any water quality changes and potential impacts on NHWWT. Annual reports will be submitted to DDW by March 30 of each year for the duration of WQSP implementation.

Unexpected increases in contaminant concentrations or detection of additional contaminants may trigger confirmatory or supplemental sampling events. If confirmatory/supplemental events are deemed necessary, the rational and results will be outlined in a letter report and included in the annual report.

8. REFERENCES

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Attachments

Attachment A Division of Drinking Water (DDW) Interim Sampling Plan Information & DDW Correspondence

INTERIM SAMPLING PLAN

CENTRALIZED TREATMENT OPERATION

Groundwater Remediation - Water Quality

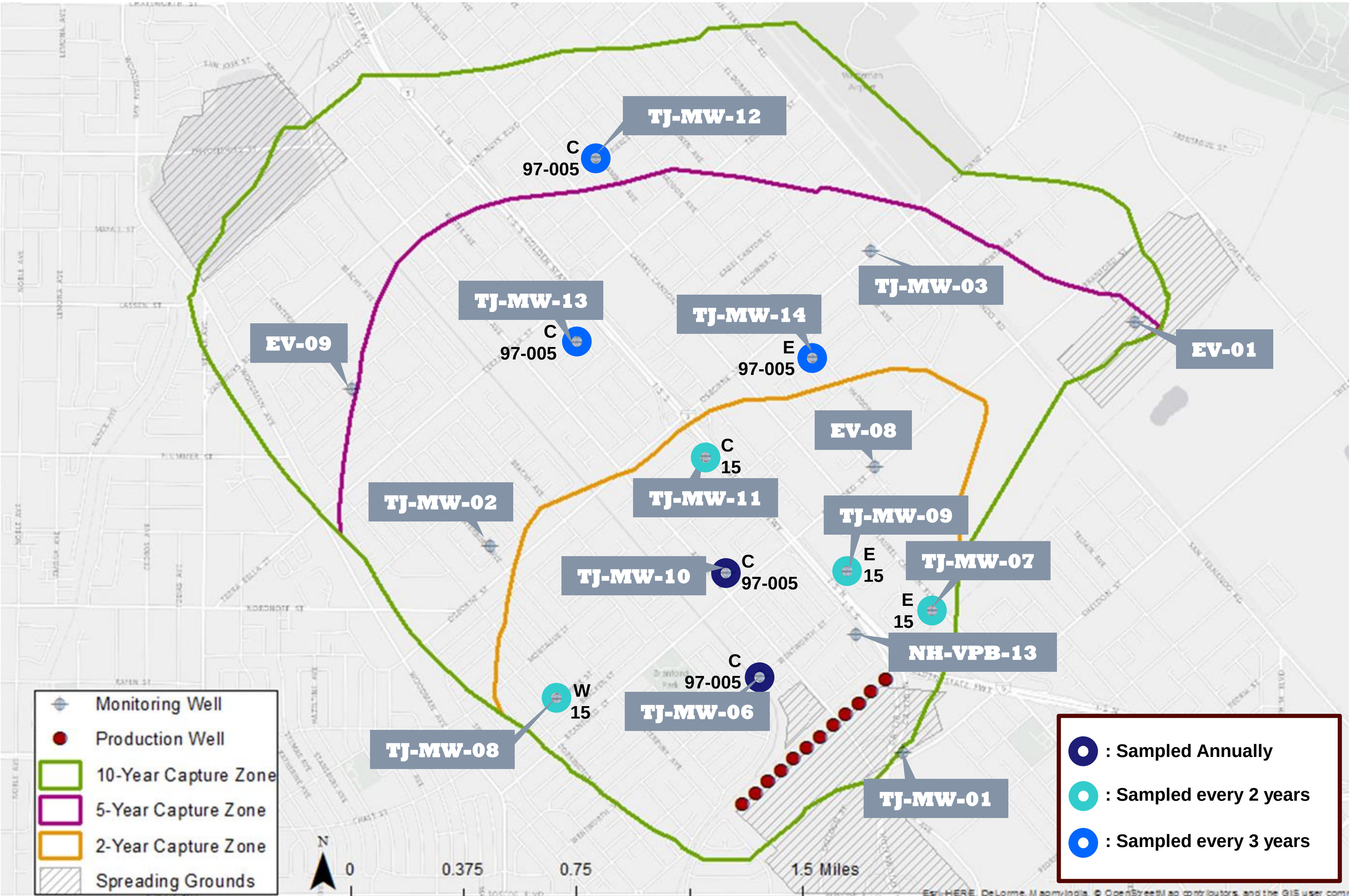
Los Angeles Department of Water and Power

April 2015

Wellfield	Capture Zone	Monitoring Well	2019 (Jan-June)	2019 (Jul-Dec)	2020	2021	2022	2023
North Hollywood West	2	NH-MW-03-Z1	X	Y	Y	Y	Y	Y
		NH-MW-03-Z3	X	Y	Y	Y	Y	Y
		NH-MW-05-Z1	X	Y	Y	Y	Y	Y
		NH-MW-05-Z2	X	Y	Y	Y	Y	Y
		NH-MW-05-Z3	X	Y	Y	Y	Y	Y
		NH-MW-06-Z1	X	Y	Y	Y	Y	Y
		NH-MW-06-Z2	X	Y	Y	Y	Y	Y
		NH-MW-06-Z3	X	Y	Y	Y	Y	Y
		NH-MW-11-Z1	X	Y	Y	Y	Y	Y
		NH-MW-11-Z2	X	Y	Y	Y	Y	Y
		NH-MW-11-Z3	X	Y	Y	Y	Y	Y
		NH-VPB-02	X	Y	Y	Y	Y	Y
	5	NH-MW-02-Z1			Y			Y
		NH-MW-02-Z2			Y			Y
		NH-MW-08-Z1			Y			Y
		NH-MW-08-Z2			Y			Y
		NH-MW-08-Z3			Y			Y
		4909C			Y			Y
	10	NH-MW-07-Z1			Y			Y
		NH-MW-07-Z2			Y			Y
		NH-MW-07-Z3			Y			Y
		NH-MW-10-Z1			Y			Y
		NH-MW-10-Z2			Y			Y
		NH-MW-10-Z3			Y			Y

Note: X = Full List for 97-005
Y = 22 Constituents

TUJUNGA



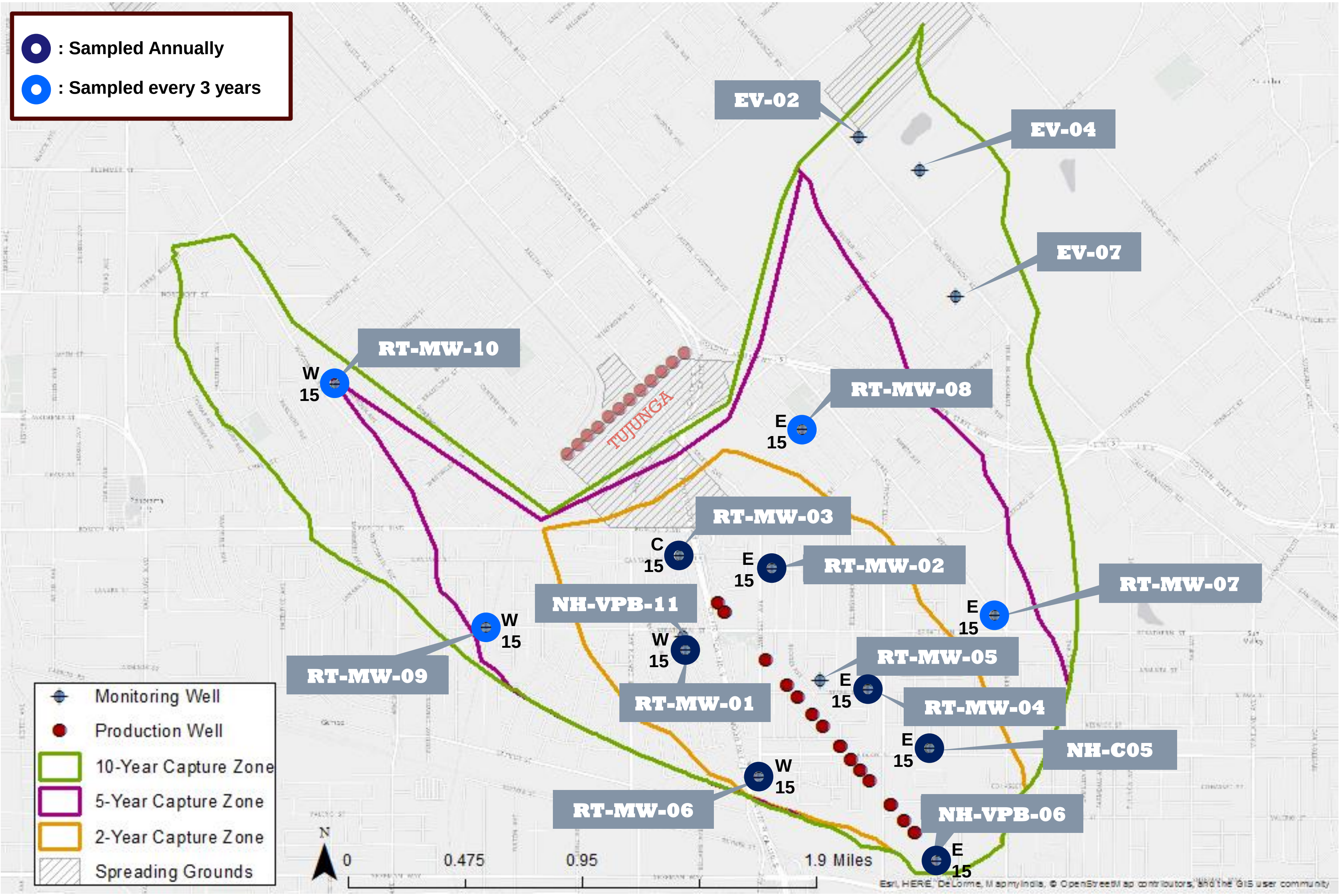
TJ-MW-12
C
97-005
TJ-MW-13
C
97-005
TJ-MW-14
E
97-005
TJ-MW-03
EV-09
EV-01
EV-08
C
15
TJ-MW-11
TJ-MW-02
TJ-MW-09
E
15
TJ-MW-10
C
97-005
TJ-MW-07
E
15
NH-VPB-13
C
97-005
TJ-MW-06
W
15
TJ-MW-08
TJ-MW-01
Monitoring Well
Production Well
10-Year Capture Zone
5-Year Capture Zone
2-Year Capture Zone
Spreading Grounds
N
0
0.375
0.75
1.5 Miles
: Sampled Annually
: Sampled every 2 years
: Sampled every 3 years

TUJUNGA Sampling Frequency

Wellfield	Capture Zone	Monitoring Well	2015	2016	2017	2018	2019	2020 (Jan-June)	2020 (July-Dec)
Tujunga	2	TJ-MW-08-390		Y		Y		X	X
		TJ-MW-08-530		Y		Y		X	X
		TJ-MW-08-820		Y		Y		X	X
		TJ-MW-06-400	X	X	X	X	X	X	X
		TJ-MW-06-570	X	X	X	X	X	X	X
		TJ-MW-06-860	X	X	X	X	X	X	X
		TJ-MW-10-440	X	X	X	X	X	X	X
		TJ-MW-10-560	X	X	X	X	X	X	X
		TJ-MW-10-860	X	X	X	X	X	X	X
		TJ-MW-11-440		Y		Y		X	X
		TJ-MW-11-560		Y		Y		X	X
		TJ-MW-11-900		Y		Y		X	X
		TJ-MW-07-420		Y		Y		X	X
		TJ-MW-07-600		Y		Y		X	X
		TJ-MW-07-860		Y		Y		X	X
		TJ-MW-09-580		Y		Y		X	X
		TJ-MW-09-850		Y		Y		X	X
	5	TJ-MW-13-460			X			X	
		TJ-MW-13-670			X			X	
		TJ-MW-13-910			X			X	
		TJ-MW-14-460			X			X	
		TJ-MW-14-580			X			X	
		TJ-MW-14-900			X			X	
	10	TJ-MW-12-490			X			X	
		TJ-MW-12-590			X			X	
		TJ-MW-12-910			X			X	

Note: X = Short List for 97-005
Y = All 21 Constituents

RINALDI TOLUCA

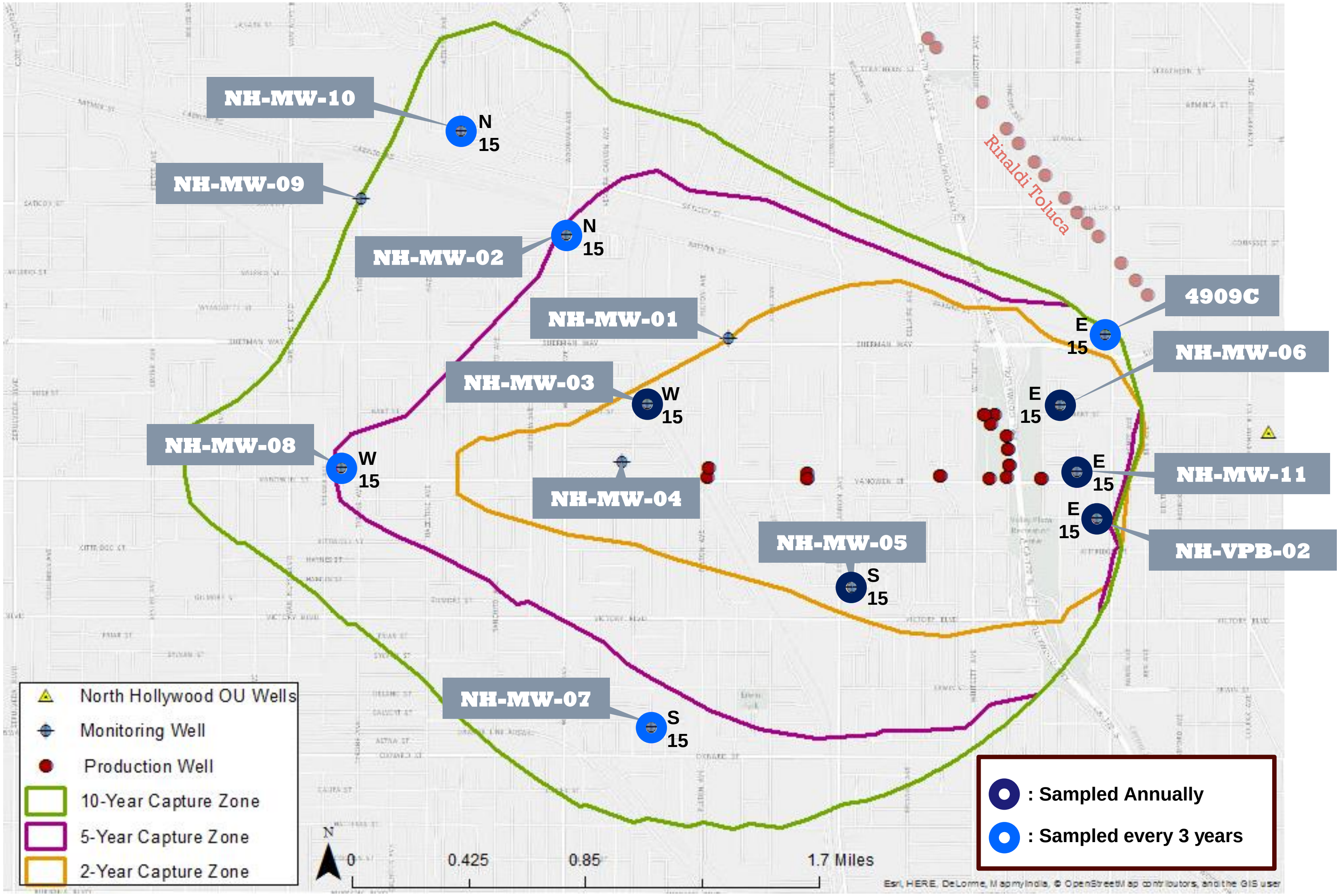


RINALDI TOLUCA Sample Frequency

Wellfield	Capture Zone	Monitoring Well	2015	2016	2017	2018	2019	2020 (Jan-June)	2020 (July-Dec)
Rinaldi Toluca	2	RT-MW-06-310	Y	Y	Y	Y	Y	X	X
		RT-MW-06-510	Y	Y	Y	Y	Y	X	X
		RT-MW-06-710	Y	Y	Y	Y	Y	X	X
		RT-MW-01-370	Y	Y	Y	Y	Y	X	X
		RT-MW-01-630	Y	Y	Y	Y	Y	X	X
		RT-MW-01-780	Y	Y	Y	Y	Y	X	X
		RT-MW-03-380	Y	Y	Y	Y	Y	X	X
		RT-MW-03-570	Y	Y	Y	Y	Y	X	X
		RT-MW-03-760	Y	Y	Y	Y	Y	X	X
		RT-MW-04-320	Y	Y	Y	Y	Y	X	X
		RT-MW-04-450	Y	Y	Y	Y	Y	X	X
		RT-MW-04-730	Y	Y	Y	Y	Y	X	X
		RT-MW-02-370	Y	Y	Y	Y	Y	X	X
		RT-MW-02-650	Y	Y	Y	Y	Y	X	X
		RT-MW-02-810	Y	Y	Y	Y	Y	X	X
		NH-VPB-06	Y	Y	Y	Y	Y	X	X
		NH-C05-320	Y	Y	Y	Y	Y	X	X
	5	RT-MW-09-300			Y			Y	
		RT-MW-09-560			Y			Y	
		RT-MW-09-800			Y			Y	
		RT-MW-07-340			Y			Y	
		RT-MW-07-510			Y			Y	
		RT-MW-07-770			Y			Y	
		RT-MW-08-400			Y			Y	
		RT-MW-08-580			Y			Y	
		RT-MW-08-760			Y			Y	
	10	RT-MW-10-400			Y			Y	
		RT-MW-10-630			Y			Y	
		RT-MW-10-860			Y			Y	

Note: X = Short List for 97-005
Y = All 21 Constituents

NORTH HOLLYWOOD WEST



NORTH HOLLYWOOD WEST Sample Frequency

Wellfield	Capture Zone	Monitoring Well	2015	2016	2017	2018	2019	2020 (Jan-June)	2020 (July-Dec)
North Hollywood West	2	NH-MW-03-268	Y	Y	Y	Y	Y	X	X
		NH-MW-03-772	Y	Y	Y	Y	Y	X	X
		NH-MW-05-250	Y	Y	Y	Y	Y	X	X
		NH-MW-05-510	Y	Y	Y	Y	Y	X	X
		NH-MW-05-720	Y	Y	Y	Y	Y	X	X
		NH-MW-06-280	Y	Y	Y	Y	Y	X	X
		NH-MW-06-580	Y	Y	Y	Y	Y	X	X
		NH-MW-06-810	Y	Y	Y	Y	Y	X	X
		NH-MW-11-280	Y	Y	Y	Y	Y	X	X
		NH-MW-11-450	Y	Y	Y	Y	Y	X	X
		NH-MW-11-710	Y	Y	Y	Y	Y	X	X
		NH-VPB- 02	Y	Y	Y	Y	Y	X	X
	5	NH-MW-08-250			Y			Y	
		NH-MW-08-430			Y			Y	
		NH-MW-08-770			Y			Y	
		NH-MW-02-305			Y			Y	
		NH-MW-02-375			Y			Y	
		4909C			Y			Y	
	10	NH-MW-10-300			Y			Y	
		NH-MW-10-450			Y			Y	
		NH-MW-10-820			Y			Y	
		NH-MW-07-230			Y			Y	
		NH-MW-07-390			Y			Y	
		NH-MW-07-770			Y			Y	

Note: X = Short List for 97-005
Y = All 21 Constituents

Monitoring Well Sampling

	Total Sampled Monitoring Wells (2015 - 2020)	Monitoring Wells Bi-annually Sampled (2020)	Monitoring Wells Sampled Every:		
			1 - year	2 - years	3 -years
Tujunga	9	6	2	4	3
Rinaldi Toluca	11	7	7	0	4
North Hollywood West	10	5	5	0	5
Total	**30**	**18**	**14**	**4**	**12**

*Well Samples are specifically for Interim Sampling before Centralized Treatment Operation. These totals do not account for sampling events outside of Centralized Treatment Operation.

Monitoring Well Sampling

TUJUNGA SAMPLES

Collection Sample Period	21 Constituents	97-005	Total
Jan 2015- Dec 2019:	22	39	61
2020 (Jan - Dec)	0	43	43
Total	**22**	**82**	**104**

RINALDI-TOLUCA SAMPLES

Collection Sample Period	21 Constituents	97-005	Total
Jan 2015- Dec 2019:	97	0	97
2020 (Jan - Dec)	12	34	46
Total	**109**	**34**	**143**

NORTH HOLLYWOOD-WEST SAMPLES

Collection Sample Period	21 Constituents	97-005	Total
Jan 2015- Dec 2019:	72	0	72
2020 (Jan - Dec)	12	24	36
Total	**84**	**24**	**108**

2020 Production Well Sampling

Wellfield	Well Numbers	Active Production Wells	97-005 Short Bi-annual Samples (2020)
Tujunga	1 - 12	12	24
Rinaldi Toluca	1 - 15	15	30
North Hollywood West	4, 7, 22, 23, 25, 26, 32, 33, 34, 36, 37, 43A, 44, 45	14	28
Total		**41**	**82**

*Well Samples are specifically for Interim Sampling before Centralized Treatment Operation. These totals do not account for sampling events outside of Centralized Treatment Operation.

All Well Sampling

	2015 - 2019 Sampled Wells	2020 Sampled Wells	Total Wells
Tujunga	21	36	57
Rinaldi Toluca	26	44	70
North Hollywood West	24	38	62
Total	**71**	**118**	**189**

*Well Samples are specifically for Interim Sampling before Centralized Treatment Operation. These totals do not account for sampling events outside of Centralized Treatment Operation.

21 Constituents

- TCE
- PCE
- 1,1-DCE
- 1,2,3-TCP
- MTBE
- Carbon Tetrachloride
- 1,4-Dioxane
- Total Dissolved Solids
- Nitrate
- Perchlorate
- Total Chromium
- Hexavalent Chromium
- Freon 11
- Freon 12
- Nitrosamines (NDMA – NDBA – NDPA – NDEA – NMEA – NPIP - NPYR)

97-005 Constituents

- 1,1,1,2-Tetrachloroethane
- 1,1,1-Trichloroethane
- 1,1,2,2-Tetrachloroethane
- 1,1,2-Trichloroethane
- 1,1-Dichloroethane (1,1-DCA)
- 1,1-Dichloroethene (1,1-DCE)
- 1,1-Dichloropropene
- 1,2,3-TCP (GCMS) -LOW
- 1,2,4-Trichlorobenzene
- 1,2,4-Trimethylbenzene
- 1,2-Dichlorobenzene (o-DCB)
- 1,2-Dichloroethane (1,2-DCA)
- 1,2-Dichloropropane
- 1,3,5-Trimethylbenzene
- 1,3-Dichlorobenzene (m-DCB)
- 1,3-Dichloropropane
- 1,3-Dichloropropene, total
- 1,4-Dichlorobenzene (p-DCB)
- 1,4-Dioxane
- 2,2-Dichloropropane
- 2-Butanone (MEK)
- 2-Chloroethyl vinyl ether
- 2-Chlorotoluene (ortho)
- 2-Hexanone
- 4-Chlorotoluene (para)
- 4-Methyl-2-pentanone
- Acetone
- Acetonitrile
- Acrolein
- Acrylonitrile
- Alachlor (Alanex)
- Alkalinity,total (as $CaCO_3$)
- Aluminum
- Antimony
- Arsenic
- Atrazine (Atrex)
- Barium
- Benzene
- Benzo(a)pyrene
- Beryllium
- Bicarbonate (HCO_3^-, calc.)
- Boron
- Bromide
- Bromobenzene
- Bromochloromethane
- Bromodichloromethane
- Bromoform
- Bromomethane (Methyl bromide)
- Cadmium
- Calcium
- Carbon disulfide
- Carbon tetrachloride
- Carbonate (CO_3^{2-}, calc.)
- Cations, total, calc
- Chloride
- Chlorobenzene (Monochlorobenzene)
- Chlorodibromomethane
- Chloroethane
- Chloroform
- Chloromethane (Methyl chloride)
- Chromium VI (Hexavalent Chromium)
- Chromium, Total
- cis-1,2-Dichloroethylene
- cis-1,3-Dichloropropene
- Coliform Total (CL,QT2000) ,MM0-MUG
- Color, Apparent, Unfiltered
- Copper
- Cyanide
- Di(2-ethylhexyl)adipate (DEHA)
- Di(2-ethylhexyl)phthalate DEHP
- Dibromomethane
- Dichlorodifluoromethane (Freon 12)
- Dichloromethane (Methylene chloride)
- Di-isopropyl ether
- Dissolved oxygen. field
- E.coli (CL,QT2000) ,MMO-MUG
- Ethyl benzene
- Ethyl tert-Butyl Ether (ETBE)
- Fluoride
- Heterotrophic plate count (PCA), PourPlate
- Heterotrophic plate count (R2A),PourPlate
- Hexachlorobutadiene
- Hexachlorocyclopentadiene
- Hydroxide (OH^-, calc.)
- Iron
- Isopropylbenzene (Cumene)
- Langelier index at field temp.,calc
- Langelier index source temp
- Lead
- m,p-Xylenes
- Magnesium
- Manganese
- Mercury
- Methyl tert-butyl ether (MTBE)
- Naphthalene
- n-Butyl Benzene
- Nickel
- Nitrate (as N)
- Nitrate (as NO_3), calc
- Nitrate and Nitrite (as N) ,Calc
- Nitrite (as N)
- N-Nitrosodiethylamine (NDEA)
- N-Nitrosodimethylamine (NDMA)
- N-Nitrosodi-n-butylamine (NDBA)
- N-Nitrosodi-n-propylamine (NDPA)
- N-Nitrosomethylethylamine (NMEA)
- N-Nitrosopiperidine (NPIP)
- N-Nitrosopyrrolidine (NPYR)
- n-Propyl benzene
- Odor threshold at 60°C
- o-Xylene
- Perchlorate
- pH, field
- p-Isopropyltoluene (p-Cymene)
- Potassium
- sec-Butylbenzene
- Selenium
- Silica
- Silver
- Simazine
- Sodium
- Spec conductance (E.C.)
- Specific conductance, field
- Styrene
- Sulfate (as SO_4)
- Temperature, field
- tert-Amyl methyl ether (TAME)
- tert-Butyl Alcohol (TBA)
- tert-Butylbenzene
- Tetrachloroethylene (PCE)
- Thallium
- Thiobencarb (Bolero)
- TOC
- Toluene (Methyl benzene)
- Total dissolved solids (TDS), 180 °C
- Total hardness (as $CaCO_3$, calc.)
- Total THM
- trans-1,2-Dichloroethylene
- trans-1,3-Dichloropropene
- trans-1,4-Dichloro-2-butene
- Trichloroethylene (TCE)
- Trichlorofluoromethane (Freon 11)
- Trichlorotrifluoroethane (F113)
- Turbidity, field
- Turbidity, lab
- Uranium
- Vanadium
- Vinyl chloride (Chloroethane)
- Xylene, Total, calc
- Zinc

*Revised 2012

Botha, Stephanie (Orange County)

Subject: FW: Interm Sampling Plan

From: Diep, Chi P.@Waterboards [mailto:Chi.Diep@waterboards.ca.gov]
Sent: Monday, March 30, 2015 3:56 PM
To: Liu, Paul
Cc: Gastelum, Albert; Leung, Jonathan; Jonny, Hadi; Han, Alice; Russell, Kyle; Van Wagoner, William; Cortez-Davis, Evelyn; Wells, Kurt; Rother, Todd; Siyahian, Ani; Rho, Melinda; Christie, Don; Brownstein, Susan@Waterboards
Subject: RE: Summary and Ask from 3-10-15 Meeting on Initial Draft Sampling Plan for Groundwater Treatment Facilties

Hi Paul,

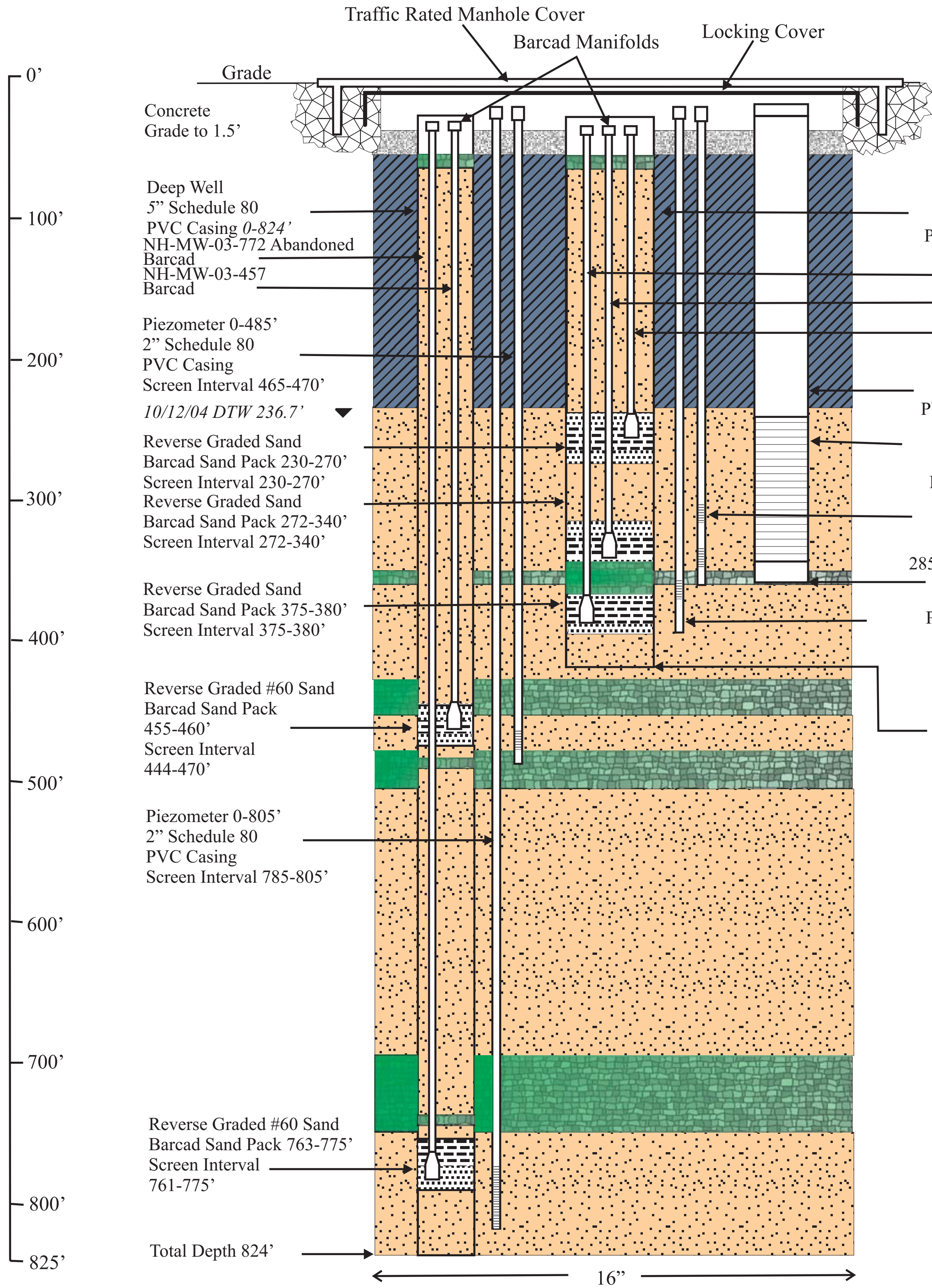
Regarding the proposed draft sampling plan, our responses are as follows:

1. Proposed sampling wells for each well field (Tujunga, Rinaldi-Toluca, and North Hollywood West): The proposed monitoring wells are acceptable.
2. Proposed sampling frequency for each well: For the Rinaldi-Toluca and North Hollywood West well fields, we would like all wells in the 2-year capture zone to be monitored annually for the proposed 15 constituents. Three-year frequency for wells in the 5- and 10-year capture zones is acceptable.
3. Proposed constituents of concern sampled for each well: This is acceptable, with the clarification that "NDMA" should include analyses for all 8 nitrosamines.

Also, when we are closer to start-up for the groundwater treatment plant(s), we will request a year of semi-annual sampling for the 2-year capture zone monitoring wells and production wells, as well as another monitoring of the full "97-005" suite of constituents in these wells. We will discuss specific requirements as we get closer to plant design and construction. Thanks,

Chi Diep, P.E.
Metropolitan District Engineer
State Water Resources Control Board
Division of Drinking Water
500 North Central Ave. Suite 500
Glendale, CA 91203
Direct: 818-551-2016
General: 818-551-2004
Fax: 818-551-2054
Email: Chi.Diep@waterboards.ca.gov

Attachment B Monitoring Well Construction Diagrams and Other Pertinent Well Information

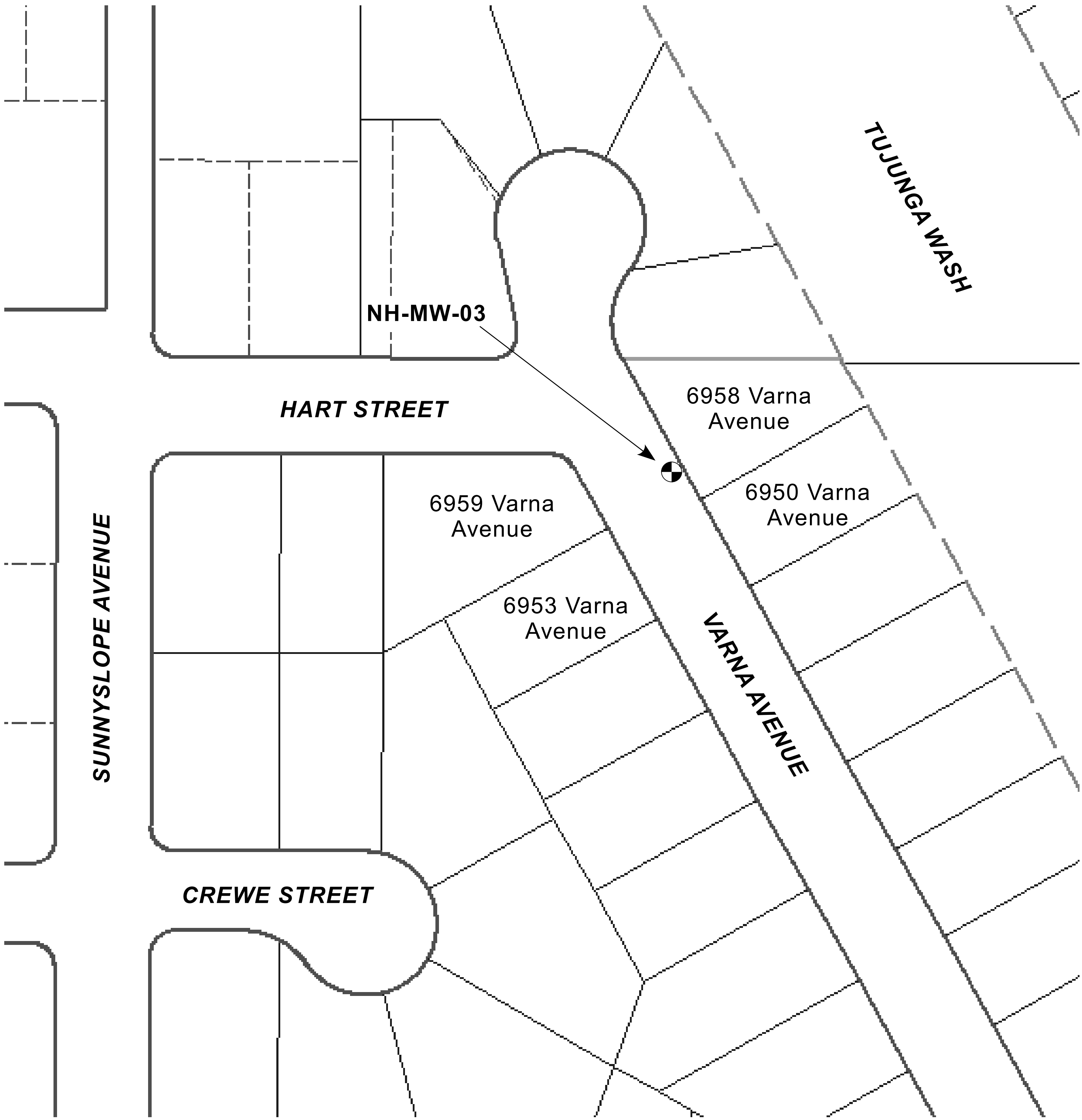


Note: Schematic Drawing, Exaggerated View

URS

FIGURE 4

N.H. WELL CONSTRUCTION DETAIL NH-MW-03
Varna Ave.



REFERENCE: City of Los Angeles (http://navigatela.lacity.org)

FIGURE NOT TO SCALE

SITE LOCATION MAP

NH-MW-03 MONITORING WELL LOCATION
6958 VARNA AVENUE
NORTH HOLLYWOOD, CALIFORNIA

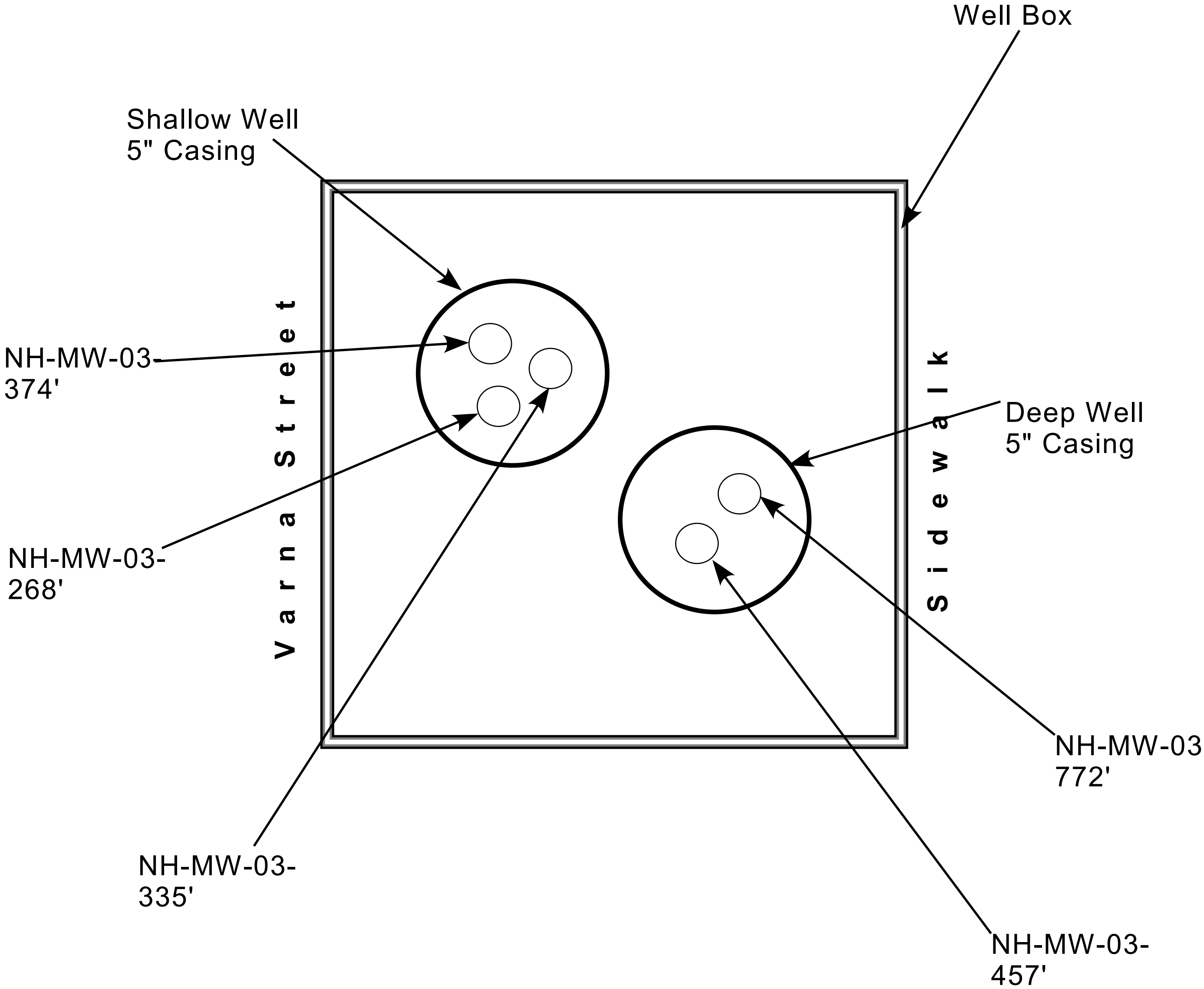
EXPLANATION

Monitoring Well Location

Lot, Tract, and Parcel Lines

URS

N



WELL AERIAL VIEW

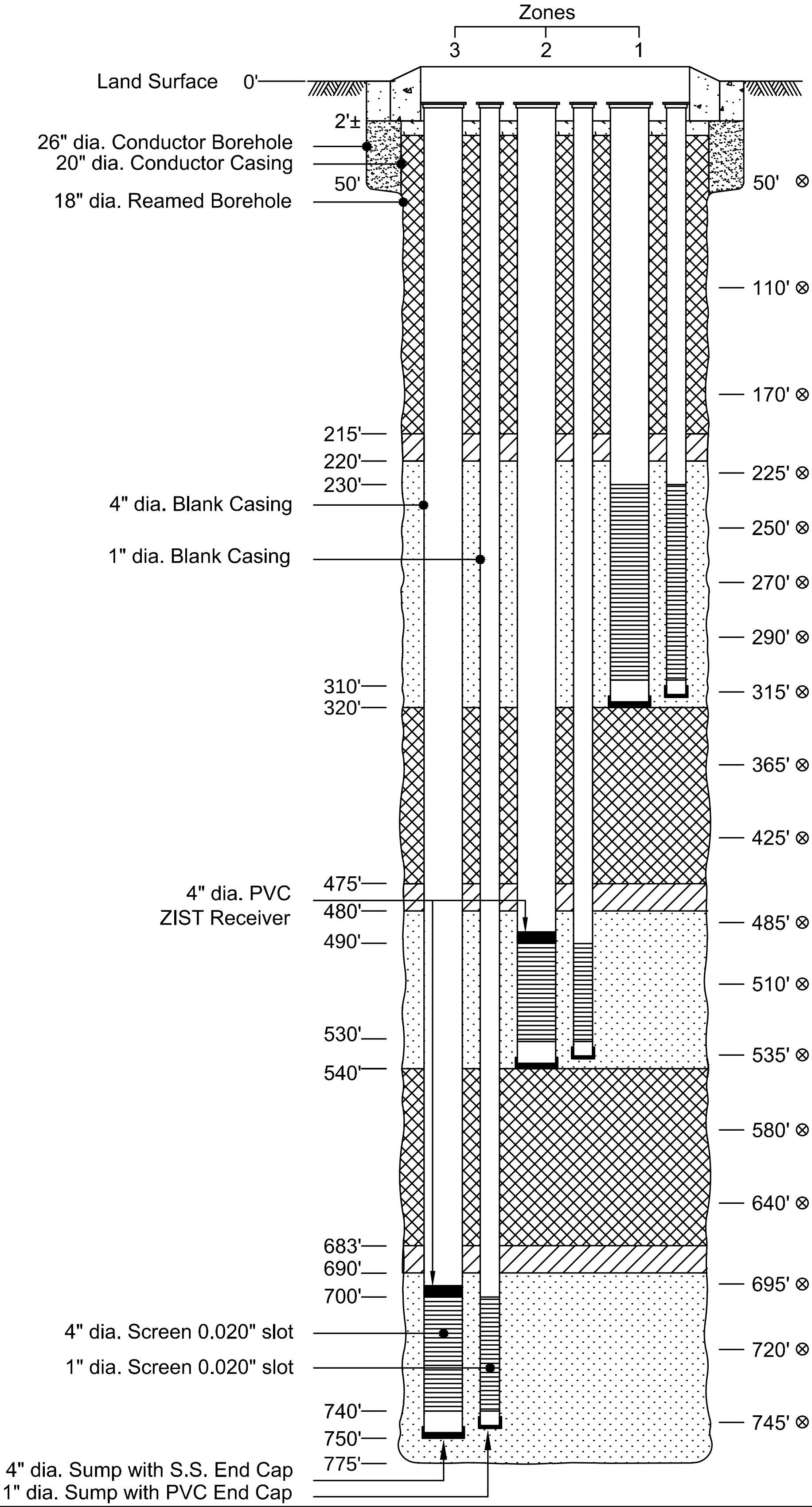
NH-MW-03 MONITORING WELL
6958 VARNA AVENUE
NORTH HOLLYWOOD, CALIFORNIA

URS

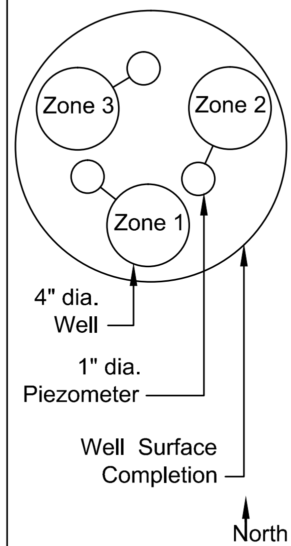
NOT TO SCALE

N

Plot Date: 01/14/15 - 8:24am, Plotted by: sflores
Drawing Path: \\bclax01\Projects\Projects\Los Angeles, City of - Department of Water and Power (DWP)\GSIS-Contract 47786\Task 3.5\Well Completion, Drawing Name: New NH-MW-05 LADWP New Wells.dwg



Plan View - Well Construction As-Built



Screen Interval Depths

- Zone 1 = 230 to 310 ft
- Zone 2 = 490 to 530 ft
- Zone 3 = 700 to 740 ft

Legend:

- ⊗ Indicates centralizer, depth provided, distance below ground surface on the right side of the diagram
- Cement and Bentonite Slurry
- #12 Sand with Medium Bentonite Chips (1:1)
- Medium Bentonite Chips
- #3 Sand
- Concrete
- Land Surface

Notes:

1. All depths are referenced to land surface unless otherwise indicated.
2. All well casing and screen materials are schedule 80 PVC.
3. Well detail and fill depths provided on the left side of the diagram.

Not to Scale

NESTED WELL INSTALLATION DIAGRAM
San Fernando Basin Groundwater System
Improvement Study

By: AP	Date: 09/04/14	Project No. 144462
LADWP	Brown AND Caldwell	Well: **NH-MW-05**

LADWP GROUNDWATER MONITORING WELL INSTALLATION PROJECT

Prepared by: Los Angeles Department of Water & Power
Water Engineering & Technical Services
Surveys & Right-of Way Group JASB

Datums:
NAVD88
CCS83, Zone 5
Elevations in Feet
Ref: WSFB 194-162-98/103 Horiz. Control
Ref: WSFB 190-162-24/41 Vert. Control
Ref: WSFB 190-162-13/23
Ref: WSFB 188-153-8/16
Ref: WSFB 180-162-1/2

Shallow, Mid & Deep wells are differenciated by the top of casing elevation

January 17, 2014

Well Number	Vicinity	Location, center of MH	Elevation MH Rim, N/s	Elevation Top of 1" Tube	Elevation Top of 4" PVC Casing
NH-MW-05	Hamlin Street, W/o Alcove Avenue	N 1891205.24 E 6436776.53	706.77		
NH-MW-05-Deep				705.63	705.62
NH-MW-05-Mid				705.67	705.68
NH-MW-05-Shallow				705.73	705.71

PROFESSIONAL LAND SURVEYOR
JOHN E. ALVO
P.L.S. 7908
STATE OF CALIFORNIA

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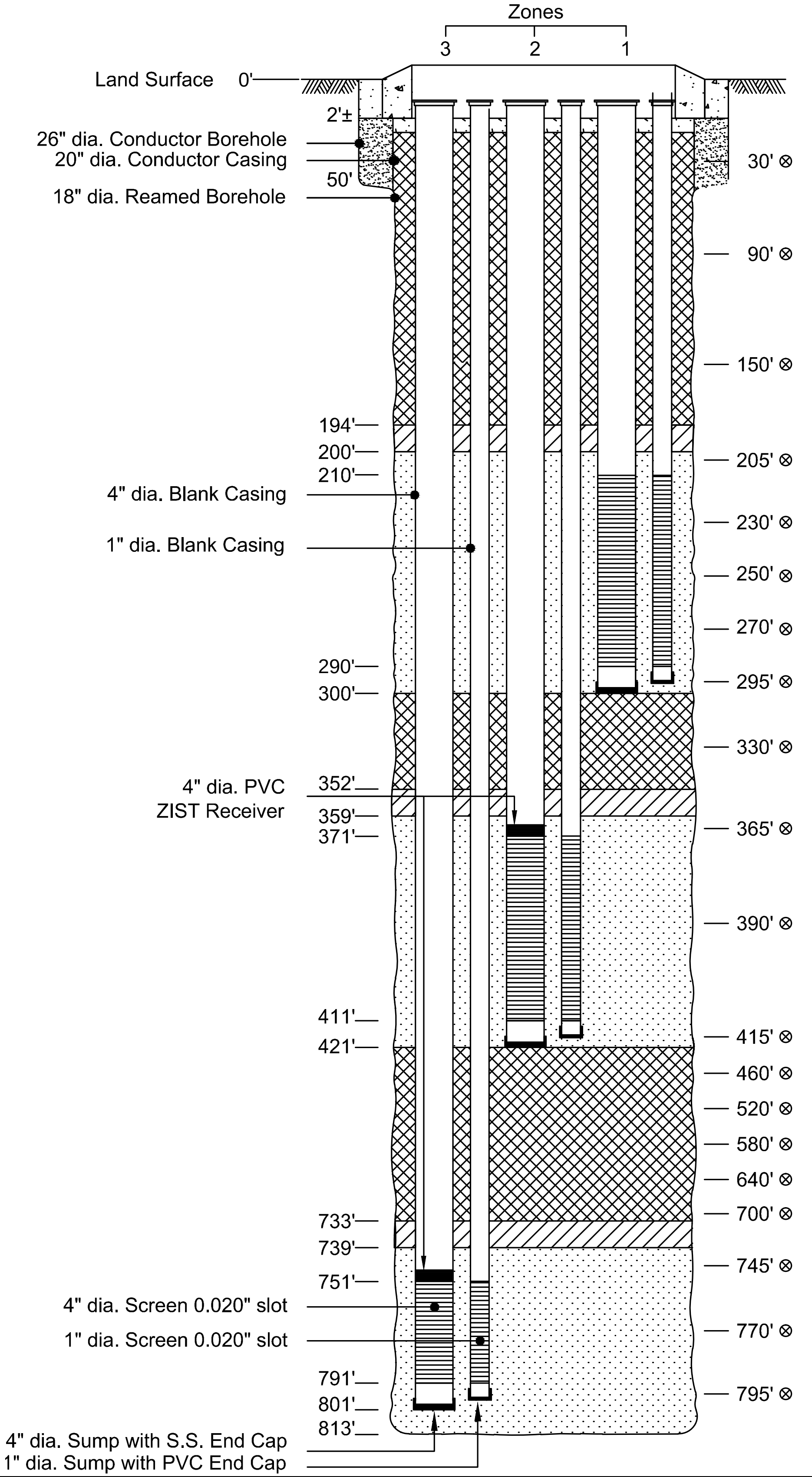
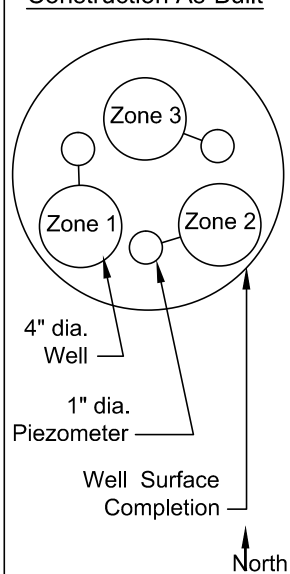
Drawing Path: \\bclax01\Projects\Projects\Los Angeles, City of - Department of Water and Power (DWP)\GSIS-Contract 47786\Task 3.5\Well Completion, Drawing Name: New NH-MW-07 LADWP New Wells.dwg



Plan View - Well Construction As-Built



Screen Interval Depths

- Zone 1 = 210 to 290 ft
- Zone 2 = 371 to 411 ft
- Zone 3 = 751 to 791 ft

Legend:

- ⊗ Indicates centralizer, depth provided, distance below ground surface on the right side of the diagram
- Cement and Bentonite Slurry
- #12 Sand with Medium Bentonite Chips (1:1)
- Medium Bentonite Chips
- #3 Sand
- Concrete
- Land Surface

Notes:

1. All depths are referenced to land surface unless otherwise indicated.
2. All well casing and screen materials are schedule 80 PVC.
3. Well detail and fill depths provided on the left side of the diagram.

Not to Scale

NESTED WELL INSTALLATION DIAGRAM
San Fernando Basin Groundwater System
Improvement Study

By: AP	Date: 09/04/14	Project No. 144462
LA DWP	Brown AND Caldwell	Well: **NH-MW-07**

LADWP GROUNDWATER MONITORING WELL INSTALLATION PROJECT

Prepared by:

Los Angeles Department of Water & Power
Water Engineering & Technical Services
Surveys & Right-of Way Group √ JHo

Datums:
NAVD88
CCS83, Zone 5
Elevations in Feet
Ref: WSFB 194-162-98/103 Horiz. Control
Ref: WSFB 190-162-24/41 Vert. Control
Ref: WSFB 188-153-6/7
Ref: WSFB 188-153-8/16

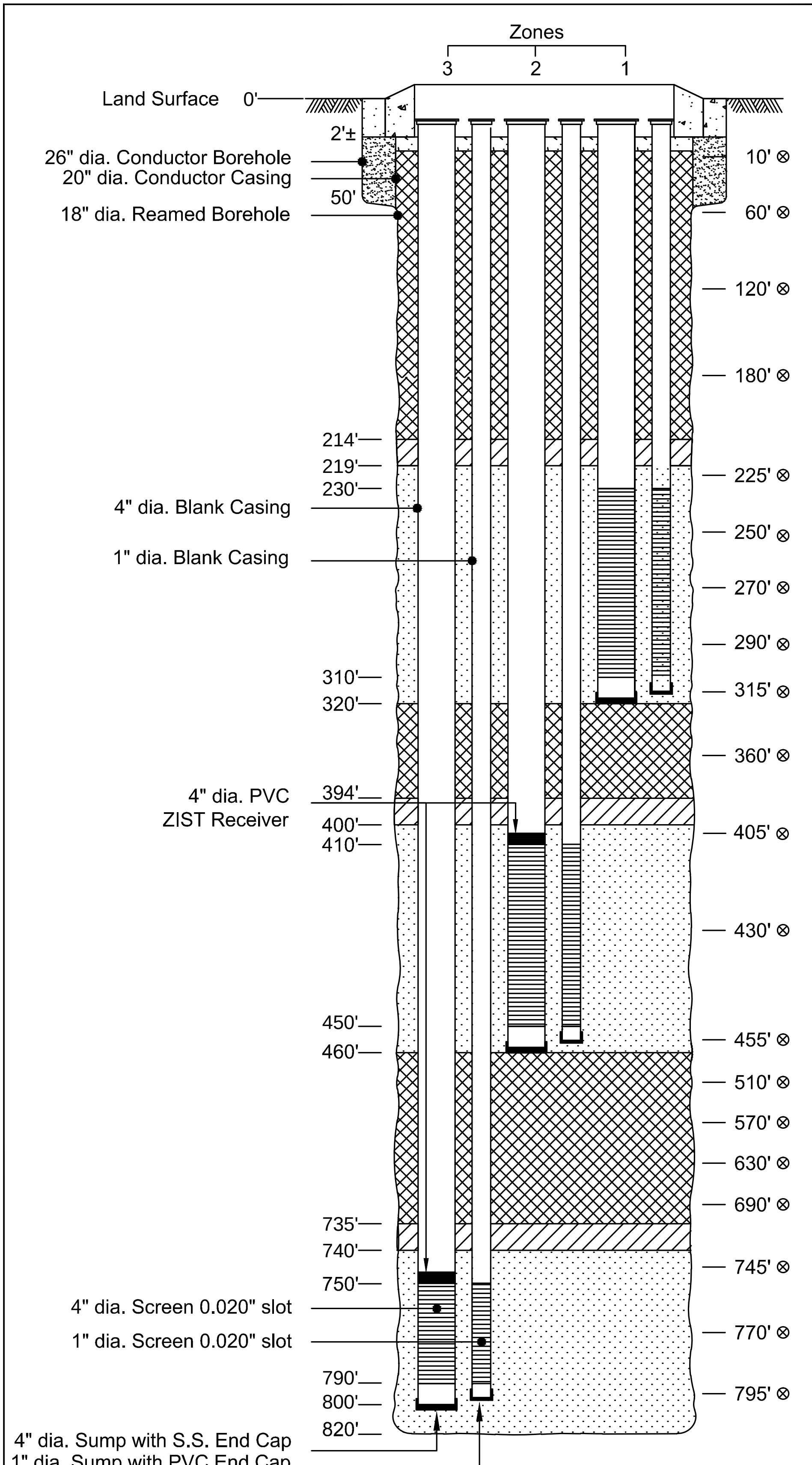
Shallow, Mid & Deep wells are differenciated by the top of casing elevation

February 22, 2014

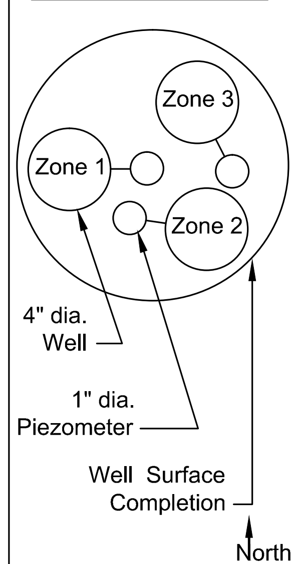
Well Number	Vicinity	Location, center of MH	Elevation MH Rim, N/s	Elevation Top of 1" Tube	Elevation Top of 4" PVC Casing
NH-MW-07	Bessemer Street & Greenbush Avenue	N 1888510.85 E 6432910.95	693.84		
NH-MW-07-Deep				692.79	692.79
NH-MW-07-Mid				692.85	692.86
NH-MW-07-Shallow				692.89	692.90

PROFESSIONAL LAND SURVEYOR
JOHN E. ALVO
P.L.S. 7908
STATE OF CALIFORNIA

Plot Date: 01/14/15 - 8:44am, Plotted by: sflores
Drawing Path: \\bclax01\Projects\Projects\Los Angeles, City of - Department of Water and Power (DWP)\GSIS-Contract 47786\Task 3.5\Well Completion, Drawing Name: New NH-MW-08 LADWP New Wells.dwg



Plan View - Well Construction As-Built



Screen Interval Depths

- Zone 1 = 230 to 310 ft
- Zone 2 = 410 to 450 ft
- Zone 3 = 750 to 790 ft

Legend:

- ⊗ Indicates centralizer, depth provided, distance below ground surface on the right side of the diagram
- Cement and Bentonite Slurry
- #12 Sand with Medium Bentonite Chips (1:1)
- Medium Bentonite Chips
- #3 Sand
- Concrete
- Land Surface

Notes:

1. All depths are referenced to land surface unless otherwise indicated.
2. All well casing and screen materials are schedule 80 PVC.
3. Well detail and fill depths provided on the left side of the diagram.

Not to Scale

NESTED WELL INSTALLATION DIAGRAM
San Fernando Basin Groundwater System
Improvement Study

By: AP	Date: 09/04/14	Project No. 144462
LA DWP	Brown AND Caldwell	Well: **NH-MW-08**

LADWP GROUNDWATER MONITORING WELL INSTALLATION PROJECT

Prepared by: Los Angeles Department of Water & Power
Water Engineering & Technical Services
Surveys & Right-of Way Group ✓JMO

Datums:
NAVD88
CCS83, Zone 5
Elevations in Feet
Ref: WSFB 194-162-98/103 Horiz. Control
Ref: WSFB 190-162-24/41 Vert. Control
Ref: WSFB 190-162-13/23
Ref: WSFB 188-153-8/16

Shallow, Mid & Deep wells are differenciated by the top of casing elevation

January 17, 2014

Well Number	Vicinity	Location, center of MH	Elevation MH Rim, N/s	Elevation Top of 1" Tube	Elevation Top of 4" PVC Casing
NH-MW-08	Lennox Avenue, N/o Vanowen Street	N 1893501.60 E 6426949.54	732.02		
NH-MW-08-Deep				730.89	730.87
NH-MW-08-Mid				730.94	730.93
NH-MW-08-Shallow				730.99	731.01

PROFESSIONAL LAND SURVEYOR
JOHN E. ALVO
P.L.S. 7908
STATE OF CALIFORNIA

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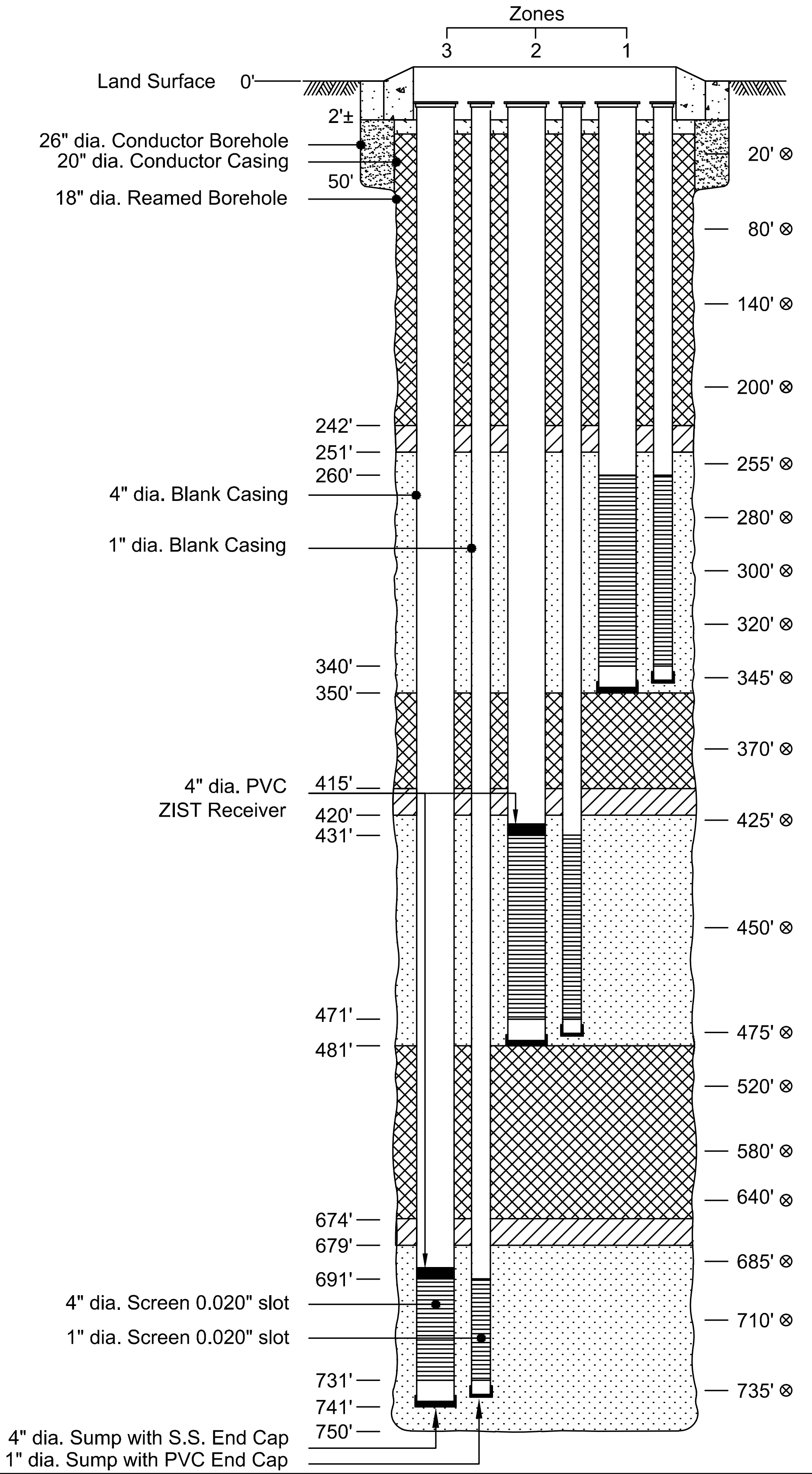
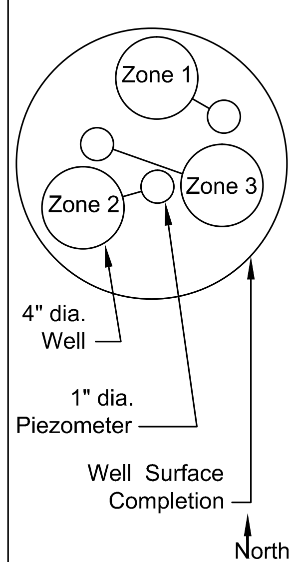
Drawing Path: \\bclax01\Projects\Projects\Los Angeles, City of - Department of Water and Power (DWP)\GSIS-Contract 47786\Task 3.5\Well Completion, Drawing Name: New NH-MW-11 LADWP New Wells.dwg



Plan View - Well Construction As-Built



Screen Interval Depths

- Zone 1 = 260 to 340 ft
- Zone 2 = 431 to 471 ft
- Zone 3 = 691 to 731 ft

Legend:

- ⊗ Indicates centralizer, depth provided, distance below ground surface on the right side of the diagram
- Cement and Bentonite Slurry
- #12 Sand with Medium Bentonite Chips (1:1)
- Medium Bentonite Chips
- #3 Sand
- Concrete
- Land Surface

Notes:

1. All depths are referenced to land surface unless otherwise indicated.
2. All well casing and screen materials are schedule 80 PVC.
3. Well detail and fill depths provided on the left side of the diagram.

Not to Scale

NESTED WELL INSTALLATION DIAGRAM
San Fernando Basin Groundwater System
Improvement Study

By: AP	Date: 09/04/14	Project No. 144462
LADWP	Brown AND Caldwell	Well: **NH-MW-11**

LADWP GROUNDWATER MONITORING WELL INSTALLATION PROJECT

Prepared by: Los Angeles Department of Water & Power
Water Engineering & Technical Services
Surveys & Right-of Way Group /JMO

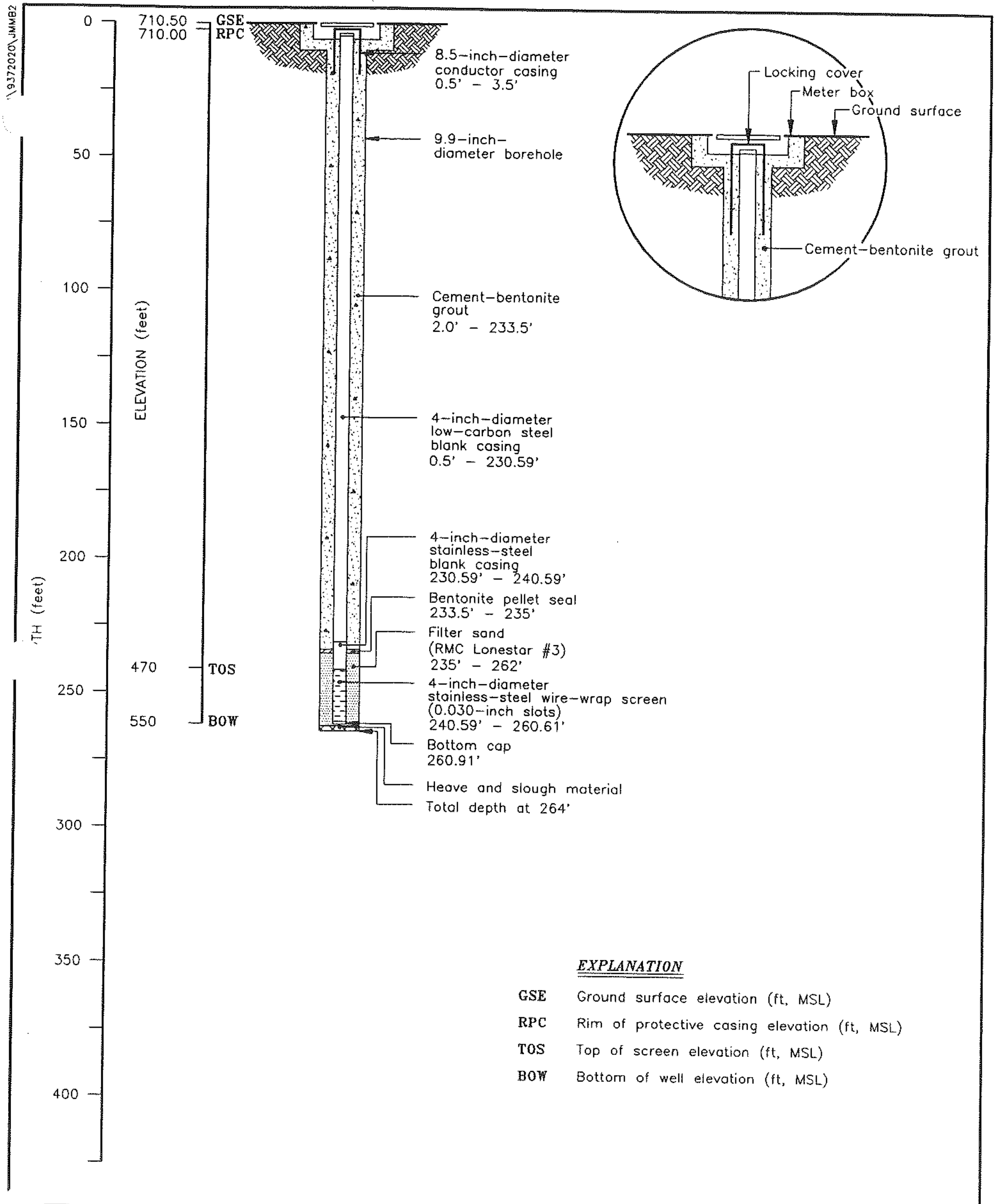
Datums:
NAVD88
CCS83, Zone 5
Elevations in Feet
Ref: WSFB 194-162-98/103 Horiz. Control
Ref: WSFB 190-162-24/41 Vert. Control
Ref: WSFB 190-162-13/23
Ref: WSFB 188-153-8/16

Shallow, Mid & Deep wells are differenciated by the top of casing elevation

January 4, 2014

Well Number	**Vicinity**	**Location, center of MH**	**Elevation MH Rim, N/s**	**Elevation Top of 1" Tube**	**Elevation Top of 4" PVC Casing**
NH-MW-11	Bellingham Avenue, N/o Vanowen Street	N 1893426.67 E 6441079.14	721.59		
NH-MW-11-Deep				720.63	720.62
NH-MW-11-Mid				720.68	720.71
NH-MW-11-Shallow				720.74	720.79

PROFESSIONAL LAND SURVEYOR
JOHN E. ALVO
P.L.S. 7908
STATE OF CALIFORNIA



Harding Lawson Associates
Engineers and Geoscientists

MONITORING WELL
NH-VPB-2
San Fernando Valley RI
Los Angeles County, California

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
JTI	9372.020.11		12/89	JMM	7/92

Attachment C Analytical Methods Information and Precision & Accuracy Measurement Performance Criteria

Analyte	Analytical Method	CAS Number	Units	MCL	NL	DLR	MRL	Laboratory Conducting Testing	Precision / Accuracy Measurement Performance Criteria					
									Field Duplicate - Precision as RPD (%)[3]	Laboratory Duplicate - Precision RPD (%)	LFB/LFBD (also referred to as LCS/LCSD) and Surrogate Limits		LFM/LFMD Limits (also referred to as MS/MSD)	
											%R Lower Control Limit	%R Upper Control Limit	%R Lower Control Limit	%R Upper Control Limit
1,1-Dichloroethane (1,1-DCA)	EPA 524.2	75-34-3	µg/L	5	--	NA	0.5	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
1,1-Dichloroethene (1,1-DCE)	EPA 524.2	75-35-4	µg/L	6	--	**<u>0.5</u>**	0.5	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
1,2,3-Trichloropropane (1,2,3-TCP)	SRL 524M-TCP	96-18-4	µg/L	0.005	--	NA	0.005	WQLab	≤30	RPD ≤50 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	80	120	80	120
1,2-Dichloroethane (1,2-DCA)	EPA 524.2	107-06-2	µg/L	0.5	--	NA	0.25	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
1,4-Dioxane	EPA 522	123-91-1	µg/L	--	1	**<u>1</u>**	0.5	WQLab	≤30	RPD ≤50 for ≤ 2 x MRL RPD ≤30 for > 2 x MRL	50	150	50	150
Benzene	EPA 524.2	71-43-2	µg/L	1	--	NA	0.5	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
Bis(2-ethylhexyl)phthalate (DEHP)	EPA 525.2	117-81-7	µg/L	4	--	NA	2	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
Carbon tetrachloride (CTET)	EPA 524.2	56-23-5	µg/L	0.5	--	NA	0.25	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
Chlorate	EPA 300.1	14866-68-3	µg/L	--	800	NA	20	WQLab	≤30	RPD ≤20 for ≤ 10 x MRL RPD ≤10 for > 10 x MRL	85	115	75	125
Chromium, Total	EPA 200.8	7440-47-3	µg/L	50	--	NA	1	WQLab	≤30	≤20	85	115	85	115
cis-1,2-Dichloroethene (cis-1,2-DCE)	EPA 524.2	156-59-2	µg/L	6	--	**<u>0.5</u>**	0.5	WQLab	≤30	RPD ≤20 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
Dichlorodifluoromethane (Freon 12)	EPA 524.2	75-71-8	µg/L	--	1000	NA	0.5	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
Hexavalent Chromium	EPA 218.7	18540-29-9	µg/L	10[1]	--	NA	0.1	WQLab	≤30	RPD ≤50 for ≤ 2 x MRL RPD ≤15 for > 2 x MRL	50	150	50	150
Methyl tert-butyl ether (MTBE)	EPA 524.2	1634-04-4	µg/L	13	--	NA	1	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
Nitrate (as Nitrogen [N])	EPA 300.0	14797-55-8	mg/L	10	--	NA	0.1	WQLab	≤30	≤10	80	120	90	110
N-Nitrosodiethylamine (NDEA)	EPA 521	55-18-5	µg/L	--	0.01	NA	0.002	Weck	≤30	NA	50	150	50	150
N-Nitrosodimethylamine (NDMA)	EPA 521	62-75-9	µg/L	--	0.01	NA	0.002	Weck	≤30	NA	50	150	50	150

Analyte	Analytical Method	CAS Number	Units	MCL	NL	DLR	MRL	Laboratory Conducting Testing	Field Duplicate - Precision as RPD (%)[3]	Laboratory Duplicate - Precision RPD (%)	Precision / Accuracy Measurement Performance Criteria: LFB/LFBD (also referred to as LCS/LCSD) and Surrogate Limits		LFM/LFMD Limits (also referred to as MS/MSD)	
											%R Lower Control Limit	%R Upper Control Limit	%R Lower Control Limit	%R Upper Control Limit
N-Nitrosodi-n-butylamine (NDBA)	EPA 521	924-16-3	µg/L	--	--	NA	0.002	Weck	≤30	NA	50	150	50	150
N-Nitrosodi-n-propylamine (NDPA)	EPA 521	621-64-7	µg/L	--	0.01	NA	0.002	Weck	≤30	NA	50	150	50	150
N-Nitrosomethylethylamine (NMEA)	EPA 521	86-30-6	µg/L	--	--	NA	0.002	Weck	≤30	NA	50	150	50	150
N-Nitrosomorpholine (NMOR)	EPA 521	59-89-2	µg/L	--	--	NA	0.002	Weck	≤30	NA	50	150	50	150
N-Nitrosopiperidine (NPIP)	EPA 521	100-75-4	µg/L	--	--	NA	0.002	Weck	≤30	NA	50	150	50	150
N-Nitrosopyrrolidine (NPYR)	EPA 521	930-55-2	µg/L	--	--	NA	0.002	Weck	≤30	NA	50	150	50	150
Perchlorate	EPA 314	14797-73-0	µg/L	6	--	NA	2	WQLab	≤30	≤15	85	115	80	120
SVOC TICs	EPA 8270	--	µg/L	--	--	NA	--	Weck	NA	NA	NA	NA	NA	NA
Tetrachloroethene (PCE)	EPA 524.2	127-18-4	µg/L	5	--	**0.5**	0.5	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
Total Dissolved Solids (TDS)	SM2540C	--	mg/L	1000[2]	--	NA	25	WQLab	NA	<5	NA	NA	NA	NA
Trichloroethene (TCE)	EPA 524.2	79-01-6	µg/L	5	--	**0.5**	0.5	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
Trichlorofluoromethane (Freon 11)	EPA 524.2	75-69-4	µg/L	150	--	NA	0.5	WQLab	≤30	RPD ≤40 for ≤ 2 x MRL RPD ≤20 for > 2 x MRL	60	140	60	140
VOC TICs	EPA 524.2	--	µg/L	--	--	NA	--	WQLab	NA	NA	NA	NA	NA	NA

Notes:
(1) MCL-surrogate adopted for the purposes of this WQSP: former CA MCL for Cr (VI) of 10 µg/L
(2) Upper Secondary MCL
(3) For field duplicate precision, an RPD of ±30% has been adopted.
Bold and gray highlighted analytes/constituents have Treated Water Goals set at the DLR (LADWP 2020)
Maximum Contaminant Level (MCL) Information obtained from Water Boards website as viewed on October 28, 2019: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.html
Notification Level (NL) information obtained from Water Boards website as viewed on October 28, 2019: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.html
Detection limits for purposes of reporting (DLR) information obtained from Water Boards website as viewed on October 28, 2019: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.html
MRL = Minimum Reporting Limit; RL = Reporting Limit; RPD = Relative Percentage Difference; %R = Percent Recovery; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; LFB = Laboratory Fortified Blank; LFB = Laboratory Fortified Blank Duplicate; LFM = Laboratory Fortified Matrix; LFMD = Laboratory Fortified Matrix Duplicate; MS = Matrix Spike; MSD = Matrix Spike Duplicate; TIC = Tentatively Identified Compounds; VOC = Volatile Organic Compound; SVOC = Semi-Volatile Organic Compound

Attachment D Laboratory Analytical Methods Tables

Volatile Organic Compounds (VOCs) by EPA 524.2 (WQLab)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Actions
MS Tune check	Start of analysis and every 12 hours	Must meet ion abundance criteria of Table 3 in the method.	Retune instrument and verify before continuing. Rerun affected samples.
Initial calibration	Before samples are analyzed, or when the calibration check fails.	Response factor (RF) RSD ≤ 20 % or correlation coefficient of the curve ≥ 0.995.	Correct problem (e.g. prepare fresh calibration standards), then recalibrate.
Continuing calibration check (CCC)	At the beginning, after each 12 hours and at the end.	Recovery for each analyte: 60-140% at the MRL level,70 -130% for other levels. Or, RF within ± 30% of the average RF in the initial calibration.	Correct problem (e.g. prepare fresh standard or perform instrument maintenance, then reanalyze CCC. Reanalyze affected samples since the last acceptable CCC.
Calibration standard check (CSC)	At least 1 per batch of 20 or fewer samples.	Recovery of analytes: 70-130%.	Correct problem (e.g. re-prepare standards), then reanalyze CSC.
Surrogate (Surr) and internal standards (IS) check	All field and QC samples	Responses of surrogates and the IS recovery: 50-150% of initial calibration average. CCC Surrogate and IS responses recovery: 70-130% of most recent CCC. Surr recovery: 70-130%. Surr and IS responses must not drift more than 50% within a day.	Correct problem (e.g. perform instrument maintenance or prepare fresh sample), then re-analyze affected samples.
Laboratory Reagent Blank (LRB)	At least 1 per batch of 20 or fewer samples, analyzed before samples.	Analytes should be less than MRL.	Remove the source of contamination and reanalyze the affected samples.
Field Reagent Blank	Analyze when a field sample shows a positive identification for an analyte at or above the RL (other than THMs in disinfected samples).	Analytes should be less than MRL.	Request a resample.
Laboratory Fortified Blank	At least 1 per batch of 20 or fewer samples.	Recovery for each analyte: 60-140% at the	Correct problem (e.g. prepare fresh standard

		MRL level, 70 -130% for other levels.	or perform instrument maintenance), then reanalyze LFB. Reanalyze affected samples in the batch.
Sample Duplicates	At least 1 per every 20 or fewer samples.	RPD ≤40% for ≤ 2XMRL. RPD ≤20 % for > 2XMRL.	Report data with a qualifier if all other QCs are acceptable.

1,2,3-TRICHLOROPROPANE (1,2,3-TCP) by SRL-524M-TCP (WQLab)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Actions
MS Tune check	Start of analysis and every 12 hours	Must meet ion abundance criteria of Table 3 in the EPA 524.2 method.	Retune instrument and verify before continuing. Rerun affected samples.
Initial calibration	Before samples are analyzed, or when the calibration check fails	Response factor (RF) RSD ≤ 20 % or linear regression curve with R^2 ≥ 0.995.	Correct problem (e.g. prepare fresh calibration standards), then recalibrate.
Continuing calibration check (CCC)	At the beginning of each analysis batch	Recovery for each analyte: 80-120% or RF = $\pm$ 20% of RF from the initial calibration. Verify RT is within calculated RT window of initial calibration.	Correct problem (e.g. prepare fresh standard or perform instrument maintenance, then reanalyze CCC.
Calibration standard check (CSC)	At least 1 per analytical batch	Recovery of analytes: 80-120%.	Correct problem (e.g. reprepare standards), then reanalyze CSC.
Internal standards (IS) check	All field and QC samples	IS response within ±20% of average response of initial calibration.	Correct problem (e.g. perform instrument maintenance or prepare fresh sample), then re-analyze affected samples.
Laboratory Reagent Blank	At least 1 per batch of 10 or fewer samples.	TCP should be less than MDL.	Remove the source of contamination and reanalyze the affected samples.
Field Reagent Blank	Analyze when a field sample shows a positive identification for TCP at or above the RL.	Analytes should be less than MRL.	Request a resample.
Laboratory Fortified Blank (LFB) at the MRL	At the beginning, every 10 samples or fewer samples, and at the end of analysis batch.	Recovery: 80-120% or RF=±20% of RF from the initial calibration	Correct problem (e.g. prepare fresh standard or perform instrument maintenance), then reanalyze LFB. Reanalyze affected samples in the batch.
Sample Duplicates or LFB Duplicates	At least 1 per every 10 or fewer samples.	RPD ≤50% for ≤ 2X MRL. RPD ≤20 % for > 2X MRL.	Report data with a qualifier.

1,4-Dioxane by EPA 522 (WQLab)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Actions
MS Tune Check (BFB)	Before Initial Calibration	Must meet ion abundance criteria of Table 1 in the method.	Retune instrument and verify before continuing with calibration.
Initial Calibration	Before samples are analyzed, or when the calibration check fails.	1,4-Dioxane: Linear or quadratic curve. Surrogate: Avg. Response Factor. Each calibration standard is calculated as unknown. Recovery of 1,4-Dioxane is 60-140 % at the lowest level (Cal 1) and 80-120 % for the others. Surrogate recovery is 70-130%. IS area count recovery: 70-130% of average IS response in all calibration standards.	Correct problem (e.g. prepare fresh calibration standards), then recalibrate.
Continuing Calibration Check (CCC)	At the beginning (CCC MRL), after 10 samples and at the end (alternate between mid-level and high-level).	Recovery for each analyte: 50-150% at MRL; 70 -130% at mid and high level.	Correct problem (e.g. prepare fresh standard or perform instrument maintenance, then reanalyze CCC. Reanalyze affected samples since the last acceptable CCC. If ending CCC recovery > 130%, sample result may be reported if it is ND.
Calibration Standard Check (CSC)	At least 1 per batch of 20 or fewer samples.	Recovery of analytes: 80-120%.	Correct problem (e.g. re-prepare standards), then reanalyze CSC.
Surrogate (Surr) and Internal Standards (IS) Check	All field and QC samples.	The IS area count recovery: 50-150% of initial calibration average and 70-130% of most recent CCC. Surr recovery: 70-130% of true value.	Correct problem (e.g. perform instrument maintenance or prepare fresh sample), then re-analyze affected samples. If surrogate recovery > 130%, sample result may be reported if it is ND.
Laboratory Reagent Blank	At least 1 per extraction batch of 20 or fewer samples, analyzed before field samples.	1,4-Dioxane should be less than 1/3 MRL.	Remove the source of contamination and reanalyze the affected samples.

Laboratory Fortified Blank	At least 1 LFB per batch of 20 or fewer samples. Rotate low, mid and high concentrations from batch to batch.	Recovery: 50-150% at the MRL level, 70 -130% for mid or high level.	Correct problem (e.g. prepare fresh standard and re-extract, or perform instrument maintenance), then reanalyze LFB. Reanalyze affected samples in the batch. Sample may be reported with a qualifier if LFB recovery is above 150% (RL level) or 130% (mid or high level) and analyte is ND in the sample.
Laboratory Fortified Matrix (LFM)	At least 1 per batch of 20 or fewer samples. Rotate low, mid and high concentrations from batch to batch.	Recovery: 50-150% at the RL level, 70 -130% for mid or high level.	Report data with qualifier if recovery is not within 70-130% and other QCs are acceptable (may indicate matrix effect).
Duplicate (Field Sample duplicate or Laboratory Fortified Matrix Duplicate (LFMD) or Laboratory Fortified Blank Duplicate (LFBD)	At least 1 per batch of 20 samples or fewer.	For Field Sample duplicates with concentration up to 2x MRL or LFMD/LFBD fortified at the RL: RPD ≤ 50%. All others, RPD ≤ 30%.	Report data with qualifier if criteria are not met.

Nitrate by EPA 300.0 (WQ Lab)

QC Check	**Minimum Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial calibration	Before original sample analysis, every 6 months, or when there is a change to the instrument that affects retention time or sensitivity.	The analytes are calculated as unknowns; recovery = 90-110% of the true value; except the lowest concentration, which should have a recovery of 80-120%.	Correct problem (prepare new calibration standards, for example) and recalibrate.
Continuing Calibration Check (CCC) and Calibration Blank (CB)	At the beginning of the sequence, after every 10 samples, and at the end of the sequence.	CCC Recovery = 90-110% of the true value. CB $\leq$ ½ MRL	May reanalyze or re-prepare a CCC for repeat analysis. If fails again, stop sample analysis and find the cause or, if drift has occurred, recalibrate. Reanalyze affected samples.
Laboratory Reagent Blank (LRB)	At least one per batch of 20 or fewer samples.	No analytes detected > ½ RL.	Remove the source of contamination and reanalyze the affected samples.
Laboratory Fortified Blank (LFB)	At least one per batch of 20 or fewer samples.	90-110% of the true value.	Correct the problem, then re-prepare and reanalyze the LFB and any samples associated with the failed LFB analyte. Recalibration might be required.
Laboratory Fortified Blank at MRL	At least one per batch of 20 or fewer samples.	80-120% of the true value.	Prepare a fresh standard and reanalyze. If fails again, the cause must be identified and corrected to restore sensitivity.

Laboratory Fortified Matrix (LFM)	At least one per every 10 samples.	90-110% of the true value.	If the system is judged to be in control by all other passing QC, a failed LFM recovery is judged to be matrix related and is flagged with the appropriate qualifier.
Sample Duplicate or Laboratory Fortified Matrix Duplicate (Dup or LFMD)	At least one per batch.	RPD ≤ 10%	If the system is judged to be in control by all other passing QC, a failed RPD is judged to be matrix related and is flagged with the appropriate qualifier.

Chlorate by EPA 300.1 (WQLab)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial calibration	Before original sample analysis or when there is a change to the instrument that affects retention time or sensitivity.	A linear regression curve $r^2 \geq 0.995$ or average response factor (RF) with RSD < 15%.	Correct problem (prepare new calibration standards, for example) and recalibrate.
Calibration Standard Check (CSC)	When a new calibration curve is established and daily afterwards.	85-115% of the true value.	The source of the problem must be identified and corrected before continuing any analysis.
Surrogate	All injections (standards, QCs, field samples, etc)	90-115% of the true value.	Identify and correct problem, then reanalyze the sample.
Instrument Performance Check (IPC) at MRL	Before analysis of samples in every batch.	PGF must be 0.80-1.15. Recovery=75-125% of the true value. Retention time shift < 2% from previous batch.	Correct problem before continuing with any analysis.
Continuing Calibration Check (CCC)	At the beginning of the sequence, after every 10 samples, and at the end of the sequence.	Below 10 x MRL, 75-125% of the true value. 10 x MRL and above, 85-115% of the true value. Retention time shift < 5% of the previous CCC.	May reanalyze or re-prepare a CCC for repeat analysis. If fails again, stop sample analysis and find the cause or, if drift has occurred, recalibrate. Reanalyze affected samples.
Laboratory Reagent Blank (LRB)	At least one per batch of 20 or fewer samples.	No analytes detected ≥ ½ MRL.	Remove the source of contamination and reanalyze the affected samples.
Laboratory Fortified Blank (LFB)	At least one per batch of 20 or fewer samples.	85-115% of the true value.	Correct the problem, then re-prepare and reanalyze the LFB and any samples associated with the failed LFB. Recalibration might be required.
Laboratory Fortified Matrix (LFM)	At least one per every 10 samples.	75-125% of the true value.	If the system is judged to be in control by all other passing QC, a failed LFM recovery is judged to be matrix related and is flagged with the appropriate qualifier.
Sample Duplicate or Laboratory Fortified Matrix Duplicate (Dup or LFMD)	At least one per every 10 samples.	Below 10 x MRL, RPD must be ≤ 20%. 10 x MRL and above, RPD must be ≤ 10 % of the true value.	If the system is judged to be in control by all other passing QC, a failed RPD is judged to be matrix related and is flagged with the appropriate qualifier.

Trace Metals by EPA 200.8 (WQLab)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Actions
Tune check	Once per day before sample analysis	Must pass mass calibration and resolution checks and meet 5% RSD for 5 replicates.	Retune instrument and rerun tune repot.
Initial calibration	Daily before samples are analyzed.	Linear with the curve correlation coefficient ≥ 0.995.	Correct problem (e.g. prepare fresh calibration standards), then recalibrate.
Continuing Calibration Check (CCC). Ending Calibration Check (ECC).	At the beginning of the run, every 10 samples, and at the end of the run.	90-110% for CCC. 85-115% for ECC.	Correct problem (e.g. prepare fresh standard or perform instrument maintenance), then reanalyze CCC. Reanalyze affected samples since the last acceptable CCC.
Calibration Blanks (CB)	At the beginning of the run, every 10 samples, and at the end of the run.	Analytes should be less than 2.2 x MDL or less than 10% of analyte level.	Correct problem (e.g. prepare fresh standard or perform instrument maintenance), then reanalyze CB. Reanalyze affected samples since the last acceptable CB.
Continuing Calibration Check at the Reporting Level (CCC-MRL)	Once per calibration before samples are analyzed.	Recovery of analytes: 80-120%.	Correct problem (e.g. prepare fresh standard or perform instrument maintenance), then reanalyze CCC-MRL.
Calibration Standard Check (CSC)	Once per calibration before samples are analyzed.	Recovery of analytes: 90-110%.	Correct problem (e.g. reprepare standards), then reanalyze CSC.
Internal standards (IS) check	All field and QC samples.	Responses of the IS recovery: 70-125% of initial calibration blank.	Correct problem (e.g. perform instrument maintenance or prepare fresh sample), then re-analyze affected samples.
Laboratory Reagent Blank (LRB)	At least 1 per batch of 20 or fewer samples.	Analytes should be less than 2.2 x MDL or less than 10% of analyte level.	Remove the source of contamination and reanalyze the affected samples. Report samples with a qualifier.

Laboratory Fortified Blank (LFB)	At least 1 per batch of 20 or fewer samples.	Recovery for each analyte: 85-115%.	Correct problem (e.g. prepare fresh standard or perform instrument maintenance), then reanalyze LFB. Reanalyze affected samples in the batch.
Laboratory Fortified Matrix (LFM)	At least 1 per 10 field samples.	Recovery for each analyte: 70-130%.	Report data with appropriate qualifier if other QCs are acceptable.
Laboratory Fortified Matrix Duplicate(LFMD)	At least 1 per 10 field samples.	RPD ≤20%	Report data with a qualifier if other QCs are acceptable.

Hexavalent Chromium (Cr+6) by EPA Method 218.7 (WQLab)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Actions
Initial calibration	Before samples are analyzed, or when the calibration check fails.	Linear or Quadratic curve, weighting allowed. -MRL within ±50% of true value -All others within ±15% true value	Correct problem (e.g. prepare fresh calibration standards), then recalibrate.
Continuing Calibration Check at MRL (CCC). This is also the LFB at the MRL.	Prepared fresh daily and analyzed at beginning of each 20 or fewer samples in a batch.	Recovery of 50-150%.	Correct problem (e.g. re-prepare standards), then reanalyze CCC. Redo curve if fails a second time.
Continuing Calibration Check at mid to high range (CCC)	After every 10 samples and at the end of the analysis batch. Alternate between mid and high levels.	Recovery of 85-115%.	Correct problem (e.g. re-prepare standards), then reanalyze CCC and any affected samples. Redo curve if fails a second time.
Calibration second source standard check (QCS)	One per batch of 20. Prepared fresh daily and run at beginning of the analysis batch.	Recovery of 85-115%.	Correct problem (e.g. re-prepare standards and or QCS), then reanalyze QCS. Redo curve if fails a second time.
Laboratory Reagent Blank (LRB)	At least 1 per batch of 20 or fewer samples.	Free from contamination. LRB < ⅓ RL Must pass before sample analysis.	Remove the source of contamination and reanalyze the affected samples.
Lab Fortified Matrix (LFM)	At least 1 per every 20 or fewer samples.	For MRL and 2xMRL Recovery: 50-150% RPD ≤50 % For Above 2xMRL Recovery: 85-115% RPD ≤15 %	Report data with a qualifier if other QCs are acceptable.
Lab Fortified Matrix Duplicate (LFMD)	At least 1 per every 20 or fewer samples.	For MRL and 2xMRL Recovery: 50-150% RPD ≤50 % For Above 2xMRL Recovery: 85-115% RPD ≤15 %	Report data with a qualifier if other QCs are acceptable.

Perchlorate by EPA 314.0 (WQLab)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Initial calibration	Before original sample analysis or when there is a change to the instrument that affects retention time or sensitivity.	A linear regression curve $r^2 \geq 0.995$ or average response factor (RF) with RSD < 15%.	Correct problem (prepare new calibration standards, for example) and recalibrate.
Calibration Standards Check (CSC)	When a new calibration curve is established and daily afterwards.	90-110% of the true value.	The source of the problem must be identified and corrected before continuing any analysis.
Instrument Performance Check (IPC)	At the beginning of each batch.	80-120% of the true value. Conductivity 90-110% of MCT. Retention time shift < 5% from previous batch. % Difference of the peak area/height ratio of this IPC and the previous LFB must be < 25%.	The source of the problem must be identified and the IPC reanalyzed. A new Maximum Conductivity Threshold (MCT) might need to be established with a lower threshold.
Continuing Calibration Check (CCC)	At the beginning of the sequence, after every 10 samples, and at the end of the sequence.	85-115% of the true value, or 75-125% of the true value if the CCC is at the MRL level.	May reanalyze or re-prepare a CCC for repeat analysis. If fails again, stop sample analysis and find the cause or, recalibrate. Reanalyze affected samples.
Laboratory Reagent Blank (LRB)	At least one per batch of 20 or fewer samples.	No analytes detected > ½ MRL.	Remove the source of contamination and reanalyze the affected samples.
Laboratory Fortified Blank (LFB)	At least one per batch of 20 or fewer samples.	85-115% of the true value.	Correct the problem, then re-prepare and reanalyze the LFB and any samples associated with the failed LFB.
Laboratory Fortified Matrix (LFM)	At least one per batch of 20 or fewer samples.	80-120% of the true value.	If all other QCs pass, a failed LFM recovery is judged to be matrix related and is flagged with the appropriate qualifier.
Sample Duplicate or Laboratory Fortified Matrix Duplicate (Dup or LFMD)	At least one per batch of 20 or fewer samples.	The RPD must be ≤ 15%	If all other QCs pass, a failed RPD recovery is judged to be matrix related and is flagged with the appropriate qualifier.

TDS by SM 2540C (WQLab)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Actions
Sample Duplicates	1 every 10 or fewer samples.	RPD <5%.	If a 5 % RPD is not achieved, discard results for the batch, investigate the problem, and redo the analysis with a well-mixed aliquot of samples.
Weight Change	Every sample	A weight change of less than 4% of previous weight or 0.5 mg is achieved.	Repeat heating and cooling of the sample until the weight change is acceptable. Reanalyze sample.

Attachment E LADWP Water Quality Division Groundwater Monitoring Standard Operating Procedure (SOP)

LADWP

WATER QUALITY DIVISION GROUNDWATER MONITORING

STANDARD OPERATING PROCEDURE

Water Quality Control
Standard Operating Procedures
Water Quality Sampling

Maintained by:		
	Name	Title
	Signature	Date
Reviewed by:		
	Name	Title
	Signature	Date
Approved by:		
	Name	Title
	Signature	Date

Periodic Review Signature:

Date	Title	Signature

Scope and Application

1. This document is a detailed description of water quality sample collection policies and procedures. Its intended use is for reference and training of Water Quality Sample Collectors (Collectors) and Water Quality Inspectors (Inspectors).
2. The policies and procedures set forth in this document are established by the City of Los Angeles Department of Water and Power (LADWP) and may be altered by the appropriate supervisors or managers in unique situations. However, no policy or procedure may be altered in a way that violates regulations established by the Federal Environmental Protection Agency (USEPA) or the Division of Drinking Water (DDW).

General Sample Collector Policies

A) Sample Location and Schedules

1) All samples scheduled at each assigned location must be collected. The sample schedule can be altered only with the explicit permission of the Water Quality Sampling Services (WQSS) supervisor or his/her back up during absences. All scheduled locations must be sampled. Locations may not be dropped without the explicit permission of the WQSS supervisor or his/her back up during absences. A list of LIMS sample schedules may be found in Appendix B.
2) Any samples assigned to a specific Collector, either by field sheet or verbal contact, must be collected by that Collector. Only the WQSS supervisor or his/her back up may reassign sampling locations between Collectors and/or Inspectors. Any "voluntary" changes between Collectors and/or Inspectors must be approved in advance by the WQSS supervisor or his/her back up.

B) Instrument care and calibration

1) Collectors are to keep and maintain a log book for instrument calibration. This book is used to record calibration, operational checks, and lot numbers for standards used for calibrations and checks.
2) Instruments are to be calibrated once per year unless a higher frequency is called for below. A calibration check is performed daily.
   a) pH meter
      (i) Calibration is required daily.
      (ii) To calibrate, clear the current calibration, then calibrate according to instrument instructions using pH 4.0, pH 7.0 and pH 10.0 standards. Record the buffer solution temperature and the percent slope in the calibration log book.
      (iii) Calibration is checked daily using a pH 7.4 standard solution. If the pH reading differs from the standard by more than 0.10, recalibrate using pH 7.0 and 10.0 standards.
   b) Colorimeter (Chlorine)
      (i) Calibration check is carried out using gel secondary standards. If the reading varies from the standard value by more than 0.2 mg/L, use backup meter and bring instrument in for recalibration.
   c) Conductivity meter
      (i) Calibration check is carried out using 500mS conductivity standard. Adjust the potentiometer in the base of the unit as needed to bring the reading within 5% of this value.
      (ii) If calibration cannot be brought within tolerance, bring unit in for repair or replacement.
   d) Turbidimeter
      (i) Weekly operational checks are conducted using sealed turbidity standards. If the reading varies from the standard value by more than 0.5NTU, the unit shall be recalibrated using dilutions of formazin solution as specified in the turbidimeter manual.
      (ii) Periodic calibration, at least once a year, is conducted using dilutions of formazin solution, as specified in the turbidimeter manual.

C) Equipment handling and sample integrity

1) Care will be taken to ensure that samples are not contaminated and remain representative of the water being sampled.
2) Equipment such as ice chests shall be disinfected and cleaned regularly using approved cleansing and disinfecting agents.

D) Data recording and handling

1) The field sheets are legal documents. Any person found to be falsifying information (e.g. collection times, field test results, etc.) on these documents will be disciplined to the fullest extent allowed by civil service rules and will be prosecuted for fraud and/or any other charges to be determined by the City Attorney's Office.
2) All bottles submitted to the Lab must have the correct location code printed on the side of the bottle (for disposable bottles) or on a white label (for reusable bottles). The printing is to be done using either a waterproof marking pen (e.g., Sharpie) or waterproof ink (e.g., Bic waterproof pen). It is to be understood that the correct location code is the full and proper LIMS location code for the sampling location (available on the field sheet). **No abbreviations are to be used.** For

example, 120A is not acceptable for LA120ACL; 98 is not acceptable for DS098, MPH is not acceptable for MPCHSPTL, etc.

3) Each bottle of a set of bottles must be individually labeled. Any constituent or group of constituents that require more than one bottle must have its own label. Labeling one bottle and rubber banding the other unlabeled bottles to it is not acceptable.
4) Collectors are expected to do their part to make sure chain of custody is maintained from the time the sample is collected until the sample is received at the lab. Details about the chain of custody are supplied in the descriptions of how to collect samples for each specific analyte.
5) In the case of samples that are not logged in to LIMS, such as auxiliary samples for Microtox (metals, VOC, UV254), the field label must show not only the correct location code, but must include the date of the sampling. (Month and day is adequate.)
6) If a customer or a member of the general public asks for the results of your sampling, give them a Water Quality Office business card and ask them to call after 48 hours and a Water Quality Inspector will provide that information.

E) General sample location procedures

1) If any location presents an immediate danger (e.g. wild dog, police action, gang activity, rain slick ladders, etc.), temporarily skip that location and return to it later before leaving the general area. Upon returning, if the location is still unsafe, contact the WQSS supervisor at 213 367 3289 or the Water Quality Office on call staff member by calling (213) 367 3188 for further instruction and/or assistance.
2) There are several reasons a sample may need to be taken from an alternative location including; substitution locations for an inoperable sample tap, 'upstream' and 'downstream' locations for coliform positive repeat sample sets, special survey samples where no sample taps are available, and customer complaint investigations. The following list contains factors that are to be considered when selecting an alternative sampling location.
   a) The alternative sampling location will almost always be a hose bib at the front of a customer's home or business.
   b) The location must be safe. Look for loose dogs, construction, or other conditions that might make the sampling location unsafe. If the location is unsafe, select a different location.
   c) Never jump or climb over locked fences or gates. Always check for dogs before opening and entering an unlocked gate.
   d) Always knock on the door or enter the business, identify yourself, and ask permission to take a water sample at the front hose bib.
   e) If no one is home, proceed with your sampling taking care not to cause any damage to the property (e.g. flower beds). Always leave the property as you found it (e.g. re attach garden hose if you removed it; if the hose was pressurized when found, turn on water to restore pressure).
   f) The selected location must be representative of the water you wish to sample. This means:
      (i) The location must be in the correct pressure zone.
      (ii) For coliform positive repeat sets, one sample within 5 services 'upstream' and one sample within 5 services 'downstream' of the original location.
      (iii) The hose bib must be on the customer's property line, not on their irrigation system (see the diagram in appendix A).
      (iv) The hose bib must be upstream of any treatment devices the customer might have installed.
   g) The hose bib should be far enough off the ground so that the sample bottle can be placed in the water stream without touching the hose bib or the ground.
   h) The hose bib should be clear of any bushes or structures that would allow splashing water from the hose bib or from rain to enter your sample bottle.
   i) The packing for the handle stem should not leak in such a way that the leaking water will run into the main water steam and/or your bottle.
   j) Remove any garden hose from the hose bib. Never take any water samples from a garden hose.
   k) Flush the hose bib for a minimum of 2 minutes if the house is a normal distance from the street (approximately 30 – 50 feet). If the house is set back further from the street, add another 1 minute of flushing per each additional 50 feet. After the initial flush, reduce the

flow to a slow steady stream and allow it to flush for an additional 30 seconds before taking your samples. If flushing the hose bib will cause damage to the property (e.g. erode a flower bed, flood a flower bed, enter a foundation ventilation opening, etc.), attach your Tygon tubing flushing hose and redirect the water to a safe location (e.g. the front lawn). Remove the flushing hose before taking samples

3) Sample taps must be in good condition to ensure samples taken are representative of the water system in the vicinity and free of external contamination not related to the water system. If a sample tap is damaged, broken, or has lost its integrity:
   a) Make a note of the nature of damage or compromise on the field sheet.
   b) Call the supervisor to report this damage.
   c) If the damage or compromise is severe enough to make it impossible to obtain a valid sample at the affected tap, use a substitute as described in section E(2). Notify supervisor of this substitution.

F) Vehicle use policies

1) If your Department vehicle breaks down during regular business hours during the week, contact the WQSS supervisor, the WQ Office on call staff member, or the WQ Office for assistance. Be prepared to give the following information to the person assisting you: your location (address or intersection), vehicle number (e.g. W4 8506), Type of vehicle (e.g. 1998 Ford Astrovan), and a detailed description of the problem. For flat tires also tell the person assisting you which tire is flat (e.g. rear passenger side), and the tire size (e.g. P233 R15) this number is printed on the sidewall of each tire.
2) If your Department vehicle breaks down after regular business hours, on the weekend, or on a holiday, contact the after-hours vehicle trouble coordinator directly at (800) 330 9337. After receiving an estimated time of assistance from the coordinator, contact the Laboratory and inform them of your situation and provide them with an estimated time of arrival to the Lab.
3) If you are involved in an accident while driving your Department vehicle:
   a) Stop at the first safe location.
   b) Check to see if you or any other parties need medical assistance.
   c) Call 911 to report ANY accident involving another party. A LAPD or CHP officer must be dispatched for accidents involving City vehicles. Be sure to be clear with the 911 Operator that you are an LA City employee driving a city vehicle and whether you need an ambulance and the police or just the police.
   d) Contact the WQSS supervisor, the Water Quality Office, or the WQ Office on call staff member.
   e) Exchange information with the other party(s): vehicle color and type, vehicle license plate number, driver's name, address, and phone number, driver's license number, insurance company name (we are self-insured: City of Los Angeles), insurance policy number including expiration date.
   f) Look for any witnesses and get their name and phone number.
   g) Make a sketch of the area including the location of vehicles, traffic controls, and any unusual circumstances. (If a camera or cell phone camera is available, take pictures.)
   h) **Wait for the police to come and make a report**. Advise the other party that they must wait for the police as well.
   i) If your vehicle is safe and drivable, continue your work.
   j) If your vehicle safety is questionable or is not drivable, follow the procedures for a vehicle break down (Item 2, above).

G) Access to Secured sampling locations

1) An increasing number of DWP facilities are being provided with alarms and entry detection systems for security. Special steps must be taken when accessing these facilities.
   a) In general, you will swipe your badge while entering and exiting a facility, and when entering commands to arm/disarm the alarms.
   b) Keep doors and gates closed when not actually entering or leaving through them. Gates propped open for more than 30 seconds will trigger an alarm. (Main gates have a 90 second delay to allow for moving vehicles in and out.)
   c) If it is necessary to keep a door or gate propped open for an extended period, contact the Central Monitoring Station (CMS) at 213-367-9111.

2) Elysian Reservoir
   a) Call LAWSDAC at 213-367-5118 before entering gated area.
   b) Upon entering the main gate:
      (i) Swipe your badge at paddle outside of the gate
      (ii) Unlock gate, enter, close and lock gate
      (iii) Swipe your badge at paddle inside of the gate.
      (iv) At the key pad, press *4#. This disarms **<u>all</u>** alarms at the facility.
   c) Upon exiting the main gate:
      (i) Swipe your badge at the paddle inside of the gate
      (ii) At the key pad, press *5#. This arms **<u>all</u>** alarms at the facility.
      (iii) Unlock gate, exit, close and lock the gate.
3) Eagle Rock Reservoir
   a) Call LAWSDAC at 213-367-5118 before entering gated area.
   b) Upon entering at the main gate:
      (i) Swipe your badge at the paddle outside the gate.
      (ii) Unlock the gate, enter, close and lock the gate.
   c) If you are working at the reservoir:
      (i) Go directly to the reservoir. There is no need to swipe your badge at the paddle inside the main gate.
   d) If you need to access the outlet tower:
      (i) Swipe your badge at the paddle next to the gate leading to the outlet tower.
      (ii) At the key pad, press *4# to disarm alarms at pedestrian gates and door leading to outlet tower.
      (iii) On leaving, swipe your badge at the key pad and press *5# to turn alarms back on.
   e) If you need to access the inlet tower:
      (i) Swipe your badge at the paddle next to the gate leading to the outlet tower.
      (ii) At the key pad, press *4# to disarm alarms at pedestrian gates and door leading to outlet tower.
      (iii) On leaving, swipe your badge at the key pad and press *5# to turn alarms back on.
   f) Upon exiting the Reservoir Complex at the main gate:
      (i) Swipe your badge at the paddle inside the gate.
      (ii) At the key pad press *5#.
      (iii) Unlock gate, exit, close and lock the gate.
4) Solano Reservoir
   a) Upon entering at the main gate:
      (i) Swipe your badge at the paddle outside the gate.
      (ii) Unlock the gate, enter, close and lock the gate.
      (iii) Swipe your badge at the paddle inside the gate, press *4# at the key pad to disarm the system.
   b) Upon entering at the main gate:
      (i) Swipe your badge at the paddle inside the gate, press *5# at the key pad to re-arm the system.
      (ii) Unlock the gate, exit, close and lock the gate.

Sample Collector Field Tests

Free Chlorine – Hach reagent colorimetry

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass container, or flow directly into sample cell
2. Preservative: None
3. Holding time: Analyze immediately

B Field equipment and calibration, reagents, and supplies

1. Hach DPD free chlorine reagent powder – pillows or dispenser
2. Demand-free water for diluting sample, if needed
3. Pipette or other measuring device for dilutions, if needed
4. At least one 10 ml sample cell sized for use in colorimeter
5. Colorimeter to be checked against gels weekly.
   a. Place the clear gel standard in colorimeter.
   b. Press "zero" to zero the meter
   c. Place any of the other gels in colorimeter
   d. Press "read" to obtain the standard reading.
   e. Record reading in log book along with established value for the standard used.

C Parameters and field data recording or documentation

1. Record sample collection location, time and results of field tests in spaces provided on collector field sheet.

D Field analysis technique

1. Add 10 ml of sample to sample cell (should come up to 10 ml line on cell)
2. Wipe dry and place in colorimeter
3. Press "zero" to zero meter
4. Add contents of DPD total chlorine reagent (or one application from SwifTest dispenser) to sample cell.
5. Wipe off spilled powder, if needed, and place cell in colorimeter.
6. Press "read". Write result in appropriate space on field sheet.
7. Discard sample and rinse cell.

Total Chlorine – Hach reagent colorimetry

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass container, or flow directly into sample cell
2. Preservative: None
3. Holding time: Analyze immediately

B Field equipment and calibration, reagents, and supplies

1. Hach DPD total chlorine reagent powder – pillows or dispenser
2. Demand-free water for diluting sample, if needed
3. Pipette or other measuring device for dilutions, if needed
4. At least one 10 ml sample cell sized for use in colorimeter

8. Colorimeter to be checked against gels weekly.
   a. Place the clear gel standard in colorimeter.
   b. Press "zero" to zero the meter
   c. Place any of the other gels in colorimeter
   d. Press "read" to obtain the standard reading.
   e. Record reading in log book along with established value for the standard used.

C Parameters and field data recording or documentation

1. Record sample collection location, time and results of field tests in spaces provided on collector field sheet.

D Field analysis technique

1. Add 10 ml of sample to sample cell (should come up to 10 ml line on cell)
2. Wipe dry and place in colorimeter
3. Press “zero” to zero meter
4. Add contents of DPD total chlorine reagent (or one application from SwifTest dispenser) to sample cell.
5. Wipe off spilled powder, if needed, and place cell in colorimeter.
6. Press “read”. Write result in appropriate space on field sheet.
7. Discard sample and rinse cell.

pH, Temperature – Beckman pH meter

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass container, wide mouth
2. Preservative: None
3. Holding time: Analyze immediately (15 minutes)

B Field equipment and calibration, reagents, and supplies

1. Beckman pH meter
2. Beckman combined pH probe
3. pH 7.0 buffer, for calibration
4. pH 10.0 buffer, for calibration
5. pH 7.4 buffer, for operational check
6. Storage solution or pH 4.0 buffer, for storage
7. Calibration to be performed at least weekly. Operational check at start of sample run. Recalibrate if operational check is not within 0.05 units of reading at pH 7.4

C Parameters and field data recording or documentation

1. Record sample collection location, time and results of field tests in spaces provided on collector field sheet.

D Field analysis technique

1. Fill sample container to depth to cover functional tip of probe (at least 2 cm)
2. Rinse probe and place in container so water covers functional tip
3. Press “read”
4. When reading stable (blinking eye stops blinking), record pH and temperature on field sheet
5. At end of sampling day, place probe in storage solution and turn off meter.

Specific Conductivity – Myron L Conductivity Meter

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: None (well of meter is the sample container during test)
2. Preservative: None
3. Holding time: Analyze immediately

B Field equipment and calibration, reagents, and supplies

1. Myron L conductivity meter
2. Standard conductivity solutions, for calibration
3. Calibration to be performed at least once per week

C Parameters and field data recording or documentation

1. Record sample collection location, time and results of field tests in spaces provided on collector field sheet.

D Field analysis technique

1. Rinse well of conductivity meter

2. Fill well with sample to level above topmost probe
3. Press “read”. If need be, adjust range setting to obtain a good reading. Very few samples will have a conductivity greater than 900 or lower than 100.
4. When reading is stable (it will creep upward a bit over the space of a second or two), record conductivity on field sheet
5. At end of sampling day, rinse well with deionized water. It is recommended the meter be stored with the well opening downward so any leftover water can drain out.
6. On occasion, mineral build-up in well may interfere with operation. A couple of drops of 1:1 HCl or phosphoric acid will dissolve this build-up. Rinse with deionized water after such treatment to spare probe.

Turbidity – Hach turbidimeter

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass container, or flow directly into sample cell
2. Preservative: None
3. Holding time: Analyze immediately

B Field equipment and calibration, reagents, and supplies

1. At least one 10 ml sample cell sized for use in turbidimeter
2. Turbidimeter to be calibrated weekly using standard solution or gels.

C Parameters and field data recording or documentation

1. Record sample collection location, time and results of field tests in spaces provided on collector field sheet.

D Field analysis technique

1. Add 20 ml of sample to sample cell (Should be nearly full)
2. Wipe dry and place in turbidimeter
3. Press “read”. Write result in appropriate space on field sheet.
4. Discard sample and rinse cell.

Microbiology Samples

General Microbiological Examination

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottles, 125 ml, 2, sterile
2. Preservative: Sodium thiosulfate (added by lab); store between 1° and 6°C
3. Holding time: 24 hours / 8 hours / 1 hour
   a. Samples stored below 10°C must be analyzed within 24 hours.
   b. An absolute holding time of 8 hours applies to heterotrophic plate count (HPC) samples.
   c. Holding time for all samples is 1 hour if not stored below 10°C.
   d. Samples that may be used in legal action are subject to special measures to ensure prompt analysis (e.g., "rush" samples).

B Field/Sampling equipment and calibration, reagents, and supplies

1. Standard field tests (free and total chlorine, pH, temperature, specific conductance) are required for all microbiological samples.
2. One bacteriological travel blank will be carried with the samples throughout the sample collection run. Bacteriology blanks expire three weeks after they're made.

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling with full location code – no abbreviations)
   a. It can be helpful to label samples on the cap with the location code to facilitate sorting during sample log-in. In this case an abbreviation is acceptable.
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Note the weather in the appropriate box on the field sheet. Weather of particular interest is:
   a. Rain or other precipitation (water can fall into sample bottle, carrying contaminants)
   b. Wind (dust and particles can blow into sample bottle)
3. Label sample bottles on side with name of sample location.
4. If using disposable bottles, write the sample location name on the side of the bottle.

E Sampling technique

1. Clean and disinfect sample tap.
   a. Pour some bleach into a small container such as a bottle cap or paper cup and immerse the spout of the sample tap in the bleach, a quarter of an inch above any threads, for at least ten seconds.
   b. Dip a brush or swab in bleach and use it to treat the areas inside of the spout which the bleach cannot reach due to trapped air in the spout.
   c. Alternatively, use a spray bottle filled with a dilute bleach solution, approximately 1 ml bleach to half a liter of water to yield a 100 mg/L solution.
2. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 liters/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
   a. If it proves impossible to obtain a steady stream at the desired flow rate, it may be necessary to adjust. (Allowable adjustments pending)
3. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.

4. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
5. Taking the Sample
   a. Always handle bacterial sample bottles near the bottom of the bottle – not by the neck. When removing and replacing cap, try to handle the cap with the fingertips on the top two thirds of the side of the cap. This will allow enough friction to loosen and tighten the cap but keep any contamination away from the edge of the cap.
   b. If disposable bottles are used, do not remove the protective seal from the cap/neck until just before the bottle is to be used.
   c. Remove the cap from the bottle right at the water source. Never set the cap down and always hold it threaded side down so dust and other particles will not fall into the inside of the cap. Keep fingers well away from the inside surface from the cap.
   d. Fill bottle from tap to where the bottle neck meets the bottle shoulder, leaving approximately 1 inch air gap. Do not overfill. Cap bottle. Shake the sample vigorously for a few seconds to dissolve the sodium thiosulfate.
   e. Do not "adjust" the level of water in a sample bottle by spilling water out. This may wash contaminants from the lip of the bottle or the outside of the neck into the sample. Instead, discard overfilled bottle and fill a fresh bottle with sample from the tap.
   f. Immediately place bottles in cooler.
6. **Microbiology resample policy** – For the purposes of sample collection policies, a tank or distribution system sample analyzed for bacteria is considered to be positive for bacteria if the Laboratory obtains at least one of the following results.
   a. Any detectable Coliform bacteria.
   b. A non-Coliform bacteria count of greater than 200 CFU/100 mL.
   c. A heterotrophic plate count (HPC) of greater than 500 CFU/mL for any tank sample with a total chlorine residual of less than 0.5 mg/L or any distribution system sample with a total chlorine residual of less than 0.3 mg/L.
7. **Bacterial Positive Resampling Policy**
   a. All samples found to be positive for bacteria, as defined above, are immediately reported by the Laboratory staff to the Engineering Operations and Analysis (EOA) on call staff member.
   b. The EOA on call staff member determines the appropriate resampling that is needed and contacts the WQSS supervisor or Water Quality Office on call staff member.
   c. The WQSS supervisor or Water Quality Office on call staff member assigns the resampling to the appropriate Collector or Inspector.
   d. Samples found to be positive for bacteria during the morning "presumptive" read will be resampled on the same day.
   e. Samples found to be positive for bacteria during the afternoon "final" read will be resampled on the next day.
   f. **All samples found to be positive for bacteria must be resampled within 24 hours of notification by the laboratory.** The 24 hours start from when the Lab first notifies EOA that a sample is positive for bacteria.
8. **Resampling Requirements for a Bacterial Positive**
   a. All locations being resampled as a result of a bacterial positive must be disinfected with bleach prior to sampling (see section E1 on page 8 for the proper disinfecting technique).
   b. Any Total Coliform Rule sample found to be positive for coliform bacteria requires a repeat sample set. A repeat sample set consists of three samples; one sample from the original sample tap, one sample from within 5 water services upstream of the original sample tap, and one sample from within 5 water services downstream of the original sample tap. Note: the 'upstream' and 'downstream' locations are arbitrarily assigned as it is impossible in most cases to know in which direction the water is flowing; this nomenclature is used simply to indicate that a sample on each side of the original sample is needed.
   c. Any Total Coliform Rule resample found to be positive for coliform bacteria requires an additional repeat sample set, as described above. In the case of a resample, whichever location was positive becomes the new "on" sample, and an "upstream" and "downstream"

sample must be collected respective to the site that was positive on resample.

d. Any tank sample found to be positive for coliform bacteria requires that the tank be isolated from the distribution system. If the total chlorine residual of the positive sample was at or above 0.5 mg/L, a resample set is taken from different water depths in the tank. If the total chlorine residual of the positive sample was below 0.5 mg/L, the tank will be treated and a resample will be taken 24 hours after the treatment is completed. The tank will not be returned to service until all resamples are free of coliform bacteria.
e. Any tank or distribution system sample found to contain non coliform bacteria in numbers greater than 200 CFU/100mL requires a replacement sample. A replacement sample is one sample taken at the original location.
f. Any distribution sample with a total chlorine residual of less than 0.3 mg/L and a HPC count of greater than 500 CFU/ml will trigger a bacterial survey of the immediate area as part of an investigation as to why the chlorine residual is low.
g. Any tank sample with a total chlorine residual of less than 0.5 mg/L and a HPC count of greater than 500 CFU/ml requires that the tank be isolated from the distribution system. The tank will be treated and a resample will be taken 24 hours after the treatment is completed.

F Sample storage during transit

1. Temperature control
   a. Store samples in ice chest with water ice or substitute (e.g., blue ice).
   b. Samples are to be cooled to a temperature below 8°C during transport to the laboratory.
      i. Samples that were collected less than an hour before receipt at the laboratory may be above 8°C and still be valid.
   c. Do not use dry ice or ice/salt mixtures capable of lowering the temperature below 0°C.
   d. Do not use ice substitute which has been stored at temperatures significantly below 0°C.
   e. Samples which contain ice crystals shall be invalidated.
2. Sample integrity
   a. Make sure sample caps are screwed down snugly.
   b. Check sample blank to make sure its cap is on snugly.
   c. Place samples bottles in a plastic bag to keep them dry.

G Sample chain of custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Supply "Name", "Weather" and "Time in Lab" in the appropriate spaces at the top of each page on the field sheet.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Microbiology supervisor Ron Dergregorian at 213-792-6096. If Microbiology supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the Collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
   e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet.
   f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
   g. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
   h. Ensure that field test data are entered into LIMS for each sample.
3. **If no custodian is present**
   a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet.

b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Log in samples and generate LIMS labels.
d. Attach LIMS labels to sample bottles.
e. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

H References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Microtox analysis

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Clear glass vials, 40 ml, 2
2. Preservative: Store between 1° and 6°C
3. Holding time: 36 hours
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis (e.g., "rush" samples).

B Field/Sampling equipment and calibration, reagents, and supplies

1. Standard field tests (free and total chlorine, pH, temperature, specific conductance) are required for all microbiological samples.

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottles on side with full name of sample location.
3. Auxiliary bottles for analytes tested if the microtox is positive (Metal, UV254, VOC) must be labeled with the full name of the sample location and the day and month of sample collection.

E Sampling technique

1. Clean and disinfect sample tap.
   a. Pour some bleach into a small container such as a bottle cap or paper cup and immerse the spout of the sample tap in the bleach, a quarter of an inch above any threads, for at least ten seconds.
   b. Dip a brush or swab in bleach and use it to treat the areas inside of the spout which the bleach cannot reach due to trapped air in the spout.
   c. Wipe bleach from sample tap or hose bib with a clean paper towel.
2. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
3. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
5. Fill vials from tap, keeping headspace to a minimum.
6. Microtox samples are collected in conjunction with Microbiological, Metal, UV-254, and VOC samples.

F Sample storage during transit

1. Temperature control
   a. Store samples in ice chest with water ice or substitute (e.g., blue ice).
   b. Do not use dry ice or ice/salt mixtures capable of lowering the temperature below 0°C.
   c. Do not use ice substitute which has been stored at temperatures significantly below 0°C.
   d. Samples which contain ice crystals shall be invalidated.
2. Sample integrity
   a. Make sure sample caps are screwed down snugly.
   b. Check sample blank to make sure its cap is on snugly.

c. Place samples bottles in a plastic bag to keep them dry.

G Sample chain-of-custody procedures

1. Field form / custody sheet

a. a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet

b. Supply "Name", "Weather" and "Time in Lab" in the appropriate spaces at the top of each page on the field sheet.

2. Sample receiving sign in

a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.

b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Microbiology supervisor Ron Dergregorian at 213-792-6096. If Microbiology supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the Collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet.

f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

g. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.

h. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet.

b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

c. Log in samples and generate LIMS labels.

d. Attach LIMS labels to sample bottles.

e. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

H References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Organic Chemistry Samples

TCP (1,2,3-Trichloropropane)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass vials, 3 X 40 ml, Teflon-lined cap/septa
2. Preservative: Ascorbic acid, 25 mg (chlorinated/chloraminated samples only), 3 drops 1:1 HCl (to pH <2); store between 1° and 6°C
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. One field blank will be carried with the samples throughout the sample collection run. Field blanks expire one week after they're made.

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated / chloraminated samples) Shake vials with a rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM

and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.

b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Dioxane (1,4-dioxane)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottle, 500 ml
2. Preservative: Sodium sulfite, 25 mg (if sample chlorinated or chloraminated); 500 mg sodium bisulfate **after filling and full dechlorination** (Usually measured into a small vial to be poured in after sample bottle filled.)
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. 1:1 HCl

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottles on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 1 L/min – a 125-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle from tap, re-cap and agitate to dissolve sodium sulfite. Analyte is not volatile, so bottles need not be completely free of head space or bubbles.
5. Immediately place bottle in cooler

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for

assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Carbamate

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber plastic bottle, 2 X 125 ml
2. Preservative: Sodium thiosulfate, 10 mg (chlorinated/chloraminated samples only, mix well before adjusting pH*); 2.5M monochloroacetic acid in empty bottle, 3.6 ml (to pH <3); freeze (store between 1° and 6°C in field while sampling)
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None. (* If sampling a chlorinated or chloraminated supply, it may be necessary to dechlorinate in another container and pour dechlorinated water into carbamate bottle.)

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottles on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 1 L/min – a 125-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle half full from tap, leaving room for expansion during freezing. Re-cap
5. Immediately place bottles in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for

assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Diquat/Paraquat

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber plastic bottle, 2 X 500 ml
2. Preservative: Sodium thiosulfate, 50 mg (chlorinated/chloraminated samples only); cool to <10°C
3. Holding time: 7 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottles on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill the bottle from tap, leaving about 1 inch of head space. Re-cap.
5. Immediately place bottle in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the

collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

EDB/DBCP

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber plastic bottle, 3 X 40 ml, Teflon lined septa
2. Preservative: Sodium thiosulfate, 3 mg (chlorinated/chloraminated samples only); store between 1° and 6°C
3. Holding time: 28 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Glyphosate

H Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottle, 2 X 125 ml
2. Preservative: Sodium thiosulfate, 10 mg; freeze
3. Holding time: 6 weeks if frozen
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

I Field/Sampling equipment and calibration, reagents, and supplies

1. None

J Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

K Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottles on side with name of sample location.

L Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 1 L/min – a 125-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle half full from tap and re-cap.
5. Immediately place bottle in cooler

M Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

N References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Haloacetic Acids (HAA)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 4 X 60 ml, Teflon lined caps
2. Preservative: NH_4Cl, 6 mg; store between 1° and 6°C
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.
   b. An additional holding time for analysis of extract applies but is not relevant to sampling procedures.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 60-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. Shake vials with rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Herbicides

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 6 X 60 ml, Teflon lined caps or septa
2. Preservative: Sodium thiosulfate, 3 mg (chlorinated/chloraminated samples only); store between 1° and 6°C
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Polynuclear Aromatic Hydrocarbons (PAH)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottles, 3 X 1L, Teflon lined caps
2. Preservative: Sodium thiosulfate, 100 mg (chlorinated/chloraminated samples only); 1:1 HCl to pH < 2; store between 1° and 6°C
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each bottle on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 1 L sample bottle will take about thirty seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle from tap to the top and re-cap, leaving no air bubbles or headspace.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Carefully remove cap and add approx. 2 ml 1:1 HCl to sample. Carefully replace cap.
   a. In some cases, more HCl will be needed. It may be necessary to measure pH of the sample after addition of acid and add more if pH is still above 2.0.
7. Immediately place bottles in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.

f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.

i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC

b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

d. Log in samples and generate LIMS labels.

e. Attach LIMS labels to sample bottles.

f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Pesticides—Cl

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 3 X 40 ml, Teflon lined caps or septa
2. Preservative: Sodium thiosulfate, 3 mg (chlorinated/chloraminated samples only); store between 1° and 6°C
3. Holding time: 7 days for heptachlor, 14 days for everything else
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Phthalates/DEHP

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottles, 3 X 1L, Teflon lined caps
2. Preservative: Sodium sulfite, 50 mg (chlorinated/chloraminated samples only); 1:1 HCl to pH < 2; store between 1° and 6°C; **sample must not contact any plastic parts or tubing**
3. Holding time: 14 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each bottle on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 1 L sample bottle will take about thirty seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle from tap to the neck of the bottle and re-cap. *Sample must not come in contact with any plastic*.
5. (Chlorinated/chloraminated samples) Shake bottle with a rocking motion to mix water and preservative.
6. Remove cap and add approx. 2 ml 1:1 HCl to sample. Replace cap.
    a. In some cases, more HCl will be needed. It may be necessary to measure pH of the sample after addition of acid and add more if pH is still above 2.0.
7. Immediately place bottles in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM,

or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Prometon

H Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottles, 3 X 1L, Teflon lined caps
2. Preservative: Sodium sulfite, 50 mg (chlorinated/chloraminated samples only); store between 1° and 6°C; **sample must not contact any plastic parts or tubing**
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

I Field/Sampling equipment and calibration, reagents, and supplies

1. None

J Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

K Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each bottle on side with full name of sample location.

L Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 1 L sample bottle will take about thirty seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle from tap to the neck of the bottle and re-cap. *Sample must not come in contact with any plastic*.
5. (Chlorinated/chloraminated samples) Shake bottle with a rocking motion to mix water and preservative.
6. Immediately place bottles in cooler.

M Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356.

If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

N References

Standard Methods for the Examination of Water and Wastewater, 21st ed.

tert-Butyl Alcohol (TBA)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 3 X 40 ml, Teflon lined caps or septa
2. Preservative: Ascorbic acid, 25 mg (chlorinated/chloraminated samples only); acidify with 3 drops 1:1 HCl; store between 1° and 6°C
3. Holding time: 14 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
    i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

THM Formation Potential (THMFP)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottle, 1L, Teflon lined cap
2. Preservative: Store between 1° and 6°C
3. Holding time: None
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 1 L sample bottle will take about thirty seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill to the top and cap bottle, leaving no bubbles or head space.
5. Immediately place bottle in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Trihalomethanes (THM)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 4 X 40 ml, Teflon lined caps or septa
2. Preservative: Ascorbic acid, 25 mg (chlorinated/chloraminated samples only); acidify with 3 drops 1:1 HCl; store between 1° and 6°C
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Carefully uncap and acidify with 3 drops of 1:1 HCl. Re-cap.
7. Immediately place vials in cooler.
8. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM,

or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Trichloroethylene (TCE)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 4 X 40 ml, Teflon lined caps or septa
2. Preservative: Ascorbic acid, 25 mg (chlorinated/chloraminated samples only); acidify with 3 drops 1:1 HCl; store between 1° and 6°C
3. Holding time: 14 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Tetrachloroethylene (PCE)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 4 X 40 ml, Teflon lined caps or septa
2. Preservative: Ascorbic acid, 25 mg (chlorinated/chloraminated samples only); acidify with 3 drops 1:1 HCl; store between 1° and 6°C
3. Holding time: 14 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Carefully uncap, add 3 drops 1:1 HCl to acidify. Re-cap
7. Immediately place vials in cooler.
8. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM,

or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Triazines

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottles, 3 X 1L, Teflon lined caps
2. Preservative: Sodium sulfite, 50 mg (chlorinated/chloraminated samples only); 1:1 HCl to pH < 2.0 (about 4 ml); store between 1° and 6°C; **Sample must not contact any plastic parts or tubing**
3. Holding time: 14 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each bottle on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 1 L sample bottle will take about thirty seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill to bottle neck and cap bottle. Shake bottle to dissolve preservative.
5. Uncap bottle, add 1:1 HCl to lower pH below 2.0. Recap bottle.
6. Immediately place bottle in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for

assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Thiobencarb

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottles, 3 X 1L, Teflon lined caps
2. Preservative: Sodium sulfite, 50 mg (chlorinated/chloraminated samples only); 1:1 HCl to lower pH below 2.0; store between 1° and 6°C
3. Holding time: 14 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 1 L sample bottle will take about thirty seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle from tap to bottle neck and re-cap. Shake with rocking motion to dissolve preservative
5. Uncap bottle, add 1:1 HCl to reduce pH below 2.0 (about 4 ml). Recap bottle
6. Immediately place bottles in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Volatile Organic Compounds (VOC)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 3 X 40 ml, Teflon lined caps or septa
2. Preservative: Ascorbic acid, 25 mg (chlorinated/chloraminated samples only); acidify with 3 drops 1:1 HCl; store between 1° and 6°C
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab) (If collected in conjunction with Microtox, sample date must be written on label in field.)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Carefully remove cap and add 3 drops of 1:1 HCl to sample. Carefully replace cap.
7. Immediately place bottles in cooler.
8. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.

b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Carbon Disulfide

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass vials, 3 X 40 ml, Teflon lined caps or septa
2. Preservative: Ascorbic acid, 25 mg (chlorinated/chloraminated samples only); acidify with 3 drops 1:1 HCl; store between 1° and 6°C
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. (Chlorinated/chloraminated samples) Shake vial with a rocking motion to mix water and preservative.
6. Carefully remove cap and add 3 drops of 1:1 HCl to sample. Carefully replace cap.
7. Immediately place bottles in cooler.
8. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM,

or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.

f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.

i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.

   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC

b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

d. Log in samples and generate LIMS labels.

e. Attach LIMS labels to sample bottles.

f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Inorganic Chemistry Samples

Alkalinity

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 250 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 14 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to within half an inch of the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for

assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Ammonia (free)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 250 ml
2. Preservative: 1 ml of 1:1 H_2SO_4 to pH < 2; store between 1° and 6°C
3. Holding time: 28 days (unpreserved sample: 24 hours)
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill to half an inch from the top.
5. Add 1 ml 1:1 H_2SO_4. Cap bottle.
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
    d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the

collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
    i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Ammonia and Chloramines

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 250 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 24 hours
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill with water to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Bromate

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: 2 drops Ethylene Diamine; store between 1° and 6°C
3. Holding time: 28 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top.
5. Add 2 drops Ethylene Diamine. Cap bottle. (This step can wait until samples arrive in lab.)
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. If not preserved in field, add 2 drops Ethylene Diamine to sample.
    d. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Bromide

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: None
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. Field form / custody sheet
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.

2. Sample receiving sign in
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Calcium

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: 1 ml of 1:1 HNO_3 to pH < 2
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top.
5. Add 1 ml of 1:1 HNO_3. Cap bottle. (This step can wait until samples arrive in lab)
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. Field form / custody sheet

a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
c. If preservative was not added in field, add 1 ml of 1:1 HNO_3 to sample.
d. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.

2. Sample receiving sign in

a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Chlorate

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: 2 drops Ethylene Diamine; store between 1° and 6°C
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top.
5. Add 2 drops Ethylene Diamine. (This step can wait until samples arrive in lab.) Cap bottle.
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. Field form / custody sheet

a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
c. If not preserved in field, add 2 drops Ethylene Diamine.
d. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.

2. Sample receiving sign in

a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Chloride

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: 2 drops Ethylene Diamine; store between 1° and 6°C
3. Holding time: 28 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
    d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Chlorite

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: Purge with inert gas (He, Ar, N_2); 2 drops Ethylene Diamine; store between 1° and 6°C
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from top.
5. Insert end of line from inert gas tank into bottle, taking care to keep it submerged.
6. Adjust gas flow from tank to approximately 3 bubbles per second.
7. Purge for 30 seconds. Turn off gas and remove line.
8. Add 2 drops ethylene diamine and cap.
9. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior

to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Chromium, Hexavalent

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Disposable plastic bottle, 125 ml, acid washed; plastic bottle, 500 ml, acid washed (for concurrent total chromium sample – see method)
2. Preservative: 1 ml $(NH_4)_2SO_4$/NAOH solution; store between 1° and 6°C
3. Holding time: 14 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. No special equipment needed

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample bottle on side with name of sample location.

E Sampling technique

1. Ensure 125 ml plastic bottle has been dosed with preservative buffer.
    a. The preservative is quite volatile. Keep bottles tightly capped in transit.
2. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
3. Fill 500-ml sample bottle completely full from sample tap.
4. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
5. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
6. Fill 500-ml sample bottle completely full from sample tap. Do not add preservative yet.
7. Transfer 125 ml of sample from 500-ml bottle into 125-ml bottle.
8. Total chromium bottle may be preserved now. Cap both bottles tightly.
9. Do not "top off" the 500-ml bottle.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.
2. EPA method 218.7

Color

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic or glass bottle, 125 ml
2. Preservative: None
3. Holding time: 48 hours
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
    d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Color, Odor, Turbidity

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass bottle, 500 ml, Teflon-lined cap
2. Preservative: Store between 1° and 6°C
3. Holding time: 48 hours
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Color and Turbidity

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic or glass bottle, 500 ml
2. Preservative: None
3. Holding time: 48 hours
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. Field form / custody sheet
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.

2. Sample receiving sign in
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Conductivity

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Cyanide

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottle, 250 ml
2. Preservative: 25 mg ascorbic acid (chlorinated / chloraminated samples only); 10 drops NaOH to pH > 12; store between 1° and 6°C
3. Holding time: 14 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top.
5. Add 10 drops NAOH. Cap bottle.
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. **If no custodian is present**
   a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
      i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
   b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
   c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
   d. Log in samples and generate LIMS labels.
   e. Attach LIMS labels to sample bottles.
   f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Dissolved Organic Carbon (DOC)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass vials, 40 ml, Teflon-lined septa
2. Preservative: Filter in field through 0.45µm filter; acidify with 5 drops 1:1 H_3PO_4 to pH < 2. Store between 1° and 6°C.
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. Shake vial with a rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior

to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Fluoride

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 28 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
    d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Hardness

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: 1 ml of 1:1 HNO_3 to pH < 2
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top.
5. Add 1 ml of 1:1 HNO_3. Cap bottle. (This step can wait until samples arrive in lab)
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. If preservative was not added in field, add 1 ml of 1:1 HNO_3 to sample.
   d. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Langelier Index (alkalinity, calcium, conductivity)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 2 X 250 ml
2. Preservative:
   a. (alkalinity and conductivity) Store between 1° and 6°C
   b. (calcium) 2 ml of 1:1 HNO_3 to pH < 2
3. Holding time: 14 days for alkalinity and conductivity bottle, 28 days for calcium bottle.
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottles to half an inch from the top.
5. Add 2 ml of 1:1 HNO_3 to calcium bottle. (This step can wait until samples arrive in lab)
6. Cap bottles and immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. If preservative was not added in field, add 2 ml of 1:1 HNO_3 to calcium bottle.
   d. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior

to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
    i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Leak (ammonia, chloride, conductivity, hardness)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic or glass, 500 ml
2. Preservative: None
3. Holding time: Analyze immediately

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Two samples are required for each location: a sample of the leak or seepage and a reference sample from a nearby tap, chosen to be representative of the water system.
   a. (Reference sample) Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
   b. (Leak or seepage sample) Fill bottle to half an inch from the top from seepage and cap. It may be necessary to use devices to suction water from the seep and transfer it to the sample bottle, depending on the depth and rate of flow.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
   e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
   g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Mercury

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 500 ml
2. Preservative: 2 ml of 1:1 HNO_3 to pH < 2; store between 1° and 6°C.
3. Holding time: 28 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top.
5. Add 2 ml of 1:1 HNO_3. Cap bottle. (This step can wait until samples arrive in lab)
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. If preservative was not added in field, add 2 ml of 1:1 HNO_3 to sample.
    d. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Metals

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 500 ml
2. Preservative: 2 ml of 1:1 HNO_3 to pH < 2; store between 1° and 6°C.
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab) (If collected in conjunction with Microtox sample, sample date must be written on label in field.)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top.
5. Add 2 ml of 1:1 HNO_3. Cap bottle. (This step can wait until samples arrive in lab)
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. If preservative was not added in field, add 2 ml of 1:1 HNO_3 to sample.
   d. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for

assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Methylene Blue Active Substances (MBAS)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 1000 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 48 hours
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 1000-ml sample bottle will take about thirty seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Nitrate

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic or glass bottle, 250 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 48 hours (14 days if sample chlorinated)
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Nitrite

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 250 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 48 hours
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
    d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
    i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Odor

H Sample containers/bottles, preservation and holding time

1. Containers/bottles: Glass bottle, 500 ml, Teflon-lined cap
2. Preservative: Store between 1° and 6°C
3. Holding time: 48 hours
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

I Field/Sampling equipment and calibration, reagents, and supplies

1. None

J Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

K Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

L Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

M Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

N References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Pb/Cu Rule

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 1 L
2. Preservative: 4 ml of 1:1 HNO_3 to pH < 2.
3. Holding time: 6 weeks; store up to 6 months
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Do not run the water in the residence for at least six hours, preferably longer.
2. Take a first-draw sample from one faucet in the building
   a. Open the sample bottle and position it under the tap
   b. Turn on water to about 3 L/min (a 1-L bottle should take about 20 seconds to fill)
   c. Fill sample bottle to within one inch of the top
   d. Cap bottle and return to lab as promptly as possible

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Add 4 ml of 1:1 HNO_3 to sample.
   d. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
   e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
   g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Perchlorate

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 28 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Phosphate (ortho)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: Filter through 0.45µm filter; store between 1° and 6°C
3. Holding time: 48 hours
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Filter 125 ml of sample from a container into 125-ml bottle:
   a. Fill a clean container with at least 125 ml of water from the sample tap.
   b. Using syringe, withdraw water from container.
   c. Attach 45µm filter to syringe and depress plunger with a force of between 10 and 20 pounds to filter water into 125-ml bottle.
   d. Remove 45µm filter.
   e. Repeat steps a-c until the required orthophosphate sample volume has been obtained.
5. Immediately cap bottle and place in cooler.

F Sample chain-of-custody procedures

1. Field form / custody sheet

   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.

2. Sample receiving sign in

   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.

c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.

f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.

i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC

b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

d. Log in samples and generate LIMS labels.

e. Attach LIMS labels to sample bottles.

f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Phosphorus (total)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 250 ml
2. Preservative: 1 ml of 1:1 H_2SO_4 to pH < 2; store between 1° and 6°C
3. Holding time: 28 days (unpreserved sample: 24 hours)
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill to half an inch from the top.
5. Add 1 ml 1:1 H_2SO_4. Cap bottle.
6. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the

collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.

f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.

i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.

   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC

b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

d. Log in samples and generate LIMS labels.

e. Attach LIMS labels to sample bottles.

f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Silica

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 250 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 28 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
    d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Sulfate

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 125 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 28 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 125-ml sample bottle will take about four seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
    d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Total Dissolved Solids (TDS)

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic bottle, 250 ml
2. Preservative: Store between 1° and 6°C
3. Holding time: 7 days
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 250-ml sample bottle will take about eight seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
   d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.

f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.

i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC

b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

d. Log in samples and generate LIMS labels.

e. Attach LIMS labels to sample bottles.

f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Total Organic Carbon (TOC)

H Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass vials, 40 ml, Teflon-lined septa
2. Preservative: 5 drops 1:1 H_3PO_4 to pH < 2; Store between 1° and 6°C
3. Holding time: 28 days
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

I Field/Sampling equipment and calibration, reagents, and supplies

1. Travel blank

J Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

K Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label each sample vial on side with full name of sample location.

L Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 500 ml/min – a 40-ml sample bottle will take about five seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap vial, leaving no bubbles or head space.
5. Shake vial with a rocking motion to mix water and preservative.
6. Immediately place vials in cooler.
7. Note: If it is impossible to obtain a smooth stream or a 500 ml/min flow rate, it is permissible to fill a glass jar or bottle with sample water and transfer it to vials in a controlled manner.

M Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356.

If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.

f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.

i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC

b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.

c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.

d. Log in samples and generate LIMS labels.

e. Attach LIMS labels to sample bottles.

f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

N References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Turbidity

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Plastic or glass bottle, 500 ml
2. Preservative: None
3. Holding time: 48 hours
    a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
    a. Allow the well to flush for a minimum of 30 minutes
    b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
    c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
    a. If the turbidity is below 2.0 NTU, samples may be taken.
    b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Fill bottle to half an inch from the top and cap.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
    a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
    b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
    c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
    a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
    b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
    c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.
    d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the

procedures in this section are carried out.

e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
    i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

UV 254

A Sample containers/bottles, preservation and holding time

1. Containers/bottles: Amber glass bottle, 500 ml, Teflon-lined cap
2. Preservative: Store between 1° and 6°C
3. Holding time: 48 hours
   a. Samples that may be used in legal action are subject to special measures to ensure prompt analysis.

B Field/Sampling equipment and calibration, reagents, and supplies

1. None

C Sample labeling – All samples must be labeled with:

1. Sample location code (must be labeled in field at time of sampling)
2. Analyte (provided on LIMS label applied at lab)
3. Lab Schedule (provided on LIMS label applied at lab)
4. Sample date (provided on LIMS label applied at lab) (If collected in conjunction with Microtox, sample date must be written on label in field.)
5. Collector name (provided on LIMS label applied at lab)

D Parameters and field data recording or documentation

1. Record sample collection time and results of field tests in spaces provided on collector field sheet.
2. Label sample bottle on side with name of sample location.

E Sampling technique

1. Open tap and flush at full volume for at least one minute. Reduce flow to a steady stream (approx. 2 L/min – a 500-ml sample bottle will take about fifteen seconds to fill) and allow to flush for at least an additional 30 seconds.
2. If sampling from a well which needs to be turned on for sampling, the following procedures apply:
   a. Allow the well to flush for a minimum of 30 minutes
   b. Check turbidity at the end of this interval. If it is below 2.0 NTU, samples may be taken; otherwise, continue flushing until it falls below that value.
   c. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
3. When sampling from a well that is in production, measure the turbidity before sampling.
   a. If the turbidity is below 2.0 NTU, samples may be taken.
   b. If the turbidity remains at or above 2.0 NTU for two hours, contact the WQSS supervisor or EOA for further instructions.
4. Hold the vial at an angle while filling so as to minimize aeration of the sample. Fill to the top and cap bottle, leaving no bubbles or head space.
5. Immediately place in cooler.

F Sample chain-of-custody procedures

1. **Field form / custody sheet**
   a. Write collector's name and initials in the appropriate spot on the Chain of Custody block at bottom of the last page of field sheet
   b. Note "Weather" and "Time in Lab" in the appropriate spaces at the top of one page on the field sheet.
   c. Initial all cases where preservatives are added to samples, circle "LAB" or "FIELD" as appropriate.
2. **Sample receiving sign in**
   a. On weekdays, sample custody services are normally available between the hours of 8:00 AM and 5:45 PM. Call Sample Receiving if samples are expected to be delivered after 3:30 PM.
   b. On weekends and holidays, sample custody services are available from 9:00 AM to 1:00 PM, or when the last scheduled Collector arrives at the lab, whichever occurs later.
   c. Emergency after-hours rush samples must be called in to laboratory section supervisors prior to arrival at Water Quality lab. Call Chemistry supervisor Houri Mandjikian at 213-798-5356. If Chemistry supervisor is not available, contact Pauline Nguyen at 213-367-8529 for assistance and/or sample processing.

d. Note: Sample Receiving Custodian may opt to carry out some of the steps listed below for the collector. This is a courtesy. The Sample Collector is responsible for ensuring that the procedures in this section are carried out.
e. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
f. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
g. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
h. Ensure that LIMS labels are printed out and attached to field sheets and sample bottles.
i. Ensure that field test data are entered into LIMS for each sample.

3. If no custodian is present

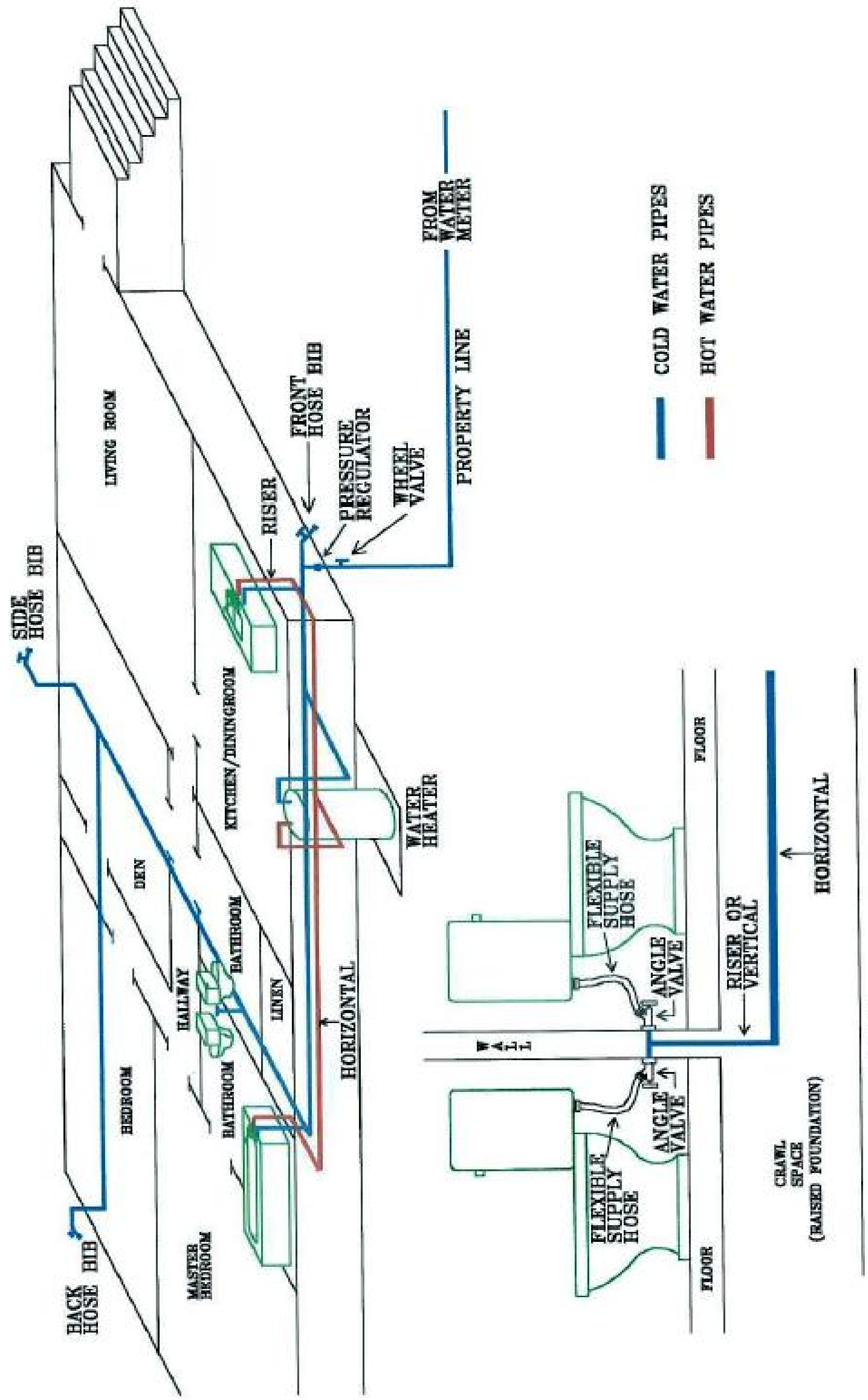
a. Enter name, initials, and sample collection date in chain of custody block on the bottom of the last page of the field sheet. Also record the preparation dates of chemical travel blanks used during sample collection run.
   i. Chemical travel blanks in use are currently VOC, THM, HAA, and TOC
b. Indicate whether samples requiring cooling were transported in an ice chest or vehicle refrigerator. If an ice chest was used, circle "ice" or "blue ice" as appropriate.
c. Initial each preservative block for each sample. If preservatives are to be added at the lab, ensure that they are, in fact, added. Indicate whether preservatives were added in the LAB or in the FIELD.
d. Log in samples and generate LIMS labels.
e. Attach LIMS labels to sample bottles.
f. Place samples in a plastic bin and put bin in the refrigerated case in room 102.

G References

1. Standard Methods for the Examination of Water and Wastewater, 21st ed.

Appendices

Appendix A: General irrigation diagram



Appendix B: List of LIMS sample schedules

Lab Schedule	Bottle
#TK	BCT250(Thio[WQL])
$PHARM	PPCP1000ag(NaN3[Lab]Ascorbic[Lab])
$PHARMQ	3PPCP1000ag(NaN3[Lab]Ascorbic[Lab])
(#TK)	(BCT250(Thio[WQL])) / No Sample
1,4-dioxane	2DIOX1000ag
AC	MET500p(HNO3[_____]) Field Lab
Aero	BCT1000(Thio[WQL])
AL	MET500p(HNO3[_____]) Field Lab
Alk	ALK250p
AO1	CRYPTO10Lp - BCT250(Thio[WQL]) - TURB500p
AO1Q	2CRYPTO10Lp - BCT250(Thio[WQL]) - TURB500p
As	MET500p(HNO3[_____]) Field Lab
Asbestos	ASB1000p
BA	BCT250(Thio[WQL])
BA1	BCT250(Thio[WQL])
BA2	BCT250(Thio[WQL])
BB	BCT250(Thio[WQL])
BB2	BCT250(Thio[WQL])
BC	BCT250(Thio[WQL]) - ODORCT500g
BCQ	BCT250(Thio[WQL]) - ODOR500g - CLRTURB500p
BD	(BCT250)(Thio[WQL]) - NITR250p - AMM250p
BD3	(BCT250)(Thio[WQL]) - NITR250p - AMM250p
BPA	2BPA40sag(NaN3[Lab]Ascorbic[Lab])
BR	BROM125p
BRF	BROMF125p
BRO3	BROM125p(EDA[_____]) Field Lab
BRO3CLO3	BRO3CLO3-125p(EDA[_____]) Field Lab
Bromate	BROM125p(EDA[_____]) Field Lab
Bromide	BROM125p
BS	BCT250(Thio[WQL])
BSTK	BCT250(Thio[WQL]) - CLRTURB500p
BSTK2	BCT250(Thio[WQL]) - ODORCT500g - 3VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
BT	UV500ag - AMM250p-ALK250p - 4TOC40ag(H3PO4[_____]) Field Lab
BU	3THM40ag(Ascorbic[_____]HCl[_____]) Field Lab - 3HAA40g(NH4Cl[_____]) Field Lab
BUQ	4THM40ag(Ascorbic[_____]HCl[_____]) Field Lab - 5HAA40g(NH4Cl[_____]) Field Lab
CLO3	CLO3-125p(EDA[_____]) Field Lab
CLO4	CLO4-125p
CN	CN250ag(Thio[_____]NaOH[_____]) Field Lab
Color	COLOR125p
ColorTurb	CLRTURB500p
Cr	MET500p(HNO3[_____]) Field Lab

Lab Schedule	Bottle
CR/6	HXCR125ap(filtered[_____]Cr6Buffer[_____]) Field Lab - MET500p(HNO3[_____]) Field Lab
Cu	MET500p(HNO3[_____]) Field Lab
DBPFP	DBPFP1000ag
DOC	3DOC40ag(aw)(field filtered[_____])(H3PO4[_____]) Field Lab
EMTD	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
EMTS	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
EMTS2	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
ERMTOXD	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
ERMTOXS	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
ERMTOXS2	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
F	F125p
Fe	MET500p(HNO3[_____]) Field Lab
Fld1	Standard field tests.
Fld2	Standard field tests plus field turbidity.
Fld3	Standard field tests plus field: free ammonia, total ammonia, NO2, NO3, & monochlor
GLY	2GLY125ag(Thio[_____])(fill 1/2 full only) Field Lab
Gross alpha/beta	RAD2000p(HNO3[_____]) Field Lab
HAA	3HAA40g(NH4Cl[_____]) Field Lab
HAA9	3HAA40ag(NH4Cl[_____]) Field Lab
HAAFP	HAAFP1000ag
HAAQ	5HAA40g(NH4Cl[_____]) Field Lab
Hg	MET500p(HNO3[_____]) Field Lab
Inspection	Collector circle one: GOOD BAD NTD
LCR	COND125p - ALK250p - MET500p(HNO3[_____]) Field Lab
LSI	COND125p - ALK250p - CA125p(HNO3[_____]) Field Lab
MA	BCT1000(Thio[WQL])
Mn	MET500p(HNO3[_____]) Field Lab
MTD	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
MTL	MET500p(HNO3[_____]) Field Lab
MTL_T22	MET500p(HNO3[_____]) Field Lab - Hg500p(HNO3[_____]) Field Lab
MTL1	MET500p(HNO3[_____]) Field Lab
MTL2	MET500p(HNO3[_____]) Field Lab
MTL3	MET500p(filtered[_____]HNO3[_____]) Field Lab
MTL4	MET500p(HNO3[_____]) Field Lab
MTS	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
MTS2	BCT250(Thio[WQL]) - 2µTox40g - MET500p - UV500ag - 2VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
NDMA	2NDMA1000ag

Lab Schedule	Bottle
NH3free	NH3-250p(H2SO4[_____]) Field Lab
Nitrosamines	2NITROS1000ag
NO2	NITR125p
NO2NO3	NITR250p
NO3	NITR125p
None	[None]
Odor	ODOR500g
Oil	OIL1000g(MainSt)
Op	OPO4-125g(aw)(filtered[_____]) Field Lab
OpQ	OPO4-250g(aw)(filtered[_____]) Field Lab
OUTAGE	BCT250(Thio[WQL]) - CLRTURB500p - Fld Pressure
Pb	MET500p(HNO3[_____]) Field Lab
PCB	2PCB1000(Thio[WECK])
Phenolics	2ACIDS1000ag - 2UCM1000ag(HCL_____) Field Lab
Phthalates	3PTA1000ag(Na2SO3)[_____]HCl[_____]) Field Lab
PM	ODORCT500g
PMQ	ODOR500g - CLRTURB500p
PTA	3PTA1000ag(Na2SO3)[_____]HCl[_____]) Field Lab
Radon	2radon40ag(MWH Labs)
SO4	SO4-125p
TBA	3TBA40ag(ascorbic[_____]HCl[_____]) Field Lab
TCP	3TCP40ag(ascorbic[_____]HCl[_____]) Field Lab
THM	3THM40ag(ascorbic[_____]HCl[_____]) Field Lab
THMFP	THMFP1000ag
THMFP2	THMFP1000ag
THMQ	4THM40ag(ascorbic[_____]HCl[_____]) Field Lab
TK	BCT250(Thio[WQL])
TOC	3TOC40ag(aw)(H3PO4[_____]) Field Lab
Turb	TURB500p
TWTP	BCT250(Thio[WQL]) - NITR250p - 3VOC40ag(HCl[_____]) Field Lab - 3TCP40ag(HCl[_____]) Field Lab - 3TBA40ag(HCl[_____]) Field Lab - CLO4-125p - MET500p(HNO3[_____]) Field Lab - 2DIOX1000ag - 2NITROS1000ag
TWTP2	BCT250(Thio[WQL]) - NITR125p - 3VOC40ag(HCl[_____]) Field Lab - 3TCP40ag(HCl[_____]) Field Lab - 3TBA40ag(HCl[_____]) Field Lab - CLO4-125p
TWTP3	BCT250(Thio[WQL]) - NITR125p - 3VOC40ag(HCl[_____]) Field Lab - 3TBA40ag(HCl[_____]) Field Lab - CLO4-125p
UVT	UVT500ag
WELLBCT	BCT250(Thio[WQL])
WELLFRQ	BCT250(Thio[WQL]) - 4TOC40ag(H3PO4[_____]) Field Lab - NO2NO3SO4-250p - AMM250p(H2SO4[_____]) Field Lab - MET500p(HNO3[_____]) Field Lab
YL	3VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
YLW	3VOC40ag(HCl[_____]) Field Lab
YM	5HAA40g(NH4Cl[_____]) Field Lab
YP	(BCT250(Thio[WQL])) - NO3F125p - 3THM40ag(ascorbic[_____]HCl[_____])

Lab Schedule	Bottle
	Field Lab
YPA	(BCT250(Thio[WQL])) - NO3SO4F125p
YPAYL	(BCT250(Thio[WQL])) - NO3SO4F125p - 3VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
YPYL	(BCT250(Thio[WQL])) - NO3F125p - 3VOC40ag(ascorbic[_____]HCl[_____]) Field Lab
Zn	MET500p(HNO3[_____]) Field Lab
zx#TBCONTRACT	Assorted Travel Blanks from contract labs
zy#TBCHEM	VOC, THM, TOC, TCP, EDB/DBCP, &/or phthlates Field Blank
zz#TBMICRO	Bacterial Travel Blank (prepared by microbiology)

Key:
Bottles are listed in the form
[Number of bottles][Analyte][Size][Composition] E.g., 3VOC40ag(ascorbic/HCL) is 3 VOC, 40 ml vials, amber glass, preserved with ascorbic acid and HCL to bring pH below 2.0.

ag = amber glass
aw = acid washed
g = glass
p = plastic
all capacities are given in ML.

Appendix C: Sample bottling and preservation table

Bottle	Description
Record bottle list from laboratory	

Bottle	Description

Appendix D: Field equipment user manuals

Aqua TROLL® 600 Multiparameter Sonde

REDUCE OPERATIONAL EXPENSES WITH THIS CUSTOMIZABLE, POWERFUL, AND EASY-TO-USE MULTIPARAMETER SONDE. THE AQUA TROLL 600 COMBINES UNIQUE INDUSTRY-LEADING WATER QUALITY TECHNOLOGY, BUILT-IN LCD DISPLAY, AND REVOLUTIONARY SMARTPHONE MOBILITY. LOW POWER CONSUMPTION AND ADVANCED ANTIFOULING FOR UP TO 9+ MONTH DEPLOYMENT SUPPORTS LONG-TERM INSTALLATION IN ANY APPLICATION.

The Aqua TROLL 600 water quality platform is rugged in groundwater and corrosion-resistant in surface water, delivering accurate, reliable data in an easy-to-use, flexible instrument that performs for years. Base sensor configuration includes RDO® dissolved oxygen, pH/ORP, turbidity, conductivity, temperature, and pressure. Integrate with In-Situ telemetry systems and HydroVu™ Data Services for real-time feedback on your remote monitoring sites.

BE MOBILE

- **Use the Aqua TROLL 600 anywhere:** Titanium components and vented or non-vented options make it perfect for challenging environments and long-term deployments in fresh and salt water. Every detail has been engineered to be easy, reliable, and cost-effective.
- **Save time in the field:** VuSitu's Calibration Assistant reduces errors and ensures accurate calibration values every time. Calibrate multiple sensors at once with Quick-Cal Solution.
- **Streamline data management:** Set up logs and manage data from the field using the VuSitu™ Mobile App. Consolidate all site information on your mobile device and tag sites with photos and GPS coordinates. Log data to your smartphone and download results in a Universal Data File for profiling, low-flow sampling, and more.

BE SMART

- **Status in an instant:** LCD display gives you an instant visual indication of sensor status, data log, battery life, and overall functionality to give confidence during deployment. The onboard SD card allows for quick and easy data backup and transfer.
- **No fuss antifouling:** Antifouling to protect all sensors. The only multiparameter sonde to have a sub-2 inch active antifouling system with cleanable conductivity.
- **Get accurate results:** Self-compensating turbidity/RDO/level, smart diagnostics, and stable sensor technology provide minimal drift and increased accuracy. Smart sensors store information internally, maintaining data and calibration within the sensor for traceable results.

TOTAL FIELD SUPPORT

- **Receive 24/7 technical support and online resources.**
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- **Get guaranteed 7-day service for maintenance (U.S.A. only).**

Applications:

- **LAKE, STREAM AND WETLAND MONITORING**
- **STORMWATER MANAGEMENT**
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- **DAM MONITORING**
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YOUR EYES IN THE FIELD

Aqua TROLL® 600 Multiparameter Sonde

GENERAL	AQUA TROLL 600 MULTIPARAMETER SONDE		
OPERATING TEMPERATURE (NON-FREEZING)	-5 to 50° C (23 to 122° F) ISE: Ammonium & Nitrate 0 to 40° C ; Chloride 0 to 50° C	ENVIRONMENTAL RATING	IP68 with all sensors and cable attached IP67 without the sensors or cable attached
STORAGE TEMPERATURE	Components w/o fluid: -40° C to 65° C (non-freezing water); pH/ORP: -5° C to 65° C; Ammonium/Nitrate: 0 to 40 ° C; Chloride: 0 to 50° C	INTERNAL MEMORY [1] MICRO SD CARD [2]	16 MB; 8+ GB micro SD card included, user replaceable
DIMENSIONS	4.7 cm (1.85 in.) OD x 60.2 cm (23.7 in.) (includes connector) With bail: 72.9 cm (28.7 in.)	INTERNAL POWER BATTERY LIFE [3]	2 internal user-replaceable Alkaline D batteries >6 months typical with wiping; >9 months typical with no wiping
WETTED MATERIALS	PC, PC alloy, Delrin™, Santoprene™, Inconel™, Viton™, Titanium, Platinum, Ceramic, Nylon	EXTERNAL POWER VOLTAGE EXTERNAL POWER CURRENT [4]	8-36 VDC (not required for normal operation); Sleep: 0.10 mA typical Measurement: 16 mA typical, 45 mA max
WEIGHT	1.45 kg / 3.2 lbs (includes all sensors, batteries, and bail)	HEX SCREW DRIVER	0.050", 1.3 mm
MAX PRESSURE RATING	Up to 350 PSI	COMMUNICATION DEVICE	TROLL Com or Wireless TROLL Com
OUTPUT OPTIONS	RS-485/MODBUS, SDI-12, Bluetooth®	CABLE OPTIONS	Vented or non-vented polyurethane or vented Tefzel®
READING RATES	1 reading every 2 seconds	LCD DISPLAY	Integrated display shows status of sonde, sensor ports, data log, battery and connectivity.
DATA LOGGING	50 logs (defined, scheduled to run, or stored)	SOFTWARE	Android™: VuSitu through Google Play™, Windows®: Win-Situ 5, Data Services: HydroVu
LOGGING MODES	Linear, Linear Average, Event	INTERFACE	Android 4.4, requires Bluetooth 2.0; Win-Situ 5 Software
LOGGING RATE	1 minute to 99 hours	CERTIFICATIONS	CE, FCC, WEEE, RoHS Compliant

STANDARD SENSORS	ACCURACY	RANGE	RESOLUTION/PRECISION	RESPONSE TIME	UNITS OF MEASURE	METHODOLOGY
TEMPERATURE [5]	± 0.1° C	-5 to 50° C (23 to 122° F)	0.01° C	T63<2s, T90<15s, 95<30s	Celsius or Fahrenheit	EPA 170.1
BAROMETRIC PRESSURE	± 1.0 mbars	300 to 1,100 mbar	0.1 mbar	T63<1s, T90<1s, T95<1s	Pressure: psi, kPa, bar, mbar, inHg, mmHg	Silicon strain gauge
pH [6]	±0.1 pH unit or better	0 to 14 pH units	0.01 pH	T63<3s, T90<15s, 95<30s	pH, mV	Std. Methods 4500-H+/EPA 150.2
ORP [7]	±5 mV	±1,400 mV	0.1 mV	T63<3s, T90<15s, 95<30s	mV	Std. Methods 2580
CONDUCTIVITY [8]	±0.5% of reading plus 1 µS/cm from 0 to 100,000 µS/cm; ±1.0% of reading from 100,000 to 200,000 µS/cm; ±2.0% of reading from 200,000 to 350,000 µS/cm	0 to 350,000 µS/cm	0.1 µS/cm	T63<1s, T90<3s, T95<5s	Actual conductivity (µS/cm, mS/cm); Specific conductivity (µS/cm, mS/cm); Salinity (PSU); Total dissolved solids (ppt, ppm); Resistivity (Ohms-cm); Density (g/cm3)	Std. Methods 2510/ EPA 120.1
TDS (DERIVED FROM CONDUCTIVITY AND TEMP)	–	0 to 350 ppt	0.1 ppt	–	ppt, ppm	–
SALINITY (DERIVED FROM CONDUCTIVITY AND TEMP)	–	0 to 350 PSU	0.1 PSU	–	PSU, ppt	Std. Methods 2520A
RUGGED DISSOLVED OXYGEN (RDO) WITH RDO-X [9] OR RDO FAST CAP	±0.1 mg/L ±2% of reading	0 to 20 mg/L 20 to 60 mg/L	0.01 mg/L	RDO-X: T63<15s, T90<45s, T95<60s Fast Cap: T63<3s, T90<30s, T95<45s	mg/L, % saturation, ppm	EPA-approved In-Situ Methods: 1002-8-2009, 1003-8-2009, 1004-8-2009
TURBIDITY	±2% of reading or ±0.5 NTU, FNU, whichever is greater	0 - 4,000 NTU 0 - 1,500 mg/L	0.01 NTU (0 - 1,000); 0.1 NTU (1,000 - 4,000) 0.1 mg/L	T63<1s, T90<1s, T95<1s	NTU, FNU ppt, mg/L	ISO 7027
TSS (DERIVED FROM TURBIDITY) [10]	–	0 to 1,500 mg/L	0.1 mg/L	–	ppt, mg/L	–
AMMONIUM (NH_4^+ -N) [11,12] RATED TO 25 m DEPTH	±10% or ±2 mg/L w.i.g.	0 to 10,000 mg/L as N	0.01 mg/L	T63<1s, T90<10s, T95<30s	mg/L, ppm, mV	–
-Unionized Ammonia, Total Ammonia (derived from Ammonium & pH sensor)	–	0 to 10,000 mg/L as N	0.01 mg/L	–	mg/L, ppm	–
NITRATE (NO_3^- -N) [11] RATED TO 25 m DEPTH	±10% or ±2 mg/L w.i.g. (freshwater only)	0 to 40,000 mg/L as N	0.01 mg/L	T63<1s, T90<1s, T95<1s	mg/L, ppm, mV	Std. Methods 4500 NO_3 D
CHLORIDE (CL) [11]	±10% or ±2 mg/L w.i.g. (freshwater only)	0 to 150,000 mg/L as Cl	0.01 mg/L	T63<1s, T90<10s, T95<30s	mg/L, ppm, mV	Std. Methods 4500 Cl- D
PRESSURE [13] (OPTIONAL)	±0.1% FS from -5 to 50°C	Non-Vented or Vented 9.0 m (30ft) (Burst: 27 m; 90 ft) 30 m (100 ft) (Burst: 40 m; 130 ft) 76 m (250 ft) (Burst: 107 m; 350 ft) 200 m (650 ft) (Burst: 229 m; 750 ft)	0.01% full scale	T63<1s, T90<1s, T95<1s	Pressure: psi, kPa, bar, mbar, inHg, mmHg Level: in, ft, mm, cm, m, cmH20, inH20	Piezoresistive; Ceramic
WARRANTY [14]	**2 year – Sonde, RDO and Sensor Cap, Temperature/Conductivity, Temperature Only, Turbidity, Chlorophyll a, Phycocyanin (BGA-PC), Phycoerythrin (BGA-PE), Rhodamine WT, Wiper; 1 year – pH/ORP, Chloride ISE, Accessories; 90 Days – Nitrate and Ammonium ISE Sensors; See warranty policy (www.in-situ.com/warranty) for full details.**					

NOTES: [1]For 30 parameters >100,000 data records, > 3 years at 15 min. interval. A single data record includes timestamp, temperature, RDO, pH, ORP, turbidity and conductivity logged in Linear or Linear Average mode. [2]Log data recorded to SD card in comma delimited variable (CSV) file format. Greater than 32 GB not supported. [3]Logging all sensors at 15 min interval on 2 D Alkaline batteries. Battery life dependent on site conditions and wiping. [4]Dependent on display and wiping. [5]Sensor only, when transferring from air to ambient water temperature. Typical system response time with all sensors and restrictor: T63<30s, T90<3.5m, T95<7.5m. [6]Response time at thermal equilibrium. [7]Accuracy from calibration standard @ 25C, response-at thermal equilibrium immediately following calibration measuring from air to +400 mV. [8]Accuracy at calibration points. [9]RDO sensor full range 0-60 mg/L, 0-600% sat. EPA-approved method under the Alternate Test Procedure Process. [10]User-defined reference. [11]Between 2 calibration points immediately following proper conditioning and calibration. Varies on site conditions and environmental interferents. See sensor summary sheet for potential interferences. [12]Average response; can be longer with increasing concentrations of ammonium. [13]Typical performance across full temperature and pressure calibrated range. [14]Extended warranty option for sonde only (1 to 3 year extension for up to 5 years total). *Specifications are subject to change without notice.*

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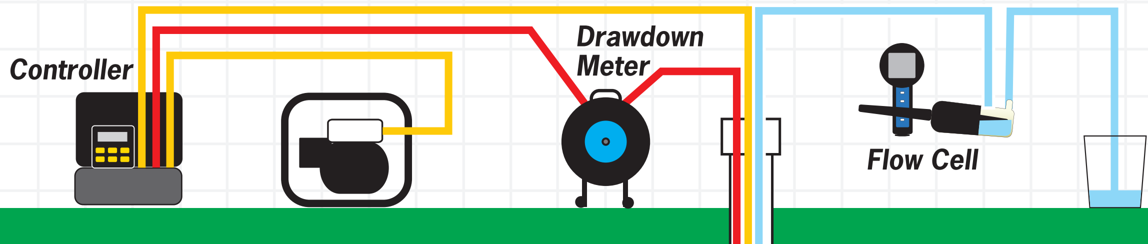
Introduction

Low-flow sampling reduces purge volumes, provides less turbid samples and improves precision.



Portable and Dedicated Sampling Pumps:

- *Soft-seat check valves for zero leak-back.*
- *Independently lab-certified clean — 100% traceable.*
- *Electropolishing of all stainless steel pump parts for maximum purity and corrosion control.*
- *Bonded, high pullout strength tubing in a range of materials.*
- *Long-life bladders and standard 10-year pump warranty.*
- *Deep-well pumps for sampling to 1,000 feet or more.*

The Controller

Easy one-touch flow rate control for low-flow sampling – simpler than old-style cycle timers.

The Flow Cell

Exclusive PurgeScan™ software automatically indicates purge stabilization.

The Drawdown Meter

Patented controller connection for automatic drawdown control to prevent over-purging.

Types of Sampling

Bladder Pumps are Proven Superior

Bladder pumps have been proven superior by the overwhelming majority of independent studies for the broadest range of groundwater quality parameters. They also have the longest warranties, so when you select a bladder pump you are selecting an enduring sampling device and method. Bladder pump advantages include:

- No suction or high speed impellers to outgas volatile compounds
- No churning action, like with bailers and inertial lift samplers, that disturbs the well and increases sample turbidity
- No contact of the drive air with the sample

Low-Flow Sampling

The science of groundwater sampling has advanced significantly in the past decade. Traditional approaches such as bailing, well-volume purging and high rate pumping have been replaced with a methodology that reduces disturbances to the well and aquifer. This proven approach, low-flow rate purging and sampling, provides numerous benefits that make it the method of choice for existing and new groundwater monitoring projects. MicroPurge® low-flow sampling systems deliver all the advantages a project manager needs:

Low-flow rate purging and sampling provides numerous benefits that make it the method of choice for existing and new groundwater monitoring projects. MicroPurge® low-flow sampling systems deliver all the advantages a project manager needs.

- Low-flow samples are flow-weighted average of the entire well screen, providing a consistent picture of the subsurface conditions around the well
- More accurate and precise samples that yield consistent, reliable monitoring data
- Lower sample turbidity provides a better picture of the true contaminant level and can eliminate the need to filter samples
- Greatly reduced purge volume and the associated expense of containment, handling, and disposal
- Superior cost control over the life of the monitoring program

Dedicated and Portable Pumps Series

Dedicated pumps such as QED's leading Well Wizard® bladder pumps provide the maximum benefits of faster, easier field operations and avoiding cross-contamination of wells or samples. The dedicated pump and tubing remain in the well, so equipment insertion and removal, and decontamination between wells are eliminated. For short term projects or any situation in which dedicated pumps are not an option, special Sample Pro® portable bladder pumps are available with quick, no-tools disassembly and disposable bladders.

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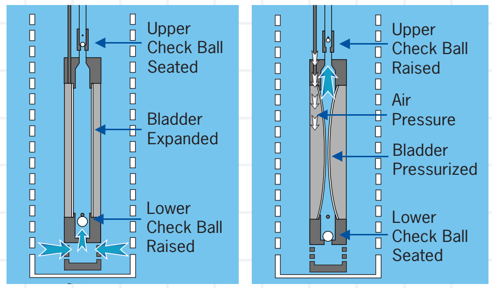
Bladder Pump Info

How a Bladder Pump Works

Pneumatic bladder pumps operate with a unique, gentle action ideal for low-flow sampling. Timed ON/OFF cycles of compressed air alternately squeeze the flexible bladder to displace water out of the pump, and release it to allow the pump to refill by submergence, without creating any disturbance that could affect sample chemistry. Bladder pumps run easily at low rates for extended times, without the problems of other devices.

Why Bladder Pumps are Superior to Other Sampling Devices



Bladder pumps are simple in their fundamental design, which makes them desirable groundwater sampling pumps. Bladder pumps produce samples with minimal alteration, providing greater accuracy and precision than devices such as bailers and electric pumps. With only three moving parts, a flexible bladder and two check valves, bladder pumps are inherently more reliable that electric pumps, air-power piston pumps, and other devices with numerous moving parts, close tolerances and high-speed motors. This combination of sampling accuracy and reliability is unmatched by other sampling devices.

What does it take to make a superior dedicated bladder pump? The answer: ongoing attention to engineering detail based on many years of wide-ranging field experience. This attention to detail focuses on 4 four critical areas:

- Long bladder life
- Reliable, leak-tight check valves
- Consistent prevention of air and water leaks
- Purity and durability of materials of construction

Each pump is cleaned and laboratory-certified to be free of volatile organic compounds, acid extractable and base neutral contaminants. Your system is pre-assembled, with tubing cut to length, ready to install. If desired, installation by OSHA-certified field technicians is available. QED customer support backs you with unmatched expertise and service, including trained local representatives, 24-hour toll-free hotline and next-day loaners or service turnaround when needed. More MicroPurge® dedicated sampling systems and pumps have been chosen since 1982 than all other manufacturers' equipment combined. To find out why, call QED today for a Low-Flow Data Sheet and site-specific cost analysis.

QED's attention to detail doesn't stop there. QED uses tubing/fitting sets engineered and quality controlled for high pullout strength so you don't lose a pump downwell; inlet screens to prevent solids from damaging the bladder or hanging up check valves and long enough to provide clear inlet flow even if it rests on the bottom; standard low-clearance wellhead caps that fit even when the well closure installation is tight; and special packaging to keep the equipment clean and help make the installation go smoothly. QED's bladder pumps build in all these details and more. Our engineers have never stopped learning how to make QED bladder pumps better!

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Dedicated Sampling Pumps

WELL WIZARD®

Well Wizard® Bladder Pumps: The Original, Low-Flow Sampling Standard

The Original, Most Complete Low-flow Pump Selection

MicroPurge® system pumps come in an unsurpassed range of sizes, materials and capabilities, including models for deep wells, narrow or obstructed casings, and small-volume pumps for low-yield wells. Together with MicroPurge controllers, flow cells and accessories, they create the most reliable, cost-effective low-flow system available.

Field proven pump designs and exclusive, high performance PTFE bladder formulation offer the reliability critical to long-term monitoring. QED was first in the industry with a standard 10-year sampling pump warranty.

The leaders since 1982 in dedicated pump technology, performance and support.

The heart of every low-flow groundwater monitoring system is the sampling device. For the system to do its job properly, the sampling device must:

- run reliably even at low rates (100 ml/min or less) over a wide range of conditions;
- operate gently without increasing turbidity or altering samples;
- deliver reliable performance for many years without needing frequent repairs or maintenance.

Unmatched Regulatory and User Acceptance

Bladder pumps, EPA-accepted for low-flow sampling, have been shown to deliver superior sample accuracy and precision in dozens of independent studies. Nearly 80,000 Well Wizard® bladder pumps are in use — more than all other brands and types of dedicated groundwater samplers combined.

Well Wizard® Bladder Pump Advantages

1. **EPA-accepted low-flow sampling accuracy.**
2. **Models for every well — low yield, short water column, depths over 1,000 feet, casing ID down to 1.25".**
3. **Proven reliability since 1982, with the industry's first standard 10-year warranty.**
4. **Exclusive PTFE bladder formulation rated for years more flex life than other bladder materials.**

Dedicated Sampling Pumps

Specifications

Model No.	Pump Materials	Length	Diameter	Fitting Material	Tubing* OD Size	Volume	Max. Lift
T1100M	Teflon®	3.3 ft. (1.0 m)	1.66 in. (4.2 cm)	Teflon®	1/4 & 3/8 in. (6 & 9 mm)	395 mL	250 ft. (75 m)
P1101M	PVC	3.4 ft. (1.04 m)	1.66 in. (4.2 cm)	Polypropylene	1/4 & 3/8 in. (6 & 9 mm)	395 mL	300 ft. (90 m)
P1101HM	PVC	3.3 ft. (1.0 m)	1.66 in. (4.2 cm)	Stainless Steel	1/4 & 3/8 in. (6 & 9 mm)	395 mL	600 ft. (180 m)
ST1102PM	316 Stainless Steel	3.4 ft. (1.04 m)	1.66 in. (4.2 cm)	Stainless Steel	1/4 & 3/8 in. (6 & 9 mm)	395 mL	1,000 ft. (305 m)
T1200M	316 S.S. and Teflon®	3.4 ft. (1.04 m)	1.50 in. (3.8 cm)	Stainless Steel	1/4 & 3/8 in. (6 & 9 mm)	495 mL	300 ft. (90 m)
T1250	316 Stainless Steel	1.25 ft. (0.38 m)	1.50 in. (3.8 cm)	Stainless Steel	1/4 & 1/4 in. (6 & 6 mm)	100 mL	300 ft. (90 m)
P1150	PVC, Teflon®	1.63 ft. (0.5 m)	1.66 in. (4.2 cm)	Polypropylene	1/4 & 1/4 in. (6 & 6 mm)	130 mL	300 ft. (90 m)
T1300	316 S.S. and Teflon®	3.8 ft. (1.16 m)	1.00 in. (2.5 cm)	Stainless Steel	1/4 & 3/8 in. (6 & 9 mm)	220 mL	200 ft. (90 m)

* To choose 1/2 in. OD (13 mm) rather than 3/8 in. (9 mm) discharge tube option, delete suffix M from pump model number.

Intake Screen Specifications

Model No.	Material	Screen Size	Fits Pump Model(s)
35200	Stainless Steel	.010 in. (0.25 mm) mesh	T1200M, T1250
37789	PVC	.010 in. (0.25 mm) slot	P1101M, P1101HM
37727	PVC	.010 in. (0.25 mm) slot	P1250 (also P1101M, P1101HM)
37733	Teflon®	.010 in. (0.25 mm) slot	T1100

Note: Pump models ST1101P, T1300 include intake screens. Screens are optional on other pump models, but are required for full 10-year warranty coverage.

Added System Benefits

Well Wizard® pumps will provide the most precise low-flow purging and sampling when operated by a MicroPurge® Model MP10 Controller, with purge water monitoring via the MicroPurge MP20 Flow Cell.

Materials Specifications

Stainless Steel	Type 316 electropolished
PVC	NSF-grade, extruded specifically for QED with no markings or lubricants.
Teflon® (pumps)	DuPont Teflon and other premium PTFE resins
Teflon® (bladders)	Q-flex exclusive 200,000 cycle rated PTFE.

Teflon is a registered DuPont trademark.

MicroPurge® Well Caps

MicroPurge® Well Caps

QED provides an extremely wide range of off-the-shelf and custom caps to complete the system to fit your project's needs and allow easy installation. Popular features include:

- high-purity flexible discharge tubes
- low-clearance fit beneath wellhead closure lids
- below-grade water-tight closures
- water level measurement ports
- freeze protection
- protective dust caps

Low Clearance Standard Cap

Low-clearance model includes a dust-tight cover and compact self-storing MicroPurge discharge tubing. Anodized aluminum caps fit 2" and 4" wells. Models for 1/4" and 3/8" discharge tubing available.

Low Clearance

Model No.	Cap Size	Discharge
C24L	2 in. (5 cm)	1/4 in. (6 mm)
C26L	2 in. (5 cm)	3/8 in. (9 mm)
C44L	4 in. (10 cm)	1/4 in. (6 mm)
C46L	4 in. (10 cm)	3/8 in. (9 mm)

Sealing Cap

Sealing model includes a water-tight cover and compact self-storing MicroPurge discharge tubing. Anodized aluminum caps fit 2" and 4" wells. Models for 1/4" and 3/8" discharge tubing available. QED offers dozens of custom well caps to work with any unique well casing or schedule. Contact QED with questions.

Sealing

Model No.	Cap Size	Discharge
C24S	2 in. (5 cm)	1/4 in. (6 mm)
C26S	2 in. (5 cm)	3/8 in. (9 mm)
C44S	4 in. (10 cm)	1/4 in. (6 mm)
C46S	4 in. (10 cm)	3/8 in. (9 mm)

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Portable Sampling Pumps

Sample Pro®

The First Portable Pump for MicroPurge® Low-Flow Sampling.

The Sample Pro® Portable Pump is the first pump developed specifically to bring the advantages of low-flow sampling to sites requiring portable pumps. The Sample Pro Pump is not only able to deliver consistent low-flow rates, it's easy to disassemble without tools, simple to clean and truly field rugged.

Unlike many other portable pumps, it is cool-running and can be operated by a lightweight backpack controller. There are no high speed rotating parts, no sample or motor heating, no costly motor replacement.

Sample Pro is the only pump available with these 3 innovations for portable low-flow sampling.

- Easy, rapid disassembly — 1/4 turn, no tools
- Pull-off bladder for fast replacement
- Integral push-in tubing connections only from QED, the originators of MicroPurge® low-flow equipment and Well Wizard® bladder pumps, the most widely used sampling pumps.

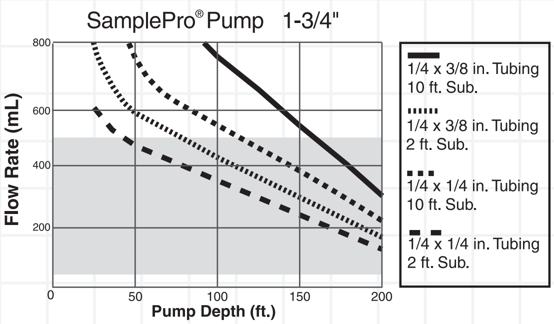
Sample Pro's reliability and low maintenance make it more economical. Its bayonet-type, twist-open design makes it easy to change the pull-off, disposable bladder in seconds. The compact 14.75" long size fits in a pail for pumping during cleaning. But, Sample Pro's innovations don't stop there. The pump is available with conventional compression fittings for tubing connections, or with a push-in head that's perfect for applications where the tubing is discarded frequently. Sample Pro's rugged, all-stainless construction will stand up to tough portable use. The simple yet effective design avoids the high maintenance expenses and destructive failure modes of other pumps.

The Sample Pro Portable Pump uses a quick-change, one-piece bladder design. Compressed gas squeezes the outside of the bladder to gently force liquid out of the pump; there is no gas contact with the pumped water inside the bladder, making it the perfect choice for VOC sampling.

Squeeze type bladder pumps are supported by years of independent research that shows they provide accurate samples for even the most sensitive parameters. Water enters the pump through the inlet in the upper, head section, then flows down into the bladder. The high inlet helps keep the pump from clogging if it is accidentally lowered into a sediment-filled sump.

Check valves with stainless steel seats and Teflon® check balls are located at the inlet and outlet. A replaceable inlet screen is provided for wells with high solids levels to help ensure proper sealing of the check valves. The Sample Pro Pump is shipped in a heavy-duty tube with rubber end caps to help keep the pump clean and protected between uses and is available in two diameters: 1.75" (4.45 cm) to fit in 2" (50 mm) monitoring wells or larger; and 3/4" (1.91 cm) to fit into small diameter monitoring wells and direct-push boreholes.

The pump is disassembled by a 1/4 turn of the cap and body; no tools are needed. The bladder pulls off for replacement. Both check valves are press-in, pull-out design and use the same size Teflon® check ball. Compression-type and push-in tube fitting kits are available and can be used interchangeably. Both options provide high pull-out strength and a cable eye is included for applications where a support cable is desired.



Specifications

Pump Model	Sample Pro 3/4 in.	Sample Pro 1-3/4 in.
Body Materials	316 Stainless Steel	316 Stainless Steel
Inlet & Discharge Housing	303 Stainless Steel	303 Stainless Steel
Bladder	Polyenthylene or Teflon®	Polyenthylene or Teflon®
O-rings	Viton®	Viton®

Teflon is a registered trademark DuPont. Viton is a registered trademark of DuPont Dow Elastomers.

Dimensions		
Diameter	0.75 in. (19 mm)	1.75 in. (47 mm)
Length	10.75 in. (273 mm) with Push-in Fittings 9.18 in. (233 mm) from Bottom of pump to centerline of inlet	14.75 in. (375 mm) with Compression Fittings 16.5 in. (419 mm) with Compression Fittings 12.1 in. (307 mm) from Bottom of pump to centerline of inlet
Weight	0.5 lbs. (0.23 Kg)	4.25 lbs. (1.93 Kg)
Fittings	Push-in Fitting w/ 316 Stainless Steel Grab Plate	Push-in Fitting w/ 316 Stainless Steel Grab Plate
Air	0.125 in. (3.2 mm) OD	0.25 in. (6.4 mm) OD
Discharge	0.25 in. (6.4 mm) OD	0.25 in. (6.4 mm) or 0.375 in. (9.5 mm) OD
Maximum Lift	200 ft. (61 m)	250 ft. (61 m)
Pump Volume	0.33-0.50 oz (10-15 mL)	3.34 oz (100 mL)

Consultant Kits

3/4” Pump

SP-3/4-PK 3/4” Sample Pro® Consultant Kit with 1/8”+ 1/4” Push-in Fitting Pump, includes Tool Box, Polyethylene Bladder Kit (10 bladders), O-Ring Kit, Grab Plate Kits (10), Tubing Cutter, Cleaning Brush Kit, Check Ball Kit, 1/8“ Air Fitting, Needle Nose Pliers, Tubing Insertion Tool, O-Ring Extractor.

1-3/4” Pump

All 1-3/4” Sample Pro Pump Consultant Kits below include Pump, Connector Kit, Tool Box, Bladder Kit (10 bladders, material listed below), O-Ring Kits (10 sets), Check Ball Kit (5), Inlet Screens (10), Air Fitting, Portable Cap, Tubing Cutter, Cleaning Brush Kit.

MP-SPK-4P pump with push-in connection for 1/4” x 1/4” tubing, polyethylene bladders, 10 SS tubing grab plates.

MP-SPK-6P pump with push-in connection for 3/8” x 1/4” tubing, polyethylene bladders, 10 SS tubing grab plates.

MP-SPK-4P-T pump with push-in connection for 1/4” x 1/4” tubing, Teflon bladders, 10 SS tubing grab plates.

MP-SPK-6P-T pump with push-in connection for 3/8” x 1/4” tubing, Teflon bladders, 10 SS tubing grab plates.

MP-SPK-4C pump with compression nut connection for 1/4” x 1/4” tubing, polyethylene bladders, 5 sets of compression nuts and ferrules.

MP-SPK-6C pump with compression nut connection for 3/8” x 1/4” tubing, polyethylene bladders, 5 sets of compression nuts and ferrules.

MP-SPK-4C-T pump with compression nut connection for 1/4” x 1/4” tubing, Teflon bladders, 5 sets of compression nuts and ferrules.

MP-SPK-6C-T pump with compression nut connection for 3/8” x 1/4” tubing, Teflon bladders, 5 sets of compression nuts and ferrules.

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Sample Pro® Supplies

Portable Pump Supplies

Disposable Bladder Kits

Pump	Material	Qty.	Order No.
1-3/4"	Polyethylene	10/Pkg.	**38360**
1-3/4"	Teflon®	10/Pkg.	**38380**
3/4"	Polyethylene	10/Pkg.	**38500**

Grab Plates for Push-In type Pumps

Discharge Tube Size	Material	Qty.	Order No
For 1-3/4" pump			
1/4"	Stainless Steel	10/Pkg.	**38364**
3/8"	Stainless Steel	10/Pkg.	**38365**
For 3/4" pump			
1/4"	Stainless Steel	10/Pkg.	**38503**

Pump O-Ring Replacement Kit

Pump	Material	Qty.	Order No.
1-3/4"	Viton®	10 sets/Pkg.	**38362**
3/4"	Viton®	10 sets/Pkg.	**38502**

Tubing

Special tubing sets have been developed to complement the Sample Pro® pumps, to provide maximum ease of use and performance in the field. Bonded twin-tube is a real time saver, but single tubes are also offered. Our tubing is carefully specified, processed, tested and packaged to provide leak tight connections, high pullout strength at connectors to prevent pump loss, and purity. The tubing is delivered in a re-sealable bucket to keep it clean during shipment and in the field after partial use. The 1/4" x 1/4" size uses contrasting colors to help identify which tube is air or water.

Twin tube, 1⁄4" x 1⁄4": Disposable tubing for 1-3/4" Sample Pro portable MicroPurge® pump. Air tube is grey to allow easy contrast vs. water discharge tube. 250' prepackaged spool of 1/4" OD + 1/4" OD bonded, polyethylene tubing (includes bucket). **DT-TP4B**

Twin tube 1/4" x 1/8": Disposable tubing for 3/4" Sample Pro portable MicroPurge pump. 250' prepackaged spool of 1/4" OD + 1/8" OD skip-bonded, polyethylene tubing (includes bucket). **DT-TP2B**

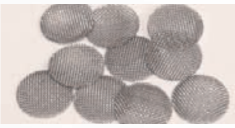
Twin tube, 3/8" discharge x 1/4" air supply, polyethylene, sold by the foot, no pail. **P5000**

Twin tube, 3/8" discharge x 1/4" air supply, Teflon®-lined polyethylene, sold by the foot, no pail. **PT5000**

Single 1/8" tube: Disposable air supply tubing for 3/4" Sample Pro portable MicroPurge pump. 250' prepackaged spool of 1/8" OD single strand, polyethylene tubing (includes bucket). **DT-SP2B**

Single 1⁄4" tube: Disposable tubing for Sample Pro portable MicroPurge pump. 250' prepackaged spool of 1/4" OD single strand, polyethylene tubing (includes bucket). **DT-SP4B**

TRSM200 - Tubing Reel.



Inlet Screens

Pump	Material	Qty.	Order No.
1-3/4"	Stainless Steel	10/Pkg	**38361**

Pump Check Balls

Pump	Material	Qty.	Order No
1-3/4"	Stainless Steel	5/Pkg.	**38408**
3/4"	Teflon	10/Pkg.	**38504**

Compression Fitting Pumps

Discharge Tube Size	Material	Qty.	Order No
1/4"	Stainless Steel	5 sets	**38366**
3/8"	Stainless Steel	5 sets	**38367**

(Each set includes nuts and ferrules for water and air tube connections)

Dedicated Sample Pump Tubing

Sample Pump Tubing

QED tubing innovations such as Teflon®-lining and bonded twin-tube protect sample integrity while making system installation and operation easier and more economical. Careful development and quality control provide tight tubing diameter tolerances for connections that are leak-tight and have high pull-out strength, something not found in hardware store tubing. All tubing is controlled quality, virgin grade material. Economical Teflon-lined polyethylene tubing is the most frequently used, with Teflon on the inside of the sample tubing, where it's really needed. Other choices include all-Teflon, polyethylene, and polypropylene (for deep-well use). QED also stocks bulk tubing and many other sizes and materials; inquire for details.

QED Tubing Advantages

1. **Hassle-free, twin-line bonded tubing, not cable tied or loose.**
2. **Systems are custom cut, pre-assembled, leak-tested and poly-bagged for easy installation all at no additional cost.**
3. **Highest quality materials and true continuous lengths.**

Twin-line simplicity
Our standard twin-line air supply/discharge tubing has a continuous heat-welded bond to prevent tangles and hangups during pump installation and maintenance, and avoids entanglement with portable water level meters and other equipment.

Tubing assemblies are cut to exact length and pre-assembled to well cap and pump per customer specifications at no extra cost. QED stocks the largest variety of discharge adapters, elbows and couplers.

Model No.	Material	Maximum Pressure	Maximum Depth	Min. Bend Radius
Air Supply: 1/4 in. OD (6 mm) Discharge: 3/8 in. OD (9 mm)				
P5000	Polyethylene	300 psi (2,070 kPa)	600 ft. (183 m)	1.25 in. (3 cm)
PT5000	Teflon-lined PE	300 psi (2,070 kPa)	600 ft. (183 m)	1.25 in. (3 cm)
T5010	Teflon	275 psi (1,896 kPa)	550 ft. (168 m)	2.5 in. (6 cm)
Air Supply: 1/4 in. OD (6 mm) Discharge: 1/2 in. (13 mm)				
P5100	Polyethylene	200 psi (1,380 kPa)	400 ft. (122 m)	2.5 in. (6 cm)
PT5100	Teflon-lined PE	200 psi (1,380 kPa)	400 ft. (122 m)	2.5 in. (6 cm)
T5110	Teflon	200 psi (1,380 kPa)	400 ft. (122 m)	3.0 in. (7.5 cm)
Air Supply: 1/4 in. OD (6 mm) Discharge: 1/4 in. (6 mm)				
P5200	Polyethylene	300 psi (2,070 kPa)	600 ft. (183 m)	1.0 in. (2.5 cm)
PT5200	Teflon-lined PE	300 psi (2,070 kPa)	600 ft. (183 m)	1.0 in. (2.5 cm)
T5200	Teflon	275 psi (1,896 kPa)	550 ft. (168 m)	1.0 in. (2.5 cm)
Air Supply: 5/16 in. OD (8 mm) Discharge: 3/8 in. (9 mm)				
DW5000	Teflon	500 psi (3,447 kPa)	1,000 ft. (305 m)	2.5 in. (6 cm)

Well Development Pumps

When a monitoring well is installed, it is essential to clear soil particles and drilling fines out of the well that interfere with pumping and result in excessive turbidity. The Sample Pro® Well Development Pump is ideal for fast, easy development of 2" and 4" diameter wells. The operator pulls up on the hoses to surge the well with the pumps flexible wipers that sweep the inside of the casing. The surge-block action's reversing flow loosens fines in the well filter pack so they can be pumped out of the well. Two models are available – standard PVC/Stainless Steel, and Stainless/Teflon for sensitive sampling situations. Wipers to fit both 2" and 4" wells are included. (This pump can also be used for purging).

Specificatons

Model No.	Well Dia.	Pump Material	Tube Fittings	Wiper Material	Max. Lift	Length	Dia.	Pump Wt.
Development Pumps								
HR4105D	2 or 4 in.	PVC/303 S.S.	Brass	PVC/Buna-N	200 ft.	65.00 in.	1.66 in.	6.0 lbs.
HR4105SS	2 or 4 in.	304 S.S.	304 S.S.	S.S./Teflon	200 ft.	65.00 in.	1.66 in.	15.0 lbs.

HR4105SS uses barbed S.S. fittings and clamps with 0.50 in. OD air supply and 0.75 in. OD discharge tubing. All other pumps have brass quick connect air supply and thread-on dischange fittings for use with model P5700 Flexible Hose Bundle.

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MicroPurge® Low-Flow Pump Control

MicroPurge® Controls

The MicroPurge® Controller (U.S. Patent Number 6,508,310) revolutionizes low-flow sampling with advanced logic control of flow rate and water level drawdown.

Simple up-down arrow keys increase and decrease flow rate, driving a microprocessor to re-create expert techniques for low-flow adjustment. Then, optimized settings are identified for recall in the next round of sampling.

The MP10 also offers an easy way to prevent excessive monitoring well drawdown during purging, by linking to the optional MP30 Drawdown/Water Level Meter that ceases flow when drawdown settings are exceeded. The lightweight, compact MP10 sets the pace for a new generation of genuine MicroPurge® equipment, first in control and power for low-flow sampling.

Simple, Stable, Repeatable Flow Rate Setting

The MP10 controls the most advanced low-flow sampling system ever made. You will purge and sample quickly and easily, with precise, steady low-flow pumping rates from one sampling event to the next. Simplified, sealed electronics complete a design that delivers famous QED durability and value. MicroPurge controllers can be connected to the MP30 Drawdown Meter for optional Automatic Drawdown Control, an industry exclusive.

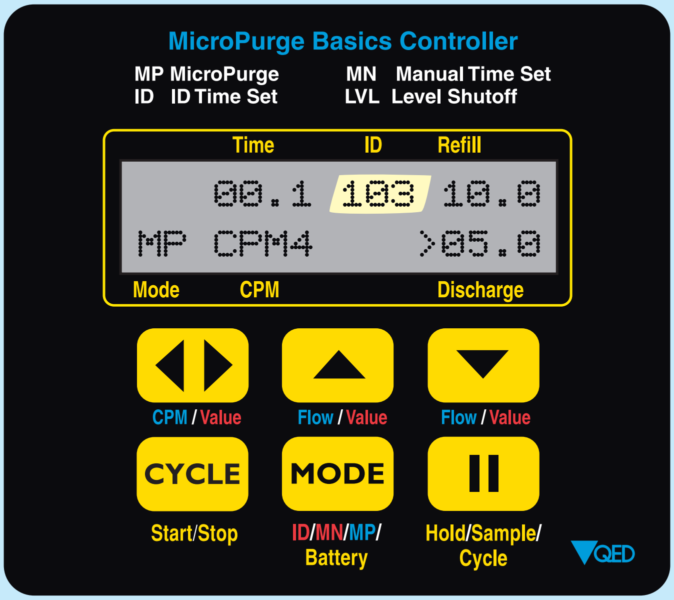
MicroPurge Controller Advantages

1. **Exclusive MicroPurge control mode uses simple arrow keys to adjust low-flow rates easily and repeatably, using a micro-processor to re-create the flow adjustment strategies used by experienced samplers.**
2. **Patented connection port allows linking to optional MP30 Drawdown/Water Level Meter, which signals MP10 Controller to enter stand by mode if drawdown limit is exceeded.**
3. **Multi-mode digital control includes MicroPurge Mode, ID Mode for repeat events, and manual control mode.**
4. **Weatherproof controls are housed in a rugged, compact (10-3/4" x 9-3/4" x 5") case.**
5. **Full digital display of all setting and status information.**
6. **Optional deep well MicroPurge Controller versions allow for effective low-flow sampling from depths to 1000 feet.**

System Specifications

Model No.	MP10	MP10H	MP10UH
Dimensions	10-3/4 in. x 9-3/4 in. x 5 in. (27 x 25 x 13 cm)	16 in. x 13 in. x7 in. (40.6 x 33 x17.8 cm)	16 in. x 13 in. x7 in. (40.6 x 33 x17.8 cm)
Weight	5.5 lbs. (2.5 kg)	19.25 lbs. (8.73 kg)	19.25 lbs. (8.73 kg)
Case Material	Structural resin	Structural resin	Structural resin
Keypad	6 Keys	6 Keys	6 Keys
Display	2 Line, 16 Character / LCD display	2 Line, 16 Character / LCD display	2 Line, 16 Character / LCD display
Power	3 "AA" batteries	3 "AA" batteries	3 "AA" batteries
Battery Life	50,000 Cycles @ 70 °F (21 °C)	50,000 Cycles @ 70 °F (21 °C)	50,000 Cycles @ 70 °F (21 °C)
Max Pressure	120 psi (8,275 kPa)	300 psi	500 psi
Max Pump Depth	250 ft. (76 m)	600 ft.	1000 ft.
Operating Temperature	-20-150 °F (-29-66 °C)	-20-150 °F (-29-66 °C)	-20-150 °F (-29-66 °C)
Connection to MP30 Drawdown Meter	Heavy-duty cable (supplied with MP30)		

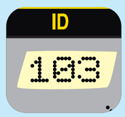
How It Works



Pressing the UP arrow increases pump flow in controlled steps.

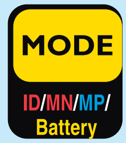
The DOWN arrow decreases the flow rate in controlled steps.

The LEFT/ RIGHT arrows adjusts Cycles Per Minute (CPM) of your pump.



The ID Number recalls settings and changes with the UP or DOWN arrows.

The CYCLE key Starts and Stops pump cycling.



The MODE key changes modes from default MP (MicroPurge) Mode to ID Mode to MN (User Set) Mode. This key also allows battery check.

Pressing the PAUSE key stops the flow. A second press allows push button controlled vial filling.

Multi-mode digital control

The MP10 gives you three easy-to-use operating modes, to cover every sampling protocol and situation.

- **MicroPurge® (MP) Mode** optimizes control settings to reach the desired pump flow rate; you don't calculate pump cycles, refill or discharge times.
- **ID Mode** recalls previously optimized settings for each well, providing consistent performance every time.
- **User Set (MN) Mode** - provides manual pump control for extreme depths and other special cases.

MicroPurge® Mode Quick Guide

1. **Opening cover turns power ON. (Close to turn OFF)**
2. **Select desired Cycles Per Minute (CPM) with the ◀ ▶ key .**
3. **Turn throttle to set depth on gauge to 10-20 feet deeper than the pump location in the well.**
4. **Press CYCLE to START pumping.**
5. **When water discharge begins, adjust throttle until a slow, steady flowstream is achieved.**
6. **Press ▲ ▼ keys to set the desired purge flow rate.**
7. **To collect samples, continue purge flow, or use ❙❙ key to directly control sample flow and pause.**

MicroPurge® Portable Control & Power Pack

Compact Controller with On-Board Gas Supply

(U.S. Patent Number 6,508,310)

Remote wells and inaccessible sites are no problem with the unique, new MP15 Control & Power Pack. The convenient carrying case combines a compact compressed gas cylinder with the advanced control of MicroPurge Controllers. With this combination, a complete sampling setup can be carried by a single person, to reach wells where trucks or even compressor carts can't go.

MicroPurge Control & Power Pack Advantages

1. **The MP15 weighs just 27 lbs. with a full cylinder in its padded nylon field case. Backpack carrying leaves hands free for other sampling equipment.**
2. **Also includes capability for optional drawdown control with link to the MP30 Drawdown Meter.**
3. **Lightweight, silent drive power: 3.5 hours of purging capacity at 75 foot pump depth!**

System Specifications

Model No.	**MP15**
Dimensions	25-1/2 in. x 12-1/2 in. x 10 in. (65 x 32 x 25 cm)
Weight	27 lbs. (12 kg)
Case Material	Polyethylene
Carry Bag	Standard
Back Pack Straps	Optional
Keypad	6 Keys
Display	2 line, 16 character LCD display
Power	3 "AA" batteries
Battery Life	50,000 cycles @ 70 °F (21 °C)
Max Pressure	120 psi (827.5 kPa)
Max Pump Dept	250 ft. (76 m)
Operating Temp.	-20-150°F (-29-66 °C)
Cylinder	5 lbs. (2.3 kg) CO_2
Cylinder Life	> 3 hrs (75 ft. pump depth)
MP30 Connection	Heavy-duty cable (supplied with MP30)

MicroPurge® Flow Cell

Simple, Economical Purge Monitoring with Automatic Stabilization Alert

The MicroPurge® MP20 Flow Cell (U.S. Patent Number 6,415,659) sets new standards in performance, size and price for purge water quality monitoring. Patented QED-exclusive PurgeScan™ technology signals when stabilization has been achieved for selected water quality parameters, with automatic storage of key data points.

The MP20 meter is designed to simplify calibration and operation in the field. It displays all readings automatically and is lightweight and waterproof.

The compact sonde is a low-profile design with rugged, easy-to-service probes. The flow cell collects and vents gas bubbles effectively, and distributes purge flow evenly for quick response and more accurate readings. The whole package is protected by a 3-year warranty and is backed by service and support from QED, the leader in low-flow sampling.

Sample With Confidence Thanks to Visible & Audible Stabilization Alert with PurgeScan™ Technology.

System Specifications

Model No.	MP20 MP20D (w/ realtime clock/ data download) MP20DT (w/ realtime clock/ data download/turbidity)
Dimensions	18.5 in. x 15 in. x 6.5 in. (47 x 38 x 17 cm)
Weight	14 lbs (6.4 kg)
Storage	100 Data Points
Stabilization	PurgeScan™ Technology
Case Material	Structural resin
Keypad	5 Keys

Meter Specifications

Display Size	3.5 in. (9 cm)
Weight	2.1 lbs. (1 kg)
Memory	100 Data Frames
Rating	Waterproof NEMA 6 [IP67]
Power	3 "C" batteries
Battery Life	12 Hours
Temperature	23-122 °F (-5-50 °C)
Cable	6 ft. (1.83 m)

Flow Cell Specifications

Volume	175 mL
Material	Rigid urethane
Fitting Type	Soft-tube "clamp-free"
Fitting Size(s)	Inlet: 1/4 in. ID x 3/8 in. OD Outlet: 3/8 in. ID x 1/2 in. OD
Venting Modes	Horizontal and vertical
Sonde Connection	Bayonet-style twist mount

Sonde Specifications

Size	3 in. x 9 in. (8 x 23 cm)
Weight	1.3 lbs. (0.6 kg)

MicroPurge Flow Cell Advantages

1. Patented QED-exclusive PurgeScan™ technology signals when selected purge water quality parameters remain steady over successive readings, at user defined intervals, automatically storing the readings.
2. Transparent, molded flow cell effectively collects and vents bubbles, even in the horizontal position; low internal volume (175 mL), designed flow distribution and stirrer give fast response, even at low-flow purge rates.
3. Three-year warranty.
4. Rugged, waterproof case doubles as a measurement and calibration workbench.
5. Waterproof MP20 meter displays all readings automatically: pH, ORP, temperature, conductivity, and DO.
6 The compact sonde attaches with a quick bayonet-type mount to the flow cell, calibration and storage cups.

Typical Sensor Performance Specifications:

	Range	Accuracy	Resolution
Temperature	23-122°F (-5-50 °C)	± 0.36 °F (0.20 °C)	0.018 °F (0.01 °C)
DO	0 to 20 mg/L	± 0.2 mg/L	0.01 mg/L
Specific Cond.	0-100 mS/cm	± 1% of reading ± 1 count	4 Digits
pH	0 to 14 units	± 0.2 units	0.01 units
ORP	-999 to 999 mV	± 20 mV	1 mV
Salinity*	0 to 70 PSS	± 1% of reading ± 1 count	0.01 PSS

*Calculated

PurgeScan Specifications:

Parameter Stabilization range criteria: (Values are user adjustable; default values shown.)	**pH**	+/- .2 units
	DO	+/- 0.2 mg/L
	Conductivity	+/- 0.020 mS/cm
	ORP	+/- 20 millivolts
	Turbidity	+/- 1 NTU

Stabilization basis: 3 consecutive readings of selected parameters (one or more of above 4) within above limits, at time interval selected, from 1 to 9 minutes. For example, if 2 minutes is selected, then stabilization would be signaled when 3 consecutive 2-minute intervals showed in-range readings at the end of each interval, requiring 6 minutes.

Elapsed time since Purge Scan initiated shows at the bottom of the screen.

Full data sets are stored at time 0, every 5 minutes, and the 3 consecutive readings which satisfy the stabilization criteria.

MicroPurge® Drawdown Meter

Links to Controller to Prevent Excessive Drawdown During Purging and Sampling.

MicroPurge® Drawdown/Water Level Meter

Drawdown control is now automatic with QED's low-flow water level meter. The MP30 Drawdown/Water Level Meter (U.S. Patent Number 6,456,201) provides a patented, simpler way to assure drawdown control when connected to the MicroPurge® controllers, and acts as a high quality water level meter. The MP30 can easily switch between both modes. For drawdown control the meter is turned to MicroPurge® mode and the probe is lowered to the point of maximum drawdown. If purging lowers the water level to the selected point, a light and buzzer on the MP30 meter are activated and the controller is signaled to enter a stand by mode until the water level rises again. A separate light indicates probe submergence in both modes.

System Specifications

Model No.	MP30
Dimensions	14 in. X 10.5 in. X 8 in. (37 x 27 x 20 cm)
Weight	7 lbs. (3.2 kg) w/150 ft. tape 9 lbs. (4 kg) w/300 ft. tape
Probe Diameter	5/8 in. OD (1.6 cm)
Probe Length	7.5 in. (19 cm)
Carry Bag	Optional
Connecting Cable	Included
Well Hanger	Included
Reel Brake	Included
Power	9V battery
Battery Life	30-40 hours
Tape Length	150 or 300 ft. (46 or 91 m)
Operating Temperature	-40-185 °F (-40-85 °C)

Well Level Meters

6000 Series Flat Tape Meters

The compact, Stainless Steel and Teflon electronic probe is specially designed to eliminate false readings caused by cascading water. Kink resistant flat tape is permanently marked in 1/50' increments, allowing repeatable depth measurements accurate to 1/100' (Metric models are available) and fits easily in wells, boreholes and stand-pipes.

The probe and cable are lowered from the easy-to-carry free standing reel. Visual and audio alarms indicate contact with static water; depth measurement is taken directly from the tape. A built-in sensitivity control allows adjustment to fit varying water conductivity conditions. The unit operates for up to a year on a single, easily replaceable 9-volt battery

Decontamination is easy – the meter electronics can be removed by disconnecting a single plug; the whole reel / tape / probe assembly can then be simply washed down or totally immersed for thorough, between-well cleaning.

Accessories

Model No.	Description
36059	Tape guide
36060	Carrying bag

Specifications

Probes	Stainless steel and Teflon (w/strain relief), 5/8 in. diameter x 5 in. long
Tape	Flat tape, Polyethylene with Kevlar® and Stainless Steel conductors, markings at 1/50 ft. intervals or 1 cm intervals for metric.
Power	One standard 9V battery
Reel	Small, free standing with carrying handle and winding knob, brake, probe holder, battery test, ON/OFF switch, sensitivity adjustment (model 6000DSS uses larger reel)

Depths Options	Model No.	Tape Length
	6000YSS	100 ft.
	6000MSS	300 ft.
	6000SS	150 ft.
	6000DSS	500 ft.

Metric Model No.	Tape Length
M6000-45	45 m
M6000-100	100 m
M6000-150	150 m

Kevlar is a trademark of DuPont.

P.O. Box 3726 Ann Arbor, MI 48106 USA **800-624-2026** **INT. 734-995-2547** **F 734-995-1170** info@qedenv.com www.qedenv.com

MicroPurge® Engine/Compressor

MP40C 4 Gallon Powered Oil Free – Direct Drive Air Compressor

5 HP HONDA OHC/OHV premium residential gas engine

- Overhead Cam/Overhead Valve (OHC/OHV) provides easy starting, smoother engine performance, lower fuel consumption, and lower emissions
- Air throttle cylinder
- Separate pilot and check valves

Low-maintenance, oil free, direct drive operation

Patented pump design with two piece cooling system

- Increases cooling efficiencies
- Lowers operating temperatures
- Extends the life of the pump

155 PSI max. pressure

"Pontoon"style tank design with two 2-gallon tanks for job-site portability

Equipped with regulator, gauges, quick connect, and cushioned handle grips

System Specifications

Model No.	**MP40C**	
Overall Dimensions	24.5" x 21.5" x 20" (62 x 54 x 50cm)	
Weight	74 lbs. (33.5 kg)	
Engine	Honda OHC/OHV	
Max Pressure	155 psi (1068 kPa)	
Output	cfm @ psi (m3/h @ kPa)	6.9 @ 40 (11.7 @ 275)
		5.0 @ 90 (8.5 @ 620)
Tank Size (two):	gl (L)	2 (7.5)
Compatible Controllers	MP10/MP15 or Model 400	
Warranty	2 Year Limited	

Model 3020 Electric Compressor

12 Volt DC Light Weight Electric Compressor

The 3020 Compressor is a useful option for low-flow sampling of wells at depths to 200 feet. It runs on a 12-volt DC electrical supply, and can be connected to your vehicle's battery with the supplied cables, or driven by a separate power source. At Just 15x11x6-1/2" and 15 pounds, it offers an extremely convenient, portable pneumatic power choice for many sampling systems.

Electric Compressor Specifications

Model No.	3020
Dimensions	15 in. x 11 in. x 6.5 in. (38 x 28 x 17 cm)
Weight	15 lbs. (7 kg)
Power Supply	12 VDC (battery cable)
Max Pressure	100 psi (6,895 kPa)
Max Lift*	200 ft. (60 m)
Output	0.21 scfm @ 100 psi (0.357 m^3/h @ 6,895 kPa)

* Pump flow rates in deeper wells, over 100 ft., will be reduced, especially for pumps with less than 10 ft. liquid submergence.

QuickFilter®

QuickFilter® In-Line Filters: The Original, In-Line Groundwater Filter.

Are You Analyzing Your Samples or Your Sample Filters?

QuickFilter® In-line Sample Filters from QED are the original disposable filter for groundwater sampling. They provide fast field filtration without exposing samples to air or on-site contamination.

QuickFilter capsules attach directly to sample tubing for faster, more efficient sampling, with no setup or decontamination required. QED's Sample Transfer Vessel allows use with any type of sampling device. If you use other filters for metals analysis, you could be risking the accuracy and consistency of your program data. A number of monitoring projects have traced false positives and other analytical errors to the use of "off-brand" filters.

QuickFilter Advantages

1. **High-performance, premium polyethersulfone membrane increases filtration capacity.**
2. **Capsules heat-sealed, not glued — for purity and performance under pressure.**
3. **Purity tested to assure metals sample integrity.**
4. **Full rated surface area guarantees maximum capacity and performance.**
5. **Always in stock — no back orders; guaranteed best value with the industry's lowest prices.**

Specifications

Model No.	Capacity	Area	Filter Material	Pore Size	Max. Press.
FF8100	Standard	30 cm²	Polyethersulfone	0.45 microns	60 psi
FF8101	Standard	30 cm²	Polypro	1.00 microns	60 psi
FF8200	High	609 cm²	2 Polyethersulfone	0.45 microns	60 psi
FF8201	High	770 cm²	2 Polypro	1.00 microns	60 psi
FF8205	High	770 cm²	2 Polypro	5.00 microns	60 psi

Accessories (ordered separately)

Model No.	
FF8500	Sample transfer vessel with hand pump
35780	Transfer vessel stand
8810	Connector for 1/2 in. OD tubing
8815	Connector for 3/8 in. OD connector
8820	Connector for 1/4 in. OD tubing
8825	Connector for 3/4 in. OD connector

Transfer Vessel Specifications

Model No.	FF8500
Volume	1100 mL
Height	12.63 in.
OD	5.25 in.
Weight	3 lbs.
Cap Material	Polypro
Reservoir Material	Styrene-Acrylonitrile
Max. Pressure	125 psi

QED Environmental Systems

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Site Information Form

QED USE ONLY	
Today's Date	
Quote Number	
Sales Order Number	

CUSTOMER INFORMATION

Name: ______________________ Title: ______________________

Company: ______________________

Address: ______________________

____

Email: ______________________

Phone: ______________________ FAX: ______________________

SITE INFORMATION

Site Name: ______________________

Project Ref: ______________________

Company: ______________________

Address: ______________________

____

Phone: ______________________ FAX: ______________________

SAMPLING DATA DESIGN

Site ______________________

Location ______________________

Date ________ Well Purge Volumes Required ________ ❑ MicroPurge

Sampling Parameters ______________________

Metals, Low Level Organics, etc. ______________________

Well Bottom to Pump Intake Distance ______________________

Casing Material ______________________

Pump Material Preference ______________________

Pump Tubing Material Preference ______________________

OPTIONAL COST ANALYSIS INFORMATION

Current Sampling Method ______________________

Frequency of Events (Quarterly, Yearly, etc.) ______________________

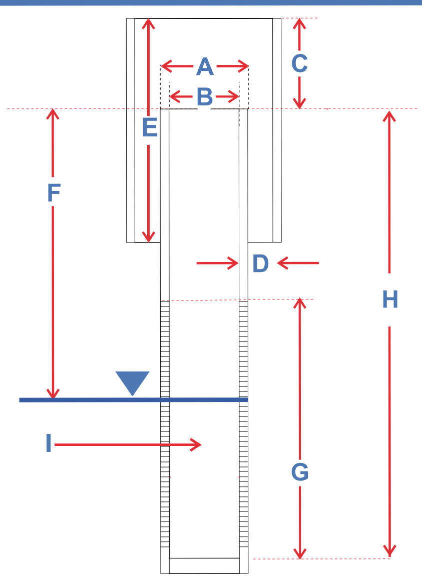
No. of Persons in Sampling Crew ______________________

Man Hours to Purge, Sample and Clean ______________________

Hourly Labor Rate Assumed ______________________

No. of Cleaning Blanks Per Event ________ Blank Cost ________

WELL DATA



WELL IDENTIFICATION NUMBER								
A. Well Casing Diameter – OD								
B. Well Casing Diameter – ID								
C. Clearance from the Top of Well Casing to the Top of Outer Casing / Vault								
D. Clearance of Outer Casing / Vault Depth								
E. Outer Casing / Vault Depth								
F. Depth to Top of Static Water								
G. Screen Length								
H. Depth of Well								
I. Water Yield (gpm)								

STANDARD CASING DIMENSIONS

	Schedule 40		Schedule 80	
Sizes	**OD**	**ID**	**OD**	**ID**
2	2.375	2.049	2.375	1.913
2-1/2	2.875	2.445	2.875	2.289
3	3.500	3.042	3.500	2.864
3-1/2	4.000	3.520	4.000	3.326
4	4.500	3.998	4.500	3.786
5	5.563	5.017	5.563	4.767
6	6.625	6.031	6.625	5.709

Note: Please note any special characteristic on illustration above

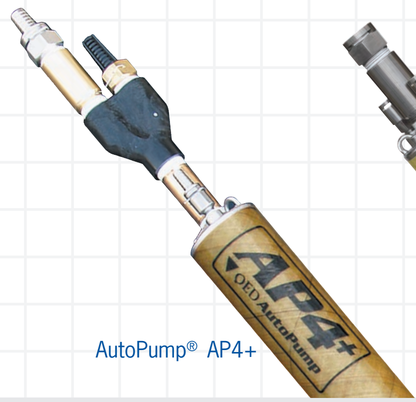
The information provided on this form will be kept confidential by QED.

The World Leader in Air-Powered Pumps

Remediation and Landfill Pumping

QED pumps and systems for landfill leachate and condensate, and groundwater remediation have been recognized worldwide for their superior quality and reliability for over two decades. From small municipal facilities to large industrial and military sites, QED can supply the equipment and expertise.

- AutoPump® (Patent Pending) AP4+
- AutoPump® (Patent Pending) AP4 Ultra



AutoPump® AP4+

AutoPump® AP4 Ultra

Air Strippers/VOC Removal

Unique air stripper designs for removing volatile organic compounds (VOC) from groundwater and industrial process streams.

- Sliding Tray SS Air Strippers
- Stacking Poly Air Strippers

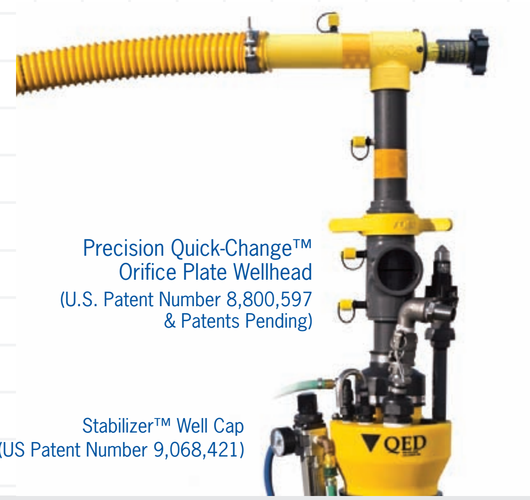
E-Z Tray® air stripper
(U.S. Patent Number 5,518,668)

E-Z Stacker® air stripper
(U.S. Patent Number 5,518,668)

LFG Products

QED has a full line of innovative Landfill Gas Products that includes:

- The Quick-Change™ Orifice Plate Wellhead (U.S. Patent Number 8,800,597 & Patents Pending), which makes plate exchanges as easy 1, 2, 3.
- The Fine Tune™ Control Valve (U.S. Patent Number 8,800,597) that allows for precise adjustment of gas flow from a well.
- The Stabilizer™ Well Cap that helps align and stabilize the entire wellhead.
- Solarguard™ (Solarguard™ trademarks are trademarks of Kuriyama of America, Inc.) UV-protected Flex Hose.
- Easy Level™ (U.S. Patent Number 8,756,991) Liquid Level Indicator, Easy Bolt™ Flange Clamps, and Easy Fittings™ Quick-release Connectors.



Precision Quick-Change™ Orifice Plate Wellhead
(U.S. Patent Number 8,800,597 & Patents Pending)

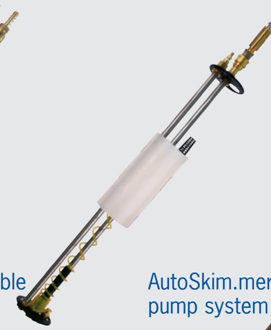
Stabilizer™ Well Cap
(US Patent Number 9,068,421)

Free Product Recovery

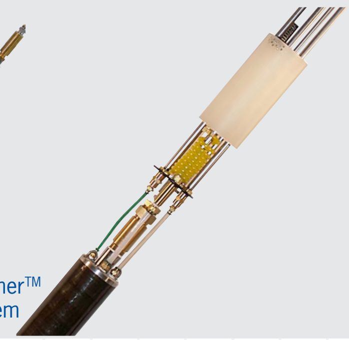
The largest family of in-well skimmers and separators available in the industry. Flexible systems to match the recovery needs of your site.

- AutoGenie™ and Programmable Genie® skimmers
- AutoSkimmer™ pump systems

SOS® AutoGenie™ skimmer



SPG Programmable Genie® skimmer



AutoSkim.mer™ pump system

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Beyond the Basics...

Since 1981, QED's Well Wizard® and Sample Pro® bladder pumps have been the best choice for producing accurate, precise samples while controlling sampling program costs. The addition of QED's MicroPurge® line of low-flow sampling controls simplifies the low-flow sampling process, further improving sample quality and reducing costs. QED's industry-leading team of technical experts will configure a dedicated or portable sampling system to meet your project needs based on site-specific data and well configurations.

Accessories

- MicroPurge® Flow Cell
- MicroPurge® Drawdown Meter
- Bonded twin-tubing, well caps and discharge adapters
- Electric or Engine-Powered Compressors
- Custom components for special applications

Call us at

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for prompt, expert assistance on your project needs.
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San Leandro, CA 94577
USA

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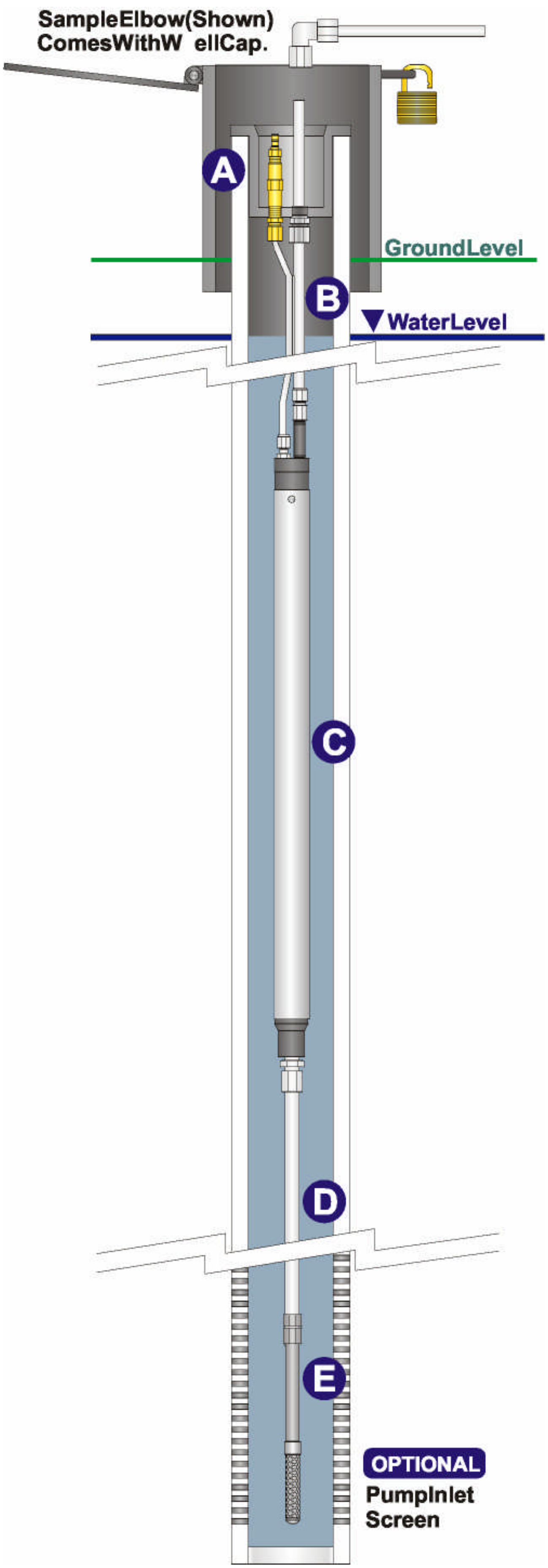
F: 510-346-0414
info@qedenv.com
www.qedenv.com

CODE 2333 3/18

SYSTEM "L" Bladder Pump with an Inlet Extension



System Components

A Well Cap

B Pump Tubing

C Pump

D Pump Inlet Extension Tubing
Inlet Tubing Weight

E

Options:

Pump Inlet Screen

Confidential

Appendix E: Revision history and log

Date: Jan 8, 2010 Changed by: Charles R. Lembke Page(s): 75-76, 121-122

Reason for and description of change: Inserted SOP for “Color & Turbidity” and “Turbidity” samples.

Incorporated new volume requirements for turbidity samples.

Date: Jan 27, 2010 Changed by: Charles R. Lembke Page(s): 77-78

Reason for and description of change: Inserted SOP for “Color, Odor, Turbidity, renumber following

pages to keep numeric sequence.

Date: Oct 4, 2010 Changed by: Charles R. Lembke Page(s): 8, 128-131, var.

Reason for and description of change: Revised sample labeling instructions to reflect memo of Sep 29,

2010. Amended labeling instructions in individual analyte SOPs. Added LIMS schedule table

Date: Jan 11, 2011 Changed by: Charles R. Lembke Page(s): 4, 85-135

Reason for and description of change: Added DOC sampling procedure, corrected mistakes from lab.

Renumbered pages 87-end to reflect addition of new sampling procedure.

Date: April 1, 2011 Changed by: Charles R. Lembke Page(s): 19-20, 21-139

Added SOP for 1,4-dioxane. Renumbered following pages. Corrected minor error in SOP for Glyphosate.

Date: Ma7 27, 2011 Changed by: Charles R. Lembke Page(s): 19

Changed SOP for 1,4-Dioxane to account for change in bottle/preservative usage at Lab.

Date: June 3, 2011 Changed by: Charles R. Lembke Page(s): 85

Change of dechlorinating agent to ascorbic acid from sodium thiosulfate per Houri Mandjikian.

Date: July 20, 2012 Changed by: Charles R. Lembke Page(s): 30-31

Modified HAA procedure per Ku Chung.

Number and size of vials changed, amount of preservative changed, QA/QC samples removed.

Date: Oct 25, 2012 Changed by: Charles R. Lembke Page(s): Many

Add procedure for Prometon, EPA 525.2. Modify preservatives in several analyses to reflect latest Preservative and bottle list from lab. Add SOPs for field test equipment.

Date: Oct 9, 2020 Changed by: Stephanie Botha Page(s): 146-152

Reason for and description of change: Incorporated specific details and procedures associated with groundwater sampling methods – included as Appendix F.

Appendix F: Groundwater Sampling Procedures

The primary objective of this standard operating procedure (SOP) is to establish uniform methods for the collection of representative groundwater samples from Los Angeles Department of Water and Power's (LADWP's) monitoring wells. Establishment of standard, repeatable, and defensible sampling techniques reduces the variability associated with purging and sampling.

Groundwater samples are collected to provide a representative aliquot of water from the groundwater-bearing zone that the well is installed in. This SOP is designed to provide guidance to competent staff on procedures for collecting groundwater samples from groundwater wells. The SOP does not cover the full spectrum of health and safety considerations associated with environmental sampling or labor-intensive tasks. This SOP is generally applicable to the following sampling methods:

- Low-flow sampling;
- Submersible pump sampling; and
- Zone Isolation Sampling Technology (ZIST).

Equipment Considerations

In addition to method specific equipment the following general equipment should be considered for inclusion in a groundwater sampling program:

- Health and safety monitoring equipment (e.g., safety glasses, nitrile gloves, splash guard, vapor monitoring equipment);
- Well completion specifications and data from previous sampling efforts;
- Water level tape;
- Water quality monitoring meter;
- Decontamination supplies;
- Method specific purging/sampling equipment (e.g. pumps, tubing, pump power supply, compressed gas tanks);
- Filters (0.45 micron), if appropriate;
- Sample bottles;
- Coolers with ice;
- Deionized water;
- Purge water disposal drums/containers;
- Tool kit;
- Notebook, field forms, permanent marking pens, calculator;
- Garbage bags; and
- Chain-of-custody records.

Field Documentation Requirements

Accurate field records must be maintained to document groundwater sampling activities. These records include technical field data, sample identification labels, and chain-of-custody information for each sample. Specifically, for groundwater sampling, the field sampling records should include, at a minimum, the following information:

- Sampling location, date and time;
- Condition of the well;
- Static water level (depth to water), depth to the bottom of the well;
- Calculated well volume;
- Purging method, actual purged volume and time;
- Sample collection method;
- Sample description and collection time;

- Field meter calibration data;
- Water quality measurements and time of readings; and
- General comments (weather conditions, etc.).

Equipment Decontamination

Decontamination consists of physically removing contaminants from personnel or equipment. Decontamination should occur any time a reusable sampling tool or instrument used in field investigations contacts sampled media or personnel using the equipment. Equipment such as water level tapes or sampling equipment including submersible pumps should be decontaminated between use in water wells. For hand tools, a three-bucket wash system may be implemented, while for larger equipment a hot water pressure washer may be appropriate. The following equipment is generally required for the task:

- Clean empty buckets/containers;
- Nitrile gloves, safety glasses and other project specific PPE;
- Deionized water;
- Spray bottles;
- Phosphate free detergent (i.e., Alconox, Liqui-Nox, Sparkleen);
- Towels/wipes; and
- Containers with lids or drums for disposal of decontamination solutions.

Decontamination Procedure

Set up a decontamination area, typically somewhere well ventilated with enough room to store equipment and used decontamination solutions. Set up three buckets filled half-way as follows:

- **Bucket 1**: Tap water with non-phosphate detergent such as Liqui-Nox made up as directed by the manufacturer;
- **Bucket 2**: Tap water or deionized water for rinsing; and
- **Bucket 3**: Deionized or distilled water for the second rinsing.

The equipment decontamination process is as follows.

1. Removal of gross (visible) contamination: remove any physical soil, sediment, or free-phase liquid particles by scrubbing, dry rubbing, or pressure washing. If investigative wastes being generated by purging are considered hazardous waste at the site, then the gross contaminant removed shall be treated as the same.
2. Removal of residual contamination: clean equipment using water with detergent using a clean scrub brush. For smaller submersible pumps circulate water through the pump for at least one minute. A spray bottle filled with detergent water is usually helpful for washing awkward equipment.
3. Rinsing, drying and clean storage: rise equipment with deionized or organic free water and air-dry or dry using clean towels. Once equipment is decontaminated it should be stored such that it will not come in contact with contaminated surfaces.

General Groundwater Sampling Considerations

Traditional groundwater sampling involves two primary activities, purging of stagnant water from the well, and collection of a sample. Groundwater sampling using low flow sampling involves little to no purging but follows many of the same general principles and objective; to collect a sample representative of the hydrogeologic formation.

Equipment that will be in contact with the sample must be decontaminated prior to each use. This is necessary to minimize inadvertent contamination of the sample. The use of dedicated or new purging and sampling equipment is preferable to avoid cross-contamination.

The sequence for which groundwater wells are monitored and sampled should be from those with lower concentrations of dissolved constituents to those with higher concentrations. The sample collection sequence should be developed based on historical results, or if historical results are not known. If water quality is not known, the wells upgradient of a suspected source area should be sampled first, followed by the wells furthest away and cross-gradient or downgradient.

Well Inspections and Water Level Monitoring

The depth to water and total well depth will be measured where downhole equipment/well access permits. The well pressure may be recorded if the depth to water cannot be measured. The water level will be monitored using an electronic sounding water level tape. Measurements will be taken relative to a recorded and repeatable measurement point marked on the well at surface. The procedure for measuring water levels is as follows:

- Prior to obtaining a water level in a given well, its condition shall be inspected. Any signs of vandalism, unauthorized entry, or settlement and/or ponding around the well surface completion shall be noted.
- Record the date, time, measurement device, location, weather conditions and any other factors which may affect the measurement.
- Place the water level tape in a clean, secure location, typically hooked on to the top of the well.
- Slowly lower the tape until the electronic sounder indicates the fluid surface.
- Record the water level by pinching the thumbnail against the graduated side of the tape to the measurement datum.
- To measure the total depth of the well carefully lower the tape will be until the tape becomes slack. Slowly raise the tape until the slack is removed and record the measurement.

Field staff shall compare the recorded values against historical values so that any anomalous data can be verified. The water level tape will be decontaminated between measurement locations to avoid cross-contamination.

Purging

Purging of groundwater wells will include removal of three casing volumes of water while monitoring field-measured parameters (i.e., dissolved oxygen [DO], temperature, conductivity, oxidation-reduction potential [ORP], pH and turbidity). Field parameter monitoring is completed to confirm that water being sampled is representative of the formation surrounding the well and is not stagnant water which was held in the casing or filter pack. Casing volumes will be determined using the diameter of the well and the height of the standing water column from recent groundwater gauging data. Once the casing volume has been determined the field parameter measurement intervals will be determined using the pumping rate. Measurements and calculations of volumes will be recorded on the groundwater sampling form or in the field book.

Purge Volume

The volume of water standing in the well should be calculated through the application of the depth to water data, the known well depth, and the well diameter using the calculation presented below:

V = 7.481*(π*r2*h)

where:
V = volume of water (gallons)
r = radius of well (feet)
h = height of water column (depth of well minus water level, in feet)

Typically, three well volumes will be purged from the well. Should the well run dry during purging then that volume is typically considered sufficient for purging. The well should be allowed to recover such that the water sample collected is not turbid. Where possible the water level should be allowed to recover to 80 percent of the original water column height prior to sampling.

Field-Measured Parameters and Stabilization

Field parameters will be measured from the initial purge water, after the removal of each casing volume, and every five minutes after removing the third casing volume. Field parameter monitoring is completed to confirm that water being sampled is representative of the formation surrounding the well and is not stagnant water in the casing or filter pack. Water will be considered representative once three wells have been purged and field parameters measured at 5-minute intervals stabilize for three consecutive measurements. Table F-1 below shows the stabilization criteria for the field parameters. Stabilization criteria measured in the field shall be recorded on groundwater sampling forms.

Table F-1: Field Parameter Stabilization Criteria

Parameter	Stabilization Criteria
pH	+/- 0.1 pH units
Temperature	+/- 1 degrees Celsius (ºC)
Conductivity	+/- 3% of reading
DO	+/- 10% of reading
ORP	+/- 10 mV
Turbidity	+/- 10% or below 10 Nephelometric Turbidity Units (NTU)

Notes: *Criteria from United States Environmental Protection Agency. "EPA/540/S-95/504 – Low-flow (Minimal Drawdown) Ground-Water Sampling Procedures (EPA 1996)."*

Specific Purging and Sampling Method Procedures

Implementation of the North Hollywood West Water Quality Surveillance Plan (NHW WQSP) will require the collection of water samples from groundwater monitoring wells utilizing the following sampling techniques (well dependent):

- Low-flow;
- Conventional; and
- Zone Isolation Sampling Technology (ZIST).

Each sampling system have specific procedures and requirements for purging, sampling, and equipment decontamination. The sampling methodology for each well is provided in the NHW WQSP. Specific sampling protocols are provided in the next sections.

Low Flow Method

Low-flow purging/sampling is a sampling technique used to minimize purge volumes. The technique relies on minimizing well drawdown and withdrawing fluid directly from the screened interval without disturbing the rest of the water column. Low-flow sampling is typically accomplished using a peristaltic pump or bladder pump. Flow rates should be kept to 0.2 L/min. Purge volume is dependent on field parameter stabilization; the three well volume purge criteria does not need to be met. Field parameters are typically monitored using a flow through cell, and parameters are read after each cell volume is exchanged; stabilization criteria in Table F-1 are applicable. Purge water can typically be captured in a bucket and transferred to a 55-gallon drum.

A bladder pump is one of the easiest devices to operate for the purpose of purging and sample collection and is commonly used as a dedicated pump for low-flow purging and sampling. Specific instructions for the use of dedicated bladder pumps to both purge a well and collect groundwater samples are provided below.

Required Equipment

- Water level meter
- Air regulator pump controller;
- Compressed air source (typically nitrogen);
- New disposable gloves of appropriate material;
- Five-gallon buckets/containers, graduated in minimum one-gallon increments; and
- Water quality monitoring equipment (preferably a flow through cell).

Purging Instructions

- Gauge water level per instruction provided above.
- If using a gasoline-powered compressor, place the gasoline-powered compressor as far from the well as possible in a down-wind direction to eliminate potential exhaust impact to sampling.
- Connect the compressed air source and pump controller to the pump as per manufacturer's instructions.
- Don a new pair of gloves after handling the gasoline-powered compressor.
- Start the pump by opening the regulator on the controller, which allows compressed air to flow into the system.
- The controller should be adjusted to maximize the flow rate while minimizing the rapid "jolting" of the tubing as water is drawn into pump.
- Direct the pump discharge to the five-gallon pail and determine the pumping rate.
- Continue pumping until the necessary until indicator parameters have stabilized.

Sampling Instructions

- Resume pumping after adjusting the regulator to the minimum pressure that will still allow water to be pumped to the surface.
- Collect the samples by pumping directly into each of the required containers.
- Bottles should be filled in order of sensitivity to volatilization and oxidation as outlined in project-specific planning documents. Care should be taken to ensure that no head space remains in the volatile organic vials. Certain other parameters may also require minimizing headspace (e.g., reduced or ferrous iron).
- Filtered samples can easily be obtained by installing an in-line, 0.45 mm disposable cartridge filter directly onto the pump discharge.

Conventional Method

This method comprises the purging and sampling of a monitoring using the three-casing volume method. To obtain a representative groundwater sample it is necessary to remove the stagnant water from the well casing before a sample is collected. It is recommended that at least three casing volumes of water is removed or purged (pumped) before samples are collected. This method typically use electric submersible pumps installed in the well to remove three casing volumes and collect groundwater samples. Specific instructions for using a dedicated electric submersible pump to both purge a well and collect groundwater samples, adopting the conventional three-casing volume method, are provided below.

Required Equipment

- Electric pump controller with appropriate power plug;
- 230-Volt, single phase, electric power source, >10 amps;
- Tool kit including basic tools, tubing cutters, extra tubing connector bracket, electrical connectors, wire ties, etc.;
- Ground fault interrupter (GFI);
- New disposable gloves of appropriate material;
- Five-gallon buckets/containers, graduated in minimum one-gallon increments;
- Water level meter; and
- Water quality monitoring equipment (preferably a flow through cell).

Purging Instructions

- Gauge water level per instruction provided above.
- Refuel the electric generator at a location that is remote from the well, being very careful not to spill any fuel on equipment or clothing that will be used at the well site.
- Place the gasoline-powered generator as far from the well as possible in a downwind direction to eliminate potential exhaust impact to sampling.
- Don a new pair of gloves after handling the generator.
- Connect electric power, GFI, and pump controller to the pump.
- Determine the volume of water to be purged, if conducting standard purging.
- Start the pump.
- Direct the pump discharge to the five-gallon pail and determine the pumping rate.
- Continue pumping until the necessary volume of water has been purged from the well, or when indicator parameters have stabilized.
- If the pump intake has been placed deeply down into the water column for some reason, slowly withdraw the pump upward through the water column while it is still running to purge all water standing above the pump unless the pump will be used for sample collection.
- Shut off the pump immediately whenever the pump stops pumping water.
- Monitor indicator parameters as discussed previously.

Sampling Instructions

- Allow the well to recharge after completion of purging, if necessary.
- Resume pumping and adjust the pump rate to the slowest possible rate.
- Collect samples by pumping directly into each of the required containers.
- Bottles should be filled in order of sensitivity to volatilization and oxidation as outlined in project-specific planning documents. Care should be taken to ensure that no head space remains in the volatile organic vials. Certain other parameters may also require minimizing headspace (e.g., reduced or ferrous iron).
- Filtered samples can easily be obtained by installing an in-line, 0.45 mm disposable cartridge filter directly onto the pump discharge.

Zone Isolation Sampling Technology (ZIST)

The ZIST system developed by BESST is a compressed gas system whereby an inert gas is used to push the water column to the surface for purging and sampling. Like bladder pumps, the ZIST pump brings water to surface with compressed gas (nitrogen). Rather than compressing a bladder to lift the water column, it is pushed directly by the gas in the line. The downhole gas line is connected to the water return line, along with two check valves in the pump. Compressed gas depresses the water level in the air line which forces water up in the return line, and when gas pressure is released the first check valve is actuated to keep water from falling while the second check valve opens to allow water in the gas line to equilibrate to static head. This cycle is repeated to bring water to surface.

Required Equipment

- Water level meter
- ZIST controller box;
- Compressed nitrogen tank;
- Nitrogen regulator, associated compression fittings;
- 120V power supply for controller (generator or inverter and battery);
- Phillips head screwdriver;
- Two 10 – 15’ of ¼” nylon tubing to connect controller box to well gas-line, and nitrogen tank to controller box;
- New disposable gloves of appropriate material;
- New plastic sheeting;

- Five-gallon pail, graduated in minimum one-gallon increments; and
- Water quality monitoring equipment (preferably a flow through cell).

<u>Purging Instructions</u>

- Set timer to desired on and off times. OFF is the green hand and means the unit is not pressurized for that duration; ON is the red hand and means the unit is pressurized for that duration.
- Set timer units as desired (1s, 10s, min, etc.) with small Philips head screwdriver.
- Turn toggle switch on when ready to begin cycling. Unit always starts with OFF cycle.
- For purging stagnant tubing water prior to low flow sampling conditions, the OFF hand can be dialed to zero, which means the unit is constantly ON. Once water is purged followed by high pressure gas exhaust, all stagnant water in the system has been purged. This replaces the need to calculate tubing volume and measure purge volume.
- Once tubing is purged, pumping can begin. Starting conservatively, adjust ON/OFF times and pressure to achieve desired flow rates. This process is similar to bladder pump operation, with the exception that it is not limited to 1-minute cycles.
- When steady pumping rates are achieved, conditions are monitored in the same manner as other low flow sampling methods.

<u>Sampling Instructions</u>

- Continue pumping after adjusting the regulator to the minimum pressure that will still allow water to be pumped to the surface.
- Collect the samples by pumping directly into each of the required containers.
- Bottles should be filled in order of sensitivity to volatilization and oxidation as outlined in project-specific planning documents. Care should be taken to ensure that no head space remains in the volatile organic vials. Certain other parameters may also require minimizing headspace (e.g., reduced or ferrous iron).
- Filtered samples can easily be obtained by installing an in-line, 0.45 mm disposable cartridge filter directly onto the pump discharge.

Reference Documents

American Society for Testing and Materials (ASTM). 2001. D 4448 – 01 Standard Guide for Sampling Ground-Water Monitoring Wells.

Nielsen, D. M. 2006. Practical Handbook of Environmental Site Characterization and Ground-Water Monitoring.

Nielsen, D.M., Nielsen G.L. 2002. Technical Guidance on Low-Flow Purging and Sampling and Minimum-Purge Sampling, Galena, OH.

Puls, R.W., Barcelona M.J. 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, EPA/540/S-95/504, Washington, DC.

United States Environmental Protection Agency (USEPA). 1994. Sampling Equipment Decontamination. August 11.

Attachment F NHW WQSP Sampling Guide

Sample Containers, Preservation, and Holding Time
(Effective 05/11/2020)

Inorganic; Analysis Name	Method Reference	Sample Container Size	Sample Container Type	FRB/ TB	Preservation	Storage	Maximum Holding Time	Additional Info
Alkalinity	SM 2320B	1 x 250mL	Plastic or glass	None	Completely full and capped tightly	Cool 1-6°C	14 days	
Ammonia	Total	1 x 250mL	Plastic	None	1 mL 1:1 H2SO4 to pH<2	Cool 1-6°C	28 days	
Ammonia	Free or monochloramine EPA 350.1, SM 4500 NH3 D				None		24 hrs	
Bromate	EPA 300.1, EPA 326	1 x 125mL	Plastic	None	2 drops of Ethylene Diamine	Cool 1-6°C	28 days	
Chlorate	EPA 300.1	1 x 125mL	Plastic	None	2 drops of Ethylene Diamine	Cool 1-6°C	28 days	
Bromide	EPA 300.0	1 x 125mL	Plastic	None	None	Ref [1]	28 days	**1 x 250mL for 6 analyses combine**
Chloride	EPA 300.0	1 x 125mL	Plastic	None	None	Ref [1]	28 days	
Fluoride	EPA 300.0	1 x 125mL	Plastic	None	None	Ref [1]	28 days	
Nitrate	EPA 300.0	1 x 125mL	Plastic	None	None	Cool 1-6°C	48 hrs	
Nitrite	EPA 300.0, SM 4500 NO_2B	1 x 250mL	Plastic	None	None	Cool 1-6°C	48 hrs	
Sulfate	EPA 300.0	1 x 125mL	Plastic	None	None	Cool 1-6°C	28 days	
Chromium, hexavalent	EPA 218.7	1 x 125mL	HDPE Plastic	None	1 mL ammonium sulfate/ammonium hydroxide buffer per100 mL; mix; pH>8; Free Cl2< 0.1 mg/L	Cool 1-6°C	14 days	
Conductivity	SM2510B	1 x 125mL	Plastic or glass	None	None	Cool 1-6°C	28 days	
Cyanide	QuikChem 1-204-00-1-X	1 x 250 mL	Glass or plastic	None	25 mg ascorbic acid*; 10 drops 10N NaOH to pH ≥12;	Cool 1-6°C	14 days	
Hardness (Ca,Mg)	SM 2340C, EPA 200.7	1 x 250 mL	Plastic	None	1 mL 1:1 HNO3 to pH <2	Ref [1]	6 months	**1 x 500mL for 2 analyses combine**
Metals (Al, Sb, As,Ba,Ca,Be,B, Cd,Cr,Cu,Fe,Pb, Li, Mn,Mg,Ni,K Na,Se,Ag,Tl,V, Zn,U,hardness)	EPA 200.7, EPA 200.8	1 x 500mL	Plastic, acid washed	None	1.5 mL 1:1 HNO3 to pH<2	Ref [1]	6 months	

Sample Containers, Preservation, and Holding Time
(Effective 05/11/2020)

Calcium	EPA 200.7	1 x 250 mL	Plastic	None	1 mL 1:1 HNO3 to pH <2	Ref [1]	6 months	
Mercury	EPA 245.1	1 x 500mL	Plastic, acid washed	None	1.5 mL 1:1 HNO3 to pH<2	Cool 1-6°C	28 days	
LCR (Pb/Cu) Rule	EPA 200.8	1 x 1L	Plastic, acid washed	None	3 mL 1:1 HNO3 to pH<2	Ref [1]	6 months	
Langelier Index Alkalinity Conductivity	SM 2320B, SM 2510B	1 x 250mL	Plastic	None	None (for alkalinity, conductivity)	Cool 1-6°C	Same as Individual tests	
Calcium	EPA 200.7	1 x 250mL			1 mL 1:1 HNO3 to pH<2 (for calcium)	Ref [1] for Calcium		
Leak (ammonia, alkalinity, Cl, conductivity, fluoride, hardness)	Same as individual tests	1 x 500mL	Plastic or glass jar	None	None	Same as individual tests	Same as Individual tests	
MBAS	SM 5540C	1 x 1L	Plastic, acid washed	None	pre-rinse sample bottles with sample	Cool 1-6°C	48 hrs	
Odor	SM 2150B	1 x 500mL	Glass, teflon-lined septa	None	None; filled to the top completely full and capped tightly.	Cool 1-6°C	24 hrs	
Color	SM 2120B	1 x 250mL	Plastic or glass	None	None	Cool 1-6°C	48 hrs	**1 x 500mL for 2 analyses combine**
Turbidity	SM 2130	1 x 500mL	Plastic or glass	None	None	Cool 1-6°C	48 hrs	
Perchlorate	EPA 314.0	1 x 250mL	Plastic	None	Fill bottle half way; aerate (shake 10 seconds)	Cool 1-6°C	28 days	
Phosphate - Ortho	SM 4500-P E	1 x 125mL**	Glass, acid washed	None	Filter through 0.45 µm when collected	Cool 1-6°C	48 hrs	
Phosphorous - Total	SM 4500-P E	1 x 250mL	Glass or plastic, acid washed	None	1 mL 1:1 H2SO4 to pH<2	Cool 1-6°C	28 days	

Sample Containers, Preservation, and Holding Time
(Effective 05/11/2020)

Silica	EPA 200.7	1 x 250mL	Plastic	None	None	Cool 1-6°C	28 days	
TDS	SM 2540C	1 x 250mL	Plastic or glass	None	None	Cool 1-6°C	7 days	
TOC	SM 5310C	3 x 40 mL**	GA, teflon-lined septa	FRB	5 drops 1:1 H3PO4 pH < 2	Cool 1-6°C	28 days	
UV254	SM 5910B	1 x 250mL	GA, teflon-lined cap	None	None	Cool 1-6°C	48 hrs	
Microbiology; Analysis Name	**Method Reference**	**Sample Container Size**	**Sample Container Type**	**FRB/ TB**	**Preservation**	**Storage**	**Maximum Holding Time**	**Additional Info**
General microbiological analyses	SM9223, SM9215 SM9222 & SM9222D	2 x 125 mL	Plastic, polycarbonate	TB	0.2 mL of 10% thiosulfate (each)	Cool <8°C, not frozen	24 hrs; 8 hrs if non-chlorinated	
Giardia/Cryptosporidium	Method 1623	See Type	Filter, or 10 L Cubitainer	None	None	<20 °C	96 hours	
Microtox	Microtox Omni Test	2 x 40 mL	G, Teflon-lined septa	None	0.4 mL of 1% thiosulfate; added at analysis	Cool <8°C	Analyze same day	
AOB	SM9245-B	1 x 125mL	GA	None	0.2 mL of 10% thiosulfate (each)	Cool <8°C, not frozen	24 hr; 8 hr if non-chlorinated	
Total Microcystins	EPA 546	1x 120 mL	GA, PTFE lined screw cap	None	10mg sodium thiosulfate	<10°C or <-15°C	48 hrs at <10°C or 14 days at <-15°C	
Organic; Analysis Name	**Method Reference**	**Sample Container Size**	**Sample Container Type**	**FRB**	**Preservation**	**Storage**	**Maximum Holding Time**	**Additional Info**
1,2,3-TCP	SRL 524M	3 x 40 mL	GA, Teflon-lined cap	FRB	25 mg ascorbic acid; mix; then 3 drops 1:1 HCl to pH<2; mix; No air bubbles	Cool 1-6°C	14 days	
1,4-Dioxane	EPA 522	1 x 500 mL**	GA, Teflon-lined cap	None	25 mg sodium sulfite; mix; 0.5 g sodium bisulfate; mix; pH <4	Cool 1-6°C	28 days	

Sample Containers, Preservation, and Holding Time
(Effective 05/11/2020)

Carbamates	EPA 531.1	2 x 125 mL	GA, Teflon-lined cap	None	10 mg sodium thiosulfate*;3.6mL 2.5M monochloroacetic acid (MCA) in the empty bottle to pH<3	Cool 1-6°C	28 days	
Diquat / Paraquat	EPA 549.2	2 x 500 mL	Plastic, Amber	None	50 mg sodium thiosulfate*; 1:1 H2SO4 to pH 2	Cool 1-6°C	7 days; analyze extract within 21 days	
EDB/DBCP	EPA 524.3	3 x 40 mL***	G, Teflon-lined cap	FRB	25 mg ascorbic acid and 200 mg maleic acid; No bubbles	Cool 1-6°C	14 days	
Glyphosate	EPA 547	2 x 125 mL	GA, Teflon-lined cap	None	10 mg sodium thiosulfate*; (Fill Bottle 3/4 Full- Freeze)	Cool 1-6°C	6 weeks when frozen	
Haloacetic Acids(HAA)	EPA 552.3	4 x 60 mL***	GA, Teflon-lined cap	None	6 mg ammonium chloride	Cool 1-6°C	14 days; analyze extract within 21 days	
Herbicides	EPA 515.4	4 x 60 mL	GA, Teflon-lined cap	None	3 mg sodium sulfite	Cool 1-6°C	14 days; analyze extract within 21 days	
MIB/Geosmin	SM6040E	3 x 40mL	GA, Teflon-lined cap	None	80 µL 3.2 % sodium omadine	Cool 1-6°C	7 days	
Nitrosamines	EPA 521	1 X 1 L**	Glass, Amber	None	100 mg sodium thiosulfate*	Cool 1-6°C	14 days	
Pesticides-Cl	EPA 505	3 x 40 mL**	GA, Teflon-lined cap	None	3 mg sodium thiosulfate	Cool 1-6°C	7 days; analyze extract within 24hrs	

Sample Containers, Preservation, and Holding Time
(Effective 05/11/2020)

Prometon	EPA 525.2	3 x 1 L**	GA, Teflon-lined cap	None	50 mg sodium sulfite*; Sample must not contact any plastic parts or tubing.	Cool 1-6°C	14 days; analyze extract within 30 days	
SOCS: Phthalates/ DEHP/PAH/ Triazines/ Thiobencarb,	EPA 525.2	3 x 1 L**	GA, Teflon-lined cap	None	50 mg sodium sulfite*; mix; then 1:1 HCl to pH<2; Sample must not contact any plastic parts or tubing.	Cool 1-6°C	14 days; analyze extract within 30 days	
THM/HAA Formation Potential	SM 5710	1 x 1 L	GA, Teflon-lined cap	None	None	Cool 1-6°C	As soon as received; within 24hrs	
THMs, VOC, tert-butyl alcohol,	EPA 524.2	3 x 40 mL	GA, Teflon-lined cap	FRB	25 mg ascorbic acid; mix; then 3 drops 1:1 HCl to pH<2; mix; No air bubbles	Cool 1-6°C	14 days	

Ref[1] Avoid temperature extremes

FRB - Field Reagent Blank prepared at Lab per sampling route or site **TB – Travel Blank (Microbiology)**

GA- Glass, Amber **G- Glass Clear**

*** Add to chlor(am)inated samples only; mix well before adjusting pH**

**** Collect an additional replicate or *** 3 replicates at 1 per 10 locations for QC purposes.**

Attachment G LADWP Water Quality Division Injury and Illness Prevention Program (IIPP)

Water Quality Division

INJURY AND ILLNESS PREVENTION PROGRAM

<u>EMERGENCY RESPONSE TELEPHONE NUMBERS</u>

Emergency Calls 9-911

Water Trouble Board (855) 262-9880

JFB Security Dispatch (213) 367-3373

NOVEMBER 2018

CITY OF LOS ANGELES
DEPARTMENT OF WATER AND POWER

WATER QUALITY DIVISION (WQD)
INJURY AND ILLNESS PREVENTION PROGRAM

NOVEMBER 2018

Andrew L. Linard
Director

14NOV18
Date

Jonathan K. Leung
Program Administrator

11/7/18
Date

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Los Angeles Department of Water and Power
WATER QUALITY DIVISION
INJURY AND ILLNESS PREVENTION PROGRAM

I. INTRODUCTION

The California Occupational Safety and Health Administration (Cal/OSHA), California Code of Regulations, Title 8, Sections 3203 and 1509, Injury and Illness Prevention Program (*Attachment A),* requires every employer to establish, implement, and maintain an effective written Injury and Illness Prevention Program (Program), including elements that will provide training for employees in general safe and healthful work conditions and practices.

This Program, which builds upon the Los Angeles Department of Water and Power (LADWP) Program as well as the Water System Program, represents a guideline for providing safe working conditions and practices at all levels of work within the LADWP Water Quality Division (Division). A copy of the Program shall be retained in the John Ferraro Building (JFB) and at each staffed reporting location. The Program is reviewed annually and updated as necessary.

II. PROGRAM POLICY AND OBJECTIVES

A. Los Angeles Department of Water and Power Safety Policy

The health and safety policy of LADWP is stated in LADWP Administrative Manual, Safety Sections, 110-01 through 110-05; Hazardous Substances, Sections, 110-10 through 110-12; Safety Inspections, Sections 110-20 through 110-21; and Accident and Injuries, Sections 110-30 through 110-34 (all included in *Attachment B).*

LADWP's safety slogan is:

**"No job is so important, or service so urgent,
that we cannot take time to perform our work safely."**

B. Division Safety Policy and Objectives

The Division's primary safety policy is to ensure the safety and health of its employees, protect the public, and to protect LADWP's physical assets. It is Division's position that accidents can be prevented through the combination of good management and good active employee involvement. Division's goal is for managers, supervisors, and employees to eliminate all accidents and lost-time injuries. To accomplish this, Division employees will continue to be trained and periodically audited in their work and workplace.

C. Division Program Objectives

The Division's Program objectives include the following:

- Include safety as part of every job.
- Emphasize that no job should be done that requires taking unnecessary risks.
- Provide training programs to instruct employees in both general and specific safe work practices with respect to hazards unique to employees' job assignments.
- Provide employees with proper work equipment, tools, and other devices to perform their job safely.
- Emphasize that an employee's safety depends on his/her:
  - ➢ mental alertness and physical preparedness
  - ➢ knowledge of safety rules, procedures, and practices
  - ➢ continual practice of safe work habits
- Promote employee knowledge of safety rules and procedures.
- Establish and maintain an effective safety recognition program.

III. AUTHORITY AND RESPONSIBILITY

LADWP Administrative Manual, Sections 110-01 and 110-02 describe the role of Chief Safety Officer, Corporate Health and Safety Services, Water System Safety (WSS), managers, supervisors, and employees with regard to safety. Memoranda from the Water System Executive Office issued in 2018 further clarify these roles *(Attachment D)*.

LADWP must provide a safe and healthful workplace and ensure compliance with applicable (federal, state, and local) laws, rules, and regulations regarding safe working conditions.

A. Role of Chief Safety Officer

The Chief Safety Officer responsibilities, as stated in the LADWP Administrative Manual Section 110-01, are the following:

- Establish and oversee written LADWP health and safety standards that are in compliance with applicable regulations, best practices and/or industry standards.
- Ensure changes to regulatory requirements are communicated throughout LADWP.
- Designate the Chair of the Accident Investigation Committee (AIC) for identified serious injuries or illness.
- Ensure the Accident Investigation report, findings, and lessons learned are disseminated to the System Heads as appropriate.

B. Role of Corporate Health and Safety Services (CHSS)

The Corporate Health and Safety Services responsibilities, as stated in the LADWP Administrative Manual Section 110-01, are the following:

- Maintain knowledge of current, applicable, health and safety related regulatory requirements and communicate relevant updates and changes to the LADWP Chief Safety Officer.
- Establish health and safety standards that are in compliance with applicable regulations, best practices and/or industry standards.
- Provide guidance in the development, implementation, and monitoring the effectiveness of health and safety programs.

C. Role of Water System Safety

The Water System Safety responsibilities, as stated in the LADWP Administrative Manual Section 110-01, are the following:

- Create, plan, implement, and review System-Level policies, protocols and procedures to establish and maintain a safe workplace and to promote cross-Division consistency of practices.
- Represent the Water System and participate on various joint labor-management teams and committees charged with determining, addressing and resolving safety issues and requirements.
- Respond to accidents or incidents that occur in the Water System, ensure appropriate responses, notifications, documentation, reporting and follow-up with various governing agencies.
- Review "near miss" incidents with Division Managers and oversee/assist with mitigation activities.
- Serve as the Water System Liaison with CHSS and with the Joint Safety Institute (JSI).
- Oversee and coordinate Water System's activities and participate in Department/CHSS programs attend meetings and assists with logistical planning.
- Oversee Emergency Preparedness and Disaster Planning through various activities such as tracking and renewing emergency food and water supplies, maintaining and updating Facility Emergency Plans for Water facilities.
- Review, research and interpret safety governing rules, regulations and policies affecting the Water System to ensure proper policies, protocols, procedures are in place.
- Oversee data collection, preparation, and reporting of statistical information and rate of injury affecting the Water System, and other safety-related reports and information.
- Review and analyze injury and illness statistics, prepare and implement recommendations to improve injury rates throughout the Water System.
- Assist Divisions with annual review, update, and distribution of their safety related policies and procedures.
- Assist management and supervision in investigating accidents and other unusual incidents in order to prepare preliminary reports, including any recommendations.
- Help evaluate and purchase necessary health and safety equipment, and keep current with state-of-the-art methods, work practices, and equipment as they relate to safety. Identify and recommend health and safety training needs to maintain compliance with changes in regulatory requirements.

D. Role of Division Management

The Division Management shall be responsible for the following in addition to the LADWP's Administrative Manual Sections 110-01, 110-02 and 110-34:

- Develop, establish and maintain an effective injury and illness prevention program that emphasizes and encourages safe and healthful working conditions and practices and recommend changes when necessary based on full evaluation of safety performance.
- Ensure employees are aware of and have access to the Division's Program.
- Institute systems for monitoring safety and health programs, evaluating and recognizing safety performance, investigating accidental occurrences, handling employee safety and health concerns, and recommending changes when necessary.
- Distribute Safety Alert(s) and share information and lessons learned with appropriate employees and management.
- Ensure all employees are suitably trained/competent to carry out the prescribed task and that the necessary licenses/certificates are in force and appropriate.
- Maintain management committees to develop safety and health policies, evaluate the overall safety and health program, and resolve safety and health issues that have not been decided at lower levels.
- Develop, establish, and monitor the Program through the Division Program Administrator.
- Provide sufficient resources to ensure that supervisors can accomplish assigned job tasks in a safe manner.
- Ensure all employees are trained and directed to follow policies and procedures that are applicable to their work.
- Emphasize that no job is to be performed in a manner that subjects employees to unnecessary risk.
- Promote and enforce LADWP's Safety Rules and all applicable safety rules.
- Promote and support labor/management commitment to safety and the role of the Worker Safety Group Tour.
- Participate in the disciplinary process, as appropriate, for violations of safety related rules and/or regulations.

Division management recognizes these responsibilities and the accountability for maintaining occupational health and safety standards. Management will provide the leadership necessary to instill a measure of "positive safety and health awareness" in the daily lives of each employee in the Division.

E. Role of the Division Director

The Division Director responsibilities, as stated in the LADWP Administrative Manual, Section 110-02, are the following:

- Establish, implement, and maintain an effective written IIPP for their respective Division and ensure approval by Water System Safety/CHSS.
- Identify the need for Safety Coordinators/Groups and assign responsibilities as appropriate ensuring collaboration with LADWP Safety/Water System Safety.
- Ensure supervisors and managers under their direction understand their responsibilities and effectively implement the IIPP and related safety programs within their span of control.
- Ensure a copy of the Division's IIPP is available to employees – this may be accomplished through electronic access.
- Ensure the development, maintenance and implementation of documented practices or standard operating procedures is in compliance with LADWP standards.
- Evaluate the effectiveness of the IIPP, update the program and provide feedback to CHSS as appropriate.
- Actively support the system implemented for communicating with employees on matters relating to employee health and safety.
- Ensure reports of major incidents, accidents, injuries, regulatory visits and communications are made as appropriate to the LADWP Chief Safety Officer.
- Apply appropriate disciplinary action for violations of health and safety rules, policies, or procedures.
- Attend the Division Safety Meetings.

F. Role of the Division Program Administrator

The Division Program Administrator is the Assistant Division Director. The Division Program Administrator's role is to ensure that this program is implemented and monitored, and that a safe and healthful working environment is provided for all employees. The Division Program Administrator will be assisted by the LADWP CHSS, WSS and Division Safety Support Staff.

The Division Program Administrator's specific Program responsibilities are as follows:

- Administer the Program.
- Ensure the Program is periodically reviewed and updated.
- Verify through the appropriate managers that supervisors inspect the work site regularly, and abate unsafe conditions.
- Ensure the Division Safety Committee meetings are held and office and field inspections are conducted.
- Ensure the Division Worker Safety Group Tours are conducted.
- Provide technical assistance and guidance to the Division Safety Committee and Division Worker Safety Groups.
- Attend the Division Safety Meetings.

- Promote and enforce LADWP's Safety Rules.
- Review work procedures to control specific hazards.
- Ensure programs are established for employee job safety orientation and safety training for both existing and new employees.
- Ensure through the appropriate managers that orientation and training information is documented.
- Ensure through the appropriate managers that accident forms are completed in a timely manner.
- Ensure through the appropriate managers that supervisors are monitoring work locations and job sites for compliance with established safety rules.
- Ensure that investigations of unusual or serious accidents or incidents are taking place.
- Assure development and administration of the Division Safety Recognition Program.
- Review and approve recommendations of accident investigation committees, safety groups, and safety audits; and monitor and assist in the implementation of those recommendations that are appropriate.
- Forward, through proper channels, any constructive suggestions or criticisms of safety-related forms.
- Review unsafe condition or hazard reports.
- Promptly report safety hazards, abnormal conditions, or any matters of importance relating to the operation or maintenance of equipment to the supervisor on Division's "Report of Unsafe Condition or Hazard" form (*Attachment I*).
- Maintain good physical condition to perform the duties of their position and minimize the opportunities for personal injury.

G. Role of Division Safety Coordinators

The Division Safety Support Staff shall have the responsibility to develop methods and procedures to assist the Division Program Administrator in implementing the following Injury and Illness Prevention Program components:

- Assist with arranging and coordinating a communication system enabling division management and supervisors to communicate to employees about routine work hazards, work hazards unique to specific work operations, and especially potential hidden hazards.
- Serve as a safety liaison between WSS, CHSS, and respective Division's groups.
- The Division Safety Coordinators with the assistance from the LADWP WSS, CHSS, and Division Safety Committee will update Division programs and policies to reflect current Cal/OSHA, Federal, State, and local regulations and industry standards.
- Arrange inclusive safety training required by the JSI, LADWP, and Federal, State, and local regulations, with the assistance of each Division Group Manager and/or Division's Training Coordinator.

- Arrange safety training on equipment, tools, and vehicles on safe methods and procedures, with the assistance of each Division Group Manager and the Division's Training Coordinator.
- Assist the LADWP CHSS, WSS and Division Group Managers with investigations of employee safety concerns, accidents, job safety analyses, and other safety-related issues.
- Assist in reviewing safety questions and safety recommendations submitted as a result of supervisor's safety meetings and recommendations of corrective measures to the Division Program Administrator and the Division Safety Committee.
- Send employee DMV pull notices to appropriate Supervisors and Division's Administration Office as needed.
- Update all Safety information on the Water Quality Division website.
- Follow up on incident response paperwork.
- Maintain the Division Safety Shoes Eligibility List in accordance with the Safety Footwear Program Bulletin 2016-05 issued by CHSS dated February 2, 2016 (*Attachment Y*)
- Send the updated Division Safety Shoes Eligibility List to WSS and follow up as needed.
- Maintain the Division Vision Safety Program Eligibility List in accordance with CHSS "Prescription Safety Eyewear Program" (Lorena Quintero is the Water System safety representative) *(Attachment Z*).
- Assist employees in finding the resources they need for safety – Injury Illness Prevention Program, Safety Rules Book, Equipment, etc.
- Participate in Division's Safety Committee Meetings.
- Attend monthly Water System Safety Committee Meetings.

H. Role of Division Supervisors

The Division Supervisors shall be responsible for the following in addition to the LADWP Administrative Manual, Sections 110-01 and 110-02:

- Ensure that all employees are provided with a copy of (or have immediate access to) the appropriate Program(s); receive identified training as defined in standards and procedures; are issued the appropriate personal protective equipment (PPE) as required and perform their activities in alignment with health and safety policies, practices, and procedures.
- Emphasize to employees their responsibility to protect themselves, their coworkers, and the public through safe and healthful work habits.
- Instruct each of their employees in general safe and healthful work practices, the scope and limitations of specific tasks, and the hazards associated with those specific tasks.
- Participate in safety meetings, regularly inspect the workplace and make arrangements for addressing unsafe conditions.
- Ensure all work performed by employees is in accordance with approved practices and that all safety rules and precautions are observed and discussed at pre-job planning meetings prior to beginning work.

- Ensure development of Job Hazard Assessments (JHAs) shall be conducted in conjunction with Water System Safety and/or Corporate Health and Safety for new or existing tasks, including processes, procedures, equipment or exposure to hazardous substances performed by employees under their direct supervision.
- Ensure no work is performed by any personnel lacking proper training, appropriate equipment, qualifications, or adequate supervision.
- Make certain that all emergency equipment under his/her jurisdiction is appropriate, properly maintained, and accessible.
- Take appropriate action when hazards are discovered.
- Assign a sufficient number of qualified workers to work at each job safely.
- Issue Safety Rule Books and safety instructions where required, and instruct and examine employees in their understanding of such material.
- Monitor work locations and job sites to ensure safety procedures are followed.
- Enforce safety and health rules and take necessary steps including disciplinary measures in accordance with LADWP Administrative Manual, Work Performance, Section 50-04 *(Attachment C)* to ensure compliance with the LADWP's safety rules and regulations.
- Promote and support labor/management commitment to safety and the role of the Worker Safety Group tours in accomplishing this commitment.
- Participate in the disciplinary process, as appropriate, for violations of safety related rules and/or regulations.

I. Role of Division Employees

The Division employees shall be responsible for the following in addition to the LADWP Administrative Manual, Sections 110-01 and 110-02:

- Adhere to and follow all safety and health rules, policies and practices that are applicable to their work, at all times.
- Immediately report any unsafe working conditions, practices, equipment, tools, "near miss" incidents, accidents and/or injuries to supervision on Division's Report of Unsafe Condition or Hazard" form *(Attachment I).*
- Use and/or wear appropriate safety equipment/PPE, tools, and devices provided to protect themselves, their co-workers, and the public from accidents and injuries.
- Work in a safe and responsible manner; perform duties with such skill and care as to eliminate injury to themselves, co-workers, and members of the public, and to avoid interruptions, impairment of services, and damage to apparatus or property.
- Familiarize themselves with the location and operation of all safety equipment, including fire extinguishers, and first aid kits at reporting site and/or when visiting a new facility.
- Forward through proper channels, any constructive suggestions or criticisms of safety-related items.
- Maintain good physical condition to perform the duties of their position and minimize the opportunities for personal injury.
- Attend and participate in safety related training and meetings as required and assigned.

- Obtain and maintain necessary licenses/certificates as appropriate.
- Participate fully in all investigations.

J. Role of Division Worker Safety Group Tours (Labor/Management Safety Program)

The Division has implemented a labor/management safety program. Selected LADWP employees represented by the International Brotherhood of Electrical Workers, Local 18, will represent labor and management will select equal numbers of representatives. Together Labor and Management will participate in Worker Safety Group Tours. The purpose of the Worker Safety Group Tours is to have both labor and management jointly review work areas for safety issues.

The primary role of the Worker Safety Group Tour is to provide an additional process to identify and correct safety and health issues, and to provide an additional means of safety communication at the group level. Any safety issues that are found shall be resolved jointly through management and labor.

Worker Safety Group major responsibilities include:

- Meet prior to the safety tour to review past reports for the work site location and the Worker Safety Group Tour's protocols.
- Meet with employees at their work site to discuss their health and safety concerns and to provide a means to address their safety issues.
- Conduct safety tours of the work sites to identify areas that may be a safety or health concern.
- If unsafe work conditions are found, take immediate corrective actions by notifying the impacted group's immediate and second level supervisors as well as informing the Division's Assistant Director.
- Discuss the safety tour results with the impacted group's immediate and second level supervisors and agree on assigned follow-up action(s) to address safety tour's results.
- Discuss all open action items on Safety Action Request (SAR) with the Division Assistant Director.
- Document the safety tour's results and follow-up actions by completing the electronic Worker Safety Group Tour Form found on the Joint Safety and Training Institute's website at http://jsi.ladwp.com.
- Report Worker Safety Group Tour results and follow-up actions at the upcoming Safety Committee meeting, Group Safety meeting and Water Quality Joint-Labor-Management Subcommittee meeting.
- Lead by example; maintain appropriate safety habits.

K. Role of Division Safety Committee

The Division Safety Committee shall meet at least quarterly or at interval directed by the Safety Committee Chairperson. The roles of the Division Safety Committee are as follow:

- Arrange and coordinate a communication system enabling division management and supervisors to communicate to employees about routine work hazards, work hazards unique to specific work operations, and especially potential hidden hazards.
- Provide an open forum to identify safety issues, recommend corrections, and assist the Administrator in their duties.

The Division Safety Committee includes participation from the following:

Name	Section or Group
Jonathan K. Leung	Safety Chairperson (Ext. 71032)
Serge Haddad	Regulatory Planning & Compliance (Ext. 71329)
Elizabeth De Simone	Administrative Services (Ext. 70838)
Ronald Dergrigorian	WQ Laboratory (Ext. 78523)
Vacant	WQ Control (Ext. 73186)
Dianna Jones	Regulatory Affairs & Consumer Protection (RACP) (Ext. 73307)
Bob Sun	Source Protection & Groundwater Remediation (Ext. 73419)
Marlyn Stasiak	Science & Research (Ext. 73018)
Ada McAllister-Phillipus	WQ Clerical Support (Ext. 74455)
Steven Torres	WQ Laboratory (Ext. 78537)
Krystie Serrano	Administrative Services (Ext. 73222)
Matt Qassis	12th Floor Emergency Warden (Ext. 72976)
Nathan Aguayo	Water Quality Customer Care (Ext. 75011)

L. Role of Water Distribution Safety Training Group

The Safety and Training Group within the Water Distribution Division provides assistance with safety training and may provide safety training, when needed to Division employees. Coordination of safety training should be done through WSS.

IV. HAZARD ASSESSMENT AND CONTROL

Methods for identifying and evaluating work place hazards:

A. Applicable Laws and Regulations

The California Code of Regulations, Title 8, Industrial Relations, is available for reference to identify any existing safety and health hazards and outline the procedures to control or eliminate them.

B. Job Hazard Review

Division personnel shall periodically review work procedures (e.g., entering and exiting limited access areas and confined spaces, lab safety, construction site safety, fall protection, heat illness prevention, chemical hygiene, etc.); and where appropriate, Job Hazard Assessments (JHAs) shall be developed or revised.

C. Inspections and Audits

In addition to Worker Safety Group Tours, safety inspections and audits will be conducted periodically by different levels of management and supervision to ensure a safe workplace is being maintained, and the potential for work-related injuries is abated. Periodic inspections of work areas will be performed to identify unsafe conditions and work practices. All inspections shall be documented on either the “Facility or Job Site Safety Inspection Form” *(Attachment E),* or the “Periodic Office Safety Inspection” form *(Attachment L)*, whichever applies. The forms shall be retained at the Supervisor’s office for a period of five years.

The Supervisors will ensure that methods and/or procedures for correcting unsafe or unhealthy conditions, work practices, and/or work procedures are identified in a timely manner. The following supervisor’s responsibilities for job safety inspections and audits are:

- Conduct periodic inspections of facilities and job sites to identify unsafe conditions and work practices.
- Document and maintain safety inspection records. Records shall include the nature of the identified hazard, location of the hazard, and any corrective or disciplinary action taken.
- Audit training and safety records annually.
- Remain constantly aware of safety issues on the job site. Supervisors shall record any unsafe work situations, accidents that have occurred, and remedial actions taken.

D. Care and Operation of Automotive Equipment

- Employees shall follow the latest versions of the “Rules and Regulations Governing the Care and Operation of Automotive Equipment” employee handbook and the “Safe driving Policy and Guidelines”. ” Both are available on the Corporate Safety intranet site.

- When driving a Department Vehicle, employees shall bring or keep in the vehicle a “blue pouch” containing emergency contacts and checklists.
- Employees shall adhere to the Water System’s vehicle backing up policy *(Attachment M).*
- Use of cellular phones and/or personal electronic devices while operating a motor vehicle is prohibited *(Attachment N).*
- Employees shall not operate a vehicle if there is a medical condition or injury that prevents them from safely driving the vehicle. In such situations, a supervisor or co-worker should drive or the employee shall seek ride assistance.

E. Occupational Illness and Prevention

1. Occupational Health Services (OHS)

   Occupational Health Services periodically performs hearing and respiratory exams for employees exposed to conditions that would warrant such exams.

2. Corporation Health Safety Services (CHSS)

   a) Injury and Illness Reports and Statistics

      LADWP CHSS prepare a monthly safety report that gives an overview of workplace injuries and lost-time hours for each LADWP Division. Division uses these safety reports and statistics to analyze the types of accidents and injuries that occur within the Division and develop methods to minimize them.

   b) Corporate Industrial Hygiene

   LADWP CHSS Industrial Hygiene upon request can perform exposure monitoring to evaluate and document employee potential exposures to biological, chemical and physical hazards. The information obtained during these assessments can be used for the following:

   - Demonstrate compliance with a particular OSHA standard
   - Verification of effectiveness of engineering controls
   - Reassurance for workers that the workplace is safe
   - Establishing a program for periodic monitoring and re-monitoring
   - Selection of appropriate respiratory protection
   - Determining need for ventilation installations

   c) Office Ergonomics

   LADWP CHSS Industrial Hygiene upon request can perform an ergonomic evaluation of on an employee work station using the Enviance request system on the CHSS intranet site. This is highly recommended and a mandatory step for obtaining ergonomic furniture *(Attachment K).*

F. Hazard Correction

Hazards should be corrected immediately as they are identified. For hazards that cannot be immediately corrected, managers and/or supervisors shall formulate a plan for correction based on considerations such as the probability and severity of an injury or illness resulting from the hazard and the availability of needed equipment, materials, personnel, or training.

Once an inspection or an accident investigation reveals a hazard to personnel working in the area or operating a particular piece of equipment, the manager and/or supervisor shall determine if the hazard poses an imminent danger or a less serious hazard to employees. In the event a hazard presents an imminent danger to employees or property, all personnel except those necessary to correct the hazardous condition, shall be evacuated from the hazardous area. Those employees involved in correcting the hazard shall be appropriately trained and provided with necessary safeguards and personal protective equipment.

Identified hazardous areas shall be barricaded and/or posted with warning signs alerting employees of the danger. All affected employees shall be notified of the hazardous area by their supervisor. The nature of the hazard and the remedial actions taken shall be documented and kept on file by the supervisor.

G. Procedures for Hazard Notification by Employees

Employees have the opportunity to provide input on safety-related matters, including the Program. Safety suggestions may be submitted, in writing, anonymously if desired, to the Division Program Administrator using the "Report of Unsafe Conditions or Hazards" form *(Attachment I).* Urgent issues may be submitted orally through the following means:

- Line supervision **(preferred method)**
- Competent person or designated person at construction-site
- Division Safety Committee Representatives
- Division Safety Support Staff
- Division Program Administrator
- Water System Safety
- Union Representatives

Any Division or Water System Safety report made orally should be documented. LADWP policy is that employees are required to immediately report any unsafe condition or hazard discovered in the workplace. Employees shall not be disciplined or reprimanded for reporting any unsafe condition or hazard.

Safety at locations not controlled by Division, such as contract construction-sites, or force account work, is the responsibility of the LADWP division doing the work, or the construction contractor. Employees shall refuse to work in unsafe conditions at these locations and shall report the situation to their supervisor. In the case of contractor work, the supervisor shall notify the Contract Administrator for assistance.

H. Emergency Evacuation

All employees shall be trained in emergency building evacuation. Please see *(Attachment G)* for a map of JFB building evacuation routes and safe refuge areas.

V. COMMUNICATIONS WITH EMPLOYEES ON SAFETY ISSUES

One way to promote safety and help ensure a safe workplace is to keep employees continually aware of safe work habits. The Division has several modes to communicate with employees on safety and health issues and for employees to communicate with management on unsafe work conditions. These include, but are not limited to, this Program and the following:

A. General Safety Communication Meetings

The Division Program Administrator is responsible for verifying that General Safety Communication meetings for the Division are regularly scheduled at least quarterly to address personnel safety issues. A record of all meetings shall be kept, stating the meeting date, time, personnel present, subjects discussed, and action taken, if any.

B. Safety Committee Meetings

The Chairperson of the Division Safety Committee is responsible for verifying that Safety Committee Meeting for the Division are regularly scheduled at least quarterly as discussed in Section III, G and to brief the members on the issues and/or initiatives that are being addressed through the Water System Safety Communication Group. A record of all meeting agendas and notes shall be kept.

C. Group Safety Meetings

The Manager of the Group is responsible for verifying that Group Safety meetings are regularly scheduled at least quarterly. The purpose of these meetings is to communicate safety information to employees. A record of all meetings shall be kept of the meeting date, time, place, personnel present, subjects discussed, and corrective actions taken, if any. A sign-in log shall be obtained and maintained in the appropriate safety office.

D. Tailgate Safety Meetings

Tailgate safety meetings shall be conducted, as needed, by individual work groups to address safety issues for the worksite. In general, these meetings will be held at the beginning of each new job, as unaddressed hazards are discovered and should be amended if conditions change or if new employees (including contractors) arrive. The meetings shall address hazards or conditions that are unique or relevant to the specific jobs being performed. During tailgate safety meetings, the following safety issues are commonly addressed:

- Work plans for the job
- Specific safety hazards
- Safe work procedures
- Use of safety equipment
- Emergency procedures

Job safety analysis will be completed by the first line supervisor at the pre-job safety "Tailgate Meeting" to identify safety issues *(Attachment J).* The analysis can be used to determine what training is required to perform the job safely.

As work progresses, newly created hazards and changing situations must be considered and safety procedures initiated as required. A record of all meetings shall be logged and maintained at the appropriate supervisor's office for at least five years.

E. Safety Awareness and Educational Programs

1. Safety Bulletins and Posters

   Safety posters, bulletins and notices will be displayed at a location(s) central to the work operation and on a board dedicated to safety related information. The safety bulletin board will be maintained on a regular basis to display the timeliest and appropriate information. Urgent bulletins will be communicated to employees on an individual basis.

2. Training

   Division provides safety training to management and employees on general safety procedures and specific operation procedures. See Section VI for detailed information on the Division training program.

3. Employee Safety Input

   Employees are encouraged to inform supervisors or management of workplace hazards and alternate safe work procedures without fear of reprisal. See Section IV, G, for proper procedures for employee input.

F. Written Hazard Communication Program

CHSS maintains a written program accessible on the CHSS webpage which includes a description of how the LADWP:

- Maintains lists of chemical inventories.
- Communicates and makes accessible hazard related information to employees and emergency responders through
  - Labels and other forms of warning,
  - Safety Data Sheets (SDSs), and
  - Information and training – including informing employees of the hazards of non-routine tasks.
- Protects employees from hazardous substances brought into the workplace by a contractor's employees.
- Informs other employers sharing the same work area of
  - The hazardous substances to which the contractor's employees may be exposed while performing their work.
  - Precautionary measures needed to protect employees during normal work as well as emergency conditions.

    - Access to SDS's during the normal operating conditions and in foreseeable emergencies.
- Implements the requirements of the California Safe Drinking Water and Toxic Enforcement Act.
- Performs periodic (e.g., annual) program evaluation to update the program and determine its effectiveness.

Note: The written Program is available upon request to employees, their representatives, Cal/OSHA representatives, and others in accordance with The California Safe Drinking Water and Toxic Enforcement Act, Section 3204(e), "Access to Employee Exposure and Medical Records."

G. Warning Labels

All containers of hazardous substances must be labeled, tagged, or marked with the identity of the chemical and the appropriate hazard warnings.

Labels must be prominently displayed, legible, in English and readily available in the work area throughout each work shift.

Employees are to ensure that existing labels are not removed or intentionally defaced on incoming containers of hazardous substances, unless the container is immediately marked with the required information.

H. Safety Data Sheets (SDS)

Provide detailed information about a specific product or substance and are organized to consistently provide the following information regarding the identified chemical:

1) Identification
2) Hazard(s) identification
3) Composition/information on ingredients
4) First-aid measures
5) Fire-fighting measures
6) Accidental release measures
7) Handling and storage
8) Personal Protective Equipment
9) Physical and chemical properties
10) Stability and reactivity
11) Toxicological information
12) Ecological information
13) Disposal considerations
14) Transport information
15) Regulatory information, and
16) Other information including date of preparation or last revision.

The LADWP maintains SDSs that are received with incoming shipments of hazardous chemicals. SDSs for hazardous substances used in each work place are available at various locations throughout the LADWP and CHSS maintains a contract to provide electronic access through the CHSS website.

The SDS Library may be searched by:

- Product Name
- Manufacturer Part Number
- Manufacturer Name

Note: The SDS is not required for consumer products when the products are used in the workplace in the same manner that a consumer would use them.

I. Employee Rights

- Employees have the right to access their medical and exposure monitoring records.
- Employees, their physician or representative, have the right to receive information regarding hazardous substances to which the employee may be exposed.
- Employees shall not be retaliated against based solely on their exercise of these rights.

VI. SAFETY TRAINNG

A. Safety Training Objectives

Division’s primary safety training objective is to provide thorough training in safe work methods and practices. Safety training is provided for the following personnel and situations:

- All new employees.
- All employees given new job assignments for which training has not been previously received.
- When new hazards are introduced to the workplace by a change in procedures or equipment.
- When employees or supervisors are made aware of a new or previously unrecognized hazard.
- To ensue supervisors are familiar with safety and health hazards that are related to their work.

B. Types of Training

1. Personal Protective Equipment (PPE) Training

   Workers subject to injury on the job shall be provided with PPE and trained in the proper use of such equipment. This includes all operations that expose employees to hazardous conditions and require such equipment to reduce the hazards where regulatory standards require such equipment.

Supervisors shall ensure that their employees are trained in the proper use and maintenance of PPE in accordance with the manufacturer's instructions, LADWP Safety Rules Book and through procedures established by WSS. Examples of PPE include, but are not limited to, the following:

- Head Protection
- Eye Protection
- Respiratory Protection
- Hearing Protection
- Fall Protection (Harness)

2. Safety Equipment Training

Safety equipment used to prevent injuries shall be provided and Supervisors shall ensure that their employees are trained in their proper use and limitations. Examples of safety equipment training may include, but are not limited to, the following:

- Fire Extinguisher Procedures
- Proper Use of Tools and Equipment
- Ladder Inspection Use and Safety
- Fall Protection Equipment Utilization

3. Specific Types of Training

Examples of training topics may include, but are not limited to, the following:

- New Employee Safety Orientation
- Injury and Illness Prevention Program
- Emergency Building Evacuation
- Earthquake Preparedness
- Confined Space Awareness
- Fire Extinguisher
- First Aid, CPR, and AED
- Fall Protection
- Defensive Driver
- Safe Start
- Lockout - Tagout Awareness
- Heat Illness Prevention Training
- Chemical Hygiene Plan (for Laboratory Staff)
- Joint Safety Institute (JSI) Classes (Supervisors Safety Skills, etc.)
- Safety By Design
- Chlorine/Ammonia chemical awareness
- Blood borne Pathogens

4. Initial Program Training

   All Division personnel will be trained on the structure of the Program, including individual responsibilities under the Program, and the availability of the written Program. Training will also be provided on how to report unsafe conditions and where to obtain information on workplace safety and health issues.

   Personnel hired after the initial training session will be oriented on this material as soon as possible by the appropriate supervisor or Safety Coordinator. These individual training sessions will be provided at the New Employee Safety Orientation.

5. Annual Safety Training Review

   The Supervisor shall review the safety training records for each of his or her employees at least once per annum. Updated safety training records shall be kept on LADWP's centralized system to the extent practical.

6. Division Safety Training Matrix

   Managers and Supervisors shall utilize the Division Safety Training Matrix as a guide for training employees under their charge. The matrix lists which training classes are required and recommended as well as the cycle for retaking a class. This matrix should be reviewed by every employee during their annual two-way communication meeting. A copy of the safety training matrix can be found on the Division website under the Safety tab.

Documentation

Documentation of safety training sessions should include a training date(s), agenda, sign-in log, and Certificates of Completion, when applicable. Safety and health training sign-in logs shall include the course title, training date(s), method of training, training providers, and the employee's name, ID number, and original signature. These records shall be kept by the supervisors and logged into the HRMS System and the appropriate safety training database for a *minimum of five (5) years.*

VII. SAFETY REGULATIONS, RULES AND PROCEDURES

A. Safety Rules

LADWP's Safety Regulations and Rules express minimum requirements for employee and public safety and shall be integrated into all phases of activities (such as design, equipment, material specification, procurement, construction, operations, and maintenance). These shall also be incorporated into instructions for new employees or employees transferred to new jobs, and for refresher training.

B. Enforcement of Safety Rules

Safety regulations, rules and procedures are contained in the following documents:

- Cal/OSHA Regulations (Title 8)
- LADWP Safety Rules Book
- LADWP Administrative Manual
- Hazardous Materials Field Guide (Water Quality Laboratory Staff only)
- Remote and Isolated Worker Policy *(see Attachment H)*
- Fall Protection Manual
- Division Emergency Response Plans
- LADWP Bulletins and Division Memorandums
- Heat Illness Prevention Plan
- Chemical Hygiene Plan (For Water Quality Laboratory Staff only)
- Lockout Tagout Rules

Violation of these rules shall be cause for disciplinary action.

C. Disciplinary Action

LADWP Administrative Manual, Work Performance, Section 50-04 *(Attachment C)* provides disciplinary guidelines and procedures. Section F of the Work Performance guidelines applies specifically to safety rule infractions. Records of disciplinary action shall be maintained by the Division Program Administrator for at least *five (5) years.*

D. Safety Recognition

Safety recognition will be done in accordance with current LADWP practice.

VIII. EMERGENCY RESPONSE PROCEDURES

Reference LADWP Administrative Manual, Section 110-30 *(Attachment B)* processes to be followed.

Personnel should also refer to the appropriate Division/Section Emergency Response Plan (or the Occupant Emergency Instructions for the WQ Lab) for instructions in obtaining fire, police, ambulance, medical, control room, or security help. During off-duty hours, personnel may refer to Emergency Response Plan: Section 4.0 Responsibilities; it contains pertinent information for both normal shift and off-shift emergencies. Orientation and periodic refresher training should include emergency response training.

A. Accident/Incident Response

Responsibilities of Senior-Level Employee at the Location:

- Make the accident scene safe and secure.
    - *Note:* Do not discuss the accident/incident with outsiders, except to obtain names of witnesses and to cooperate with any police investigation.

- Call for medical assistance.
  - Contact information will vary by location.
- Administer first aid and/or CPR, as appropriate. Check for any medical alert tags.
- In the absence of an approved local procedure, report the information as described in Administrative Manual, Section 110-31 *(Attachment B),* Reporting Injury or Fatality or Damage to Facilities of Equipment to the appropriate entity:
    - Energy Control Center (ECC) at (818) 352-9981
    - Los Angeles Water System Data Acquisition Control (LAWSDAC) at (213) 367-5118
    - Water Trouble Board (WTB) at (855) 262-9880
- Shut down the work activity at the site, as appropriate, as soon as it is safe and practical to do so.
- Preserve the accident scene by protecting and securing all equipment, tools, and clothing that are related to the accident/incident until the on-site investigation is completed.
- Call in others to perform the work if operations need to be restored and it is safe and practical to do so.
- Transport those personnel who were at the accident site to a suitable location away from the site, preferably to district headquarters.
- Inform involved personnel that Employee Assistance Program (EAP) counselors will be arriving to offer assistance.
- Monitor the management of the incident. Be readily available to provide direction, guidance and support as needed.
- Order a medical evaluation for drugs and/or alcohol whenever one or more of the following occurs:
  - There are any injuries.
  - There is any damage to LADWP property or private property which may result in a claim.
  - The supervisor determines that the sequence, the behavior, or unusual actions exhibited by any involved employee prior to the accident supports the need.

Note: if it is determined that a medical evaluation for drugs and/or alcohol is necessary, refer to Administrative Manual, Section 100-03, Supervisor’s Guidelines for Employee Drug and Alcohol Abuse.

- As appropriate, update the supervisor/manager, organization safety, WSS, CHSS, Chief Safety Officer, and Occupational Health Services regarding the accident/incident.

IX. ACCIDENT/INCIDENT INVESTIGATION

All injuries, newsworthy events, fatalities, or extensive damage to major facilities or major equipment are to be reported. Depending on the severity of the accident/incident, one or more reports may be required (refer to Administrative Manual, Sections 110-31 and 110-32, *Attachment B*).

A. Reporting Procedures

As a guide please see the “WATER SYSTEM SAFETY ACCIDENT/INCIDENT FORMS FLOW CHART” (*Attachment P*). Employees must report all injuries to their supervisor within 24 hours to comply with California law and for the injury to be considered as a potential workers’ compensation case. Employee and Vehicle Accident Guidelines are provided in (*Attachment D)*. A “State of California Employer’s Report of Occupational Injury or Illness,” Form 5020” *(Attachment S)* must be filed with the State of California within five days of knowledge of every occupational injury or illness resulting in lost time, beyond the day of the incident, or which requires medical treatment beyond first aid.

If the injury warrants the employee being sent to LADWP OHS or an outside medical facility, appropriate arrangements shall be made. A supervisor should represent the LADWP in discussions with LADWP OHS on the best method for returning the employee to work. Review the Worker’s Compensation Forms and information *(Attachments T and U)* for additional reference.

All supervisors are required to verbally, telephonically, or electronically (by e-mail) notify their respective Division Group Manager of injuries as soon as possible.

The Division Group Manager must attempt to verbally, telephonically or electronically (by e-mail) notify the Division Director, Division Assistant Director, Division Safety Support Staff Representative, and Manager of WSS of injuries as soon as possible. Specific instances require immediate telephonic notification to WSS – please see Accident/Incident Notification Memo November 2014 (*Attachment O*).

B. Formal Investigations

Formal accident investigations shall be conducted in accordance with LADWP Administrative Manual, Accidents and Injuries, Section 110-32 *(Attachment B).*

C. Informal Investigations

The Water System Safety Manager shall determine if there is a need for an informal investigation. It will be conducted by representatives from Water System Safety and coordinated with any Divisional Safety Groups in accordance with LADWP Administrative Manual, Section 110-32.

D. Cal OSHA Visits

Division should immediately notify WSS of any Cal OSHA visit or inspection. All document responses will be coordinated through WSS. Management and Supervisors should provide documents as requested to ensure a timely and thorough response.

E. Initial Investigations

Initial investigations of accidents/incidents resulting in minor injuries shall be conducted by the employee's immediate supervisor as soon as possible following any accident/incident, including preparation of the "Initial Accident/Incident Report" *(Attachment R),* which shall be forwarded to Water System Safety within eight (8) hours. The findings shall also be documented on a "State of California Employer's Report of Occupational Injury or Illness," Form 5020 *(Attachment S)* and LADWP's "Accident Analysis" *(Attachment Q)* forms.

The immediate supervisor and group leader shall review and approve each "Accident Analysis" form. Initial investigations shall include a determination of appropriate corrective action to prevent a recurrence of a similar accident. At times, Division may appoint inter-Division investigation and/or safety group to investigate accidents.

F. Mobile Equipment Accident Reporting Procedures

All incidents resulting in employee injury and/or illness or involving LADWP Mileage, contract, and rental vehicles resulting in damage to property of the LADWP or property of outsiders must be reported and forms completed as follows: An "Initial Accident/Incident Report" *(Attachment R),* shall be completed and forwarded to Water System Safety within eight (8) hours. Additionally, a "Statement of Accident-Mobile Equipment" *(Attachment W) and a "Supervisor's Analysis of Mobile Equipment Accident" (Attachment X) forms* must be filled out completely and provided to offices as indicated in the Employee and Vehicle Accident Guidelines *(Attachment P).*

XI. RECORDKEEPING

In compliance with Cal/OSHA recordkeeping requirements, each section shall keep records of training, tailgate meetings, safety audits, unsafe condition reports, and safety inspections and investigations. All records shall be maintained by the sections for a *minimum of five (5) years*.

Accident and injury investigations, disciplinary actions, Cal/OSHA logs and summary of Occupational Injuries and Illnesses, Cal/OSHA Log 300 and Cal/OSHA related notifications, citations, and letters shall be maintained indefinitely.

XII. ATTACHMENTS

A Cal/OSHA Title 8 CCR Section 3202, Injury and Illness Prevention Program
Cal/OSHA Title 8 CCR Section 1509, Injury and Illness Prevention Program

B LADWP Administrative Manual
- Sections 110-01 to 110-05 – Safety
- Sections 110-10 to 110-12 – Hazardous Substances
- Sections 110-20 to 110-21 – Safety Inspections
- Sections 110-30 to 110-34 – Accidents/Injuries

C LADWP Administrative Manual Section 50-04 - Work Performance

D Safety Roles and Responsibilities

E Facility or Job Site Safety Inspection Form

F Room Emergency Assignment Board Policy

G Safe Refuge Areas Map

H Remote and Isolated Worker Policy

I Report of Unsafe Condition or Hazard

J Tailgate or Group Safety Meeting-(Updated to WSS Tailgate Form)

K Office Ergonomics Bulletin 2018-090

L Periodic Office Safety Inspection Form

M Vehicle Backing-Up Policy

N Electronic Devices Policy Changes Bulletin 2015-05

O Accident/Incident Notification to Water System Safety Memorandum

P Employee and Vehicle Accident Forms and Guidelines and Water System Safety Accident/Incident Forms Flow Chart

Q LADWP Accident Analysis Form

R Initial Incident/Accident Report

S Employer's Report of Occupational Injury or Illness (Form 5020)

T Worker's Compensation Claim Form (DWC1) & Notice of Potential Eligibility

U Worker’s Compensation Program – Pre-designated Physician or Health Care Provider Form

V Statement of Accident – Mobile Equipment

W Supervisor’s Analysis of Mobile Equipment Accident Forms

X Safety Footwear Program Bulletin 2016-05

Y Prescription Safety Eyewear Program

If you need additional copies of this manual, or
if the manual needs revisions, please contact
the Water Quality Safety Committee Participants.

ATTACHMENT A

CAL/OSHA TITLE 8 CCR SECTION 3203,
INJURY ILLNESS PREVENTION PROGRAM

CAL/OSHA TITLE 8 CCR SECTION 1509,
INJURY AND ILLNESS PREVENTION PROGRAM

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Subchapter 7. General Industry Safety Orders
Group 1. General Physical Conditions and Structures Orders
Introduction

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§3203. Injury and Illness Prevention Program. ETOOL

Cal/OSHA Workplace Injury and Illness Prevention Program, with checklists for self-inspection || (printable version)

Prevention Model Program for High Hazard Employers
Prevention Model Program for Non-High Hazard Employers
Prevention Model Program for Employers with Intermittent Workers
Prevention Model Program for Workplace Security || (printable version)

(a) Effective July 1, 1991, every employer shall establish, implement and maintain an effective Injury and Illness Prevention Program (Program). The Program shall be in writing and, shall, at a minimum:
(1) Identify the person or persons with authority and responsibility for implementing the Program.
(2) Include a system for ensuring that employees comply with safe and healthy work practices. Substantial compliance with this provision includes recognition of employees who follow safe and healthful work practices, training and retraining programs, disciplinary actions, or any other such means that ensures employee compliance with safe and healthful work practices.
(3) Include a system for communicating with employees in a form readily understandable by all affected employees on matters relating to occupational safety and health, including provisions designed to encourage employees to inform the employer of hazards at the worksite without fear of reprisal. Substantial compliance with this provision includes meetings, training programs, posting, written communications, a system of anonymous notification by employees about hazards, labor/management safety and health committees, or any other means that ensures communication with employees.
Exception: Employers having fewer than 10 employees shall be permitted to communicate to and instruct employees orally in general safe work practices with specific instructions with respect to hazards unique to the employees' job assignments as compliance with subsection (a)(3).
(4) Include procedures for identifying and evaluating work place hazards including scheduled periodic inspections to identify unsafe conditions and work practices. Inspections shall be made to identify and evaluate hazards:
(A) When the Program is first established;
Exception: Those employers having in place on July 1, 1991, a written Injury and Illness Prevention Program complying with previously existing section 3203.
(B) Whenever new substances, processes, procedures, or equipment are introduced to the workplace that represent a new occupational safety and health hazard; and
(C) Whenever the employer is made aware of a new or previously unrecognized hazard.
(5) Include a procedure to investigate occupational injury or occupational illness.
(6) Include methods and/or procedures for correcting unsafe or unhealthy conditions, work practices and work

procedures in a timely manner based on the severity of the hazard:
(A) When observed or discovered; and,
(B) When an imminent hazard exists which cannot be immediately abated without endangering employee(s) and/or property, remove all exposed personnel from the area except those necessary to correct the existing condition. Employees necessary to correct the hazardous condition shall be provided the necessary safeguards.
(7) Provide training and instruction:
(A) When the program is first established;
Exception: Employers having in place on July 1, 1991, a written Injury and Illness Prevention Program complying with the previously existing Accident Prevention Program in Section 3203.
(B) To all new employees;
(C) To all employees given new job assignments for which training has not previously been received;
(D) Whenever new substances, processes, procedures or equipment are introduced to the workplace and represent a new hazard;
(E) Whenever the employer is made aware of a new or previously unrecognized hazard; and,
(F) For supervisors to familiarize themselves with the safety and health hazards to which employees under their immediate direction and control may be exposed.
(b) Records of the steps taken to implement and maintain the Program shall include:
(1) Records of scheduled and periodic inspections required by subsection (a)(4) to identify unsafe conditions and work practices, including person(s) conducting the inspection, the unsafe conditions and work practices that have been identified and action taken to correct the identified unsafe conditions and work practices. These records shall be maintained for at least one (1) year; and
Exception: Employers with fewer than 10 employees may elect to maintain the inspection records only until the hazard is corrected.
(2) Documentation of safety and health training required by subsection (a)(7) for each employee, including employee name or other identifier, training dates, type(s) of training, and training providers. This documentation shall be maintained for at least one (1) year.
EXCEPTION NO. 1:Employers with fewer than 10 employees can substantially comply with the documentation provision by maintaining a log of instructions provided to the employee with respect to the hazards unique to the employees' job assignment when first hired or assigned new duties.
EXCEPTION NO. 2: Training records of employees who have worked for less than one (1) year for the employer need not be retained beyond the term of employment if they are provided to the employee upon termination of employment.
EXCEPTION NO. 3: For Employers with fewer than 20 employees who are in industries that are not on a designated list of high-hazard industries established by the Department of Industrial Relations (Department) and who have a Workers' Compensation Experience Modification Rate of 1.1 or less, and for any employers with fewer than 20 employees who are in industries on a designated list of low-hazard industries established by the Department, written documentation of the Program may be limited to the following requirements:
A. Written documentation of the identity of the person or persons with authority and responsibility for implementing the program as required by subsection (a)(1).
B. Written documentation of scheduled periodic inspections to identify unsafe conditions and work practices as required by subsection (a)(4).
C. Written documentation of training and instruction as required by subsection (a)(7).
ExceptionNo. 4: Local governmental entities (any county, city, city and county, or district, or any public or quasi-public corporation or public agency therein, including any public entity, other than a state agency, that is a member of, or created by, a joint powers agreement) are not required to keep records concerning the steps taken to implement and maintain the Program.
Note1: Employers determined by the Division to have historically utilized seasonal or intermittent employees shall be deemed in compliance with respect to the requirements for a written Program if the employer adopts the Model Program prepared by the Division and complies with the requirements set forth therein.
Note2: Employers in the construction industry who are required to be licensed under Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code may use records relating to employee training provided to the employer in connection with an occupational safety and health training program approved by the Division, and shall only be required to keep records of those steps taken to implement and maintain the program with respect to hazards specific to the employee's job duties.
(c) Employers who elect to use a labor/management safety and health committee to comply with the communication

requirements of subsection (a)(3) of this section shall be presumed to be in substantial compliance with subsection (a)(3) if the committee:
(1) Meets regularly, but not less than quarterly;
(2) Prepares and makes available to the affected employees, written records of the safety and health issues discussed at the committee meetings and, maintained for review by the Division upon request. The committee meeting records shall be maintained for at least one (1) year;
(3) Reviews results of the periodic, scheduled worksite inspections;
(4) Reviews investigations of occupational accidents and causes of incidents resulting in occupational injury, occupational illness, or exposure to hazardous substances and, where appropriate, submits suggestions to management for the prevention of future incidents;
(5) Reviews investigations of alleged hazardous conditions brought to the attention of any committee member. When determined necessary by the committee, the committee may conduct its own inspection and investigation to assist in remedial solutions;
(6) Submits recommendations to assist in the evaluation of employee safety suggestions; and
(7) Upon request from the Division, verifies abatement action taken by the employer to abate citations issued by the Division.
Note: Authority cited: Sections 142.3 and 6401.7, Labor Code. Reference: Sections 142.3 and 6401.7, Labor Code.
HISTORY
1. New section filed 4-1-77; effective thirtieth day thereafter (Register 77, No. 14). For former history, see Register 74, No. 43.
2. Editorial correction of subsection (a)(1) (Register 77, No. 41).
3. Amendment of subsection (a)(2) filed 4-12-83; effective thirtieth day thereafter (Register 83, No. 16).
4. Amendment filed 1-16-91; operative 2-15-91 (Register 91, No. 8).
5. Editorial correction of subsections (a), (a)(2), (a)(4)(A) and (a)(7) (Register 91, No. 31).
6. Change without regulatory effect amending subsection (a)(7)(F) filed 10-2-92; operative 11-2-92 (Register 92, No. 40).
7. Amendment of subsection (b)(2), ExceptionNo. 1, new ExceptionNo. 3 through ExceptionNo. 4, Note2, and amendment of subsection (c)(2) filed 9-13-94; operative 9-13-94 pursuant to Government Code section 11346.2 (Register 94, No. 37).
8. Editorial correction of subsections (a)(6)(A) and (a)(7)(A) (Register 95, No. 22).
9. Amendment of subsections (b)(1)-(2) and (c)(2) filed 6-1-95; operative 7-3-95 (Register 95, No. 22).
10. Editorial correction of subsection (a)(4) (Register 2002, No. 46).

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Subchapter 4. Construction Safety Orders
Article 3. General

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§1509. Injury and Illness Prevention Program. ETOOL

- Pocket Guide for the Construction Industry
- Cal/OSHA Workplace Injury and Illness Prevention Program, with checklists for self-inspection

- Prevention Model Program for High Hazard Employers
- Prevention Model Program for Non-High Hazard Employers
- Prevention Model Program for Employers with Intermittent Workers
- Prevention Model Program for Employers with Intermittent Workers in Agriculture
- Workplace postings
- Tailgate/Toolbox Topics: Setting up a Tailgate/Toolbox Safety Meeting

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(a) Every employer shall establish, implement and maintain an effective Injury and Illness Prevention Program in accordance with section 3203 of the General Industry Safety Orders.

(b) Every employer shall adopt a written Code of Safe Practices which relates to the employer's operations. The Code shall contain language equivalent to the relevant parts of Plate A-3 of the Appendix.

(c) The Code of Safe Practices shall be posted at a conspicuous location at each job site office or be provided to each supervisory employee who shall have it readily available.

(d) Periodic meetings of supervisory employees shall be held under the direction of management for the discussion of safety problems and accidents that have occurred.

(e) Supervisory employees shall conduct "toolbox" or "tailgate" safety meetings, or equivalent, with their crews at least every 10 working days to emphasize safety.

NOTE: Authority cited: Sections 142.3 and 6401.7, Labor Code. Reference: Sections 142.3 and 6401.7, Labor Code.

HISTORY

1. Amendment of subsection (b) filed 3-28-75; effective thirtieth day thereafter (Register 75, No. 13).

2. Amendment of subsection (b) filed 5-21-75; effective thirtieth day thereafter (Register 75, No. 21).

3. Amendment of subsection (d) filed 10-18-77; effective thirtieth day thereafter (Register 77, No. 43).

4. Repealer and new section filed 9-27-85; effective thirtieth day thereafter (Register 85, No. 40).

5. Amendment filed 1-16-91; operative 2-15-91 (Register 91, No. 8).

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ATTACHMENT B

LADWP ADMINISTRATIVE MANUAL

- **Sections 110-01 to 110-05: Safety**
- **Sections 110-10 to 110-12: Hazardous Substances**
- **Sections 110-20 to 110-21: Safety Inspections**
- **Sections 110-30 to 110-34: Accidents/Injuries**

110

ADMINISTRATIVE MANUAL	Section: SAFETY
	Subject: Safety Related Roles and Responsibilities

The Los Angeles Department of Water and Power (LADWP) is committed to a system of health and safety management that employs the collective efforts of multiple groups, organizations, and personnel dedicated to ensuring a safe and healthful work environment as well as to achieving and maintaining regulatory compliance. Organizations with contributing roles and responsibilities towards the LADWP's health and safety efforts include LADWP Safety, Corporate Health and Safety Services (CHSS), System Safety Groups, and Division Safety Groups.

References:

California Code of Regulations, Title 8, Section 330, 342, 3203
Administrative Manual, Sections:
50-04, A Guide to Employee Discipline
100-13, Employee Assistance Program
110-02, Injury and Illness Prevention Program
110-31, Reporting a Serious Injury or Fatality or Damage to Facilities or Equipment
110-32, Accident/Incident Investigation
Applicable MOUs

ROLES AND RESPONSIBILITIES

CHIEF SAFETY OFFICER

Has the resonsiblity to:

Lead LADWP's health and safety program and provide direction regarding the overall health and safety effort.

Advise the General Manager regarding all matters relating to the health and safety of employees and others affected by the LADWP's operations. In particular, the Chief Safety Officer shall:

- Establish and oversee written LADWP health and safety standards that are in compliance with applicable regulations, best practices and/or industry standards.
- Ensure changes to regulatory requirements are communicated throughout LADWP.

- Designate the Chair of the Accident Investigation Committee (AIC) for identified serious injuries or illness.
- Ensure the Accident Investigation report, findings, and lessons learned are disseminated to the System Heads as appropriate.

CORPORATE HEALTH AND SAFETY SERVICES (CHSS)

Has the responsiblity to:

Assist managers, supervisors, and employees by coordinating LADWP safety and health related activities to include:

- Maintain knowledge of current, applicable, health and safety related regulatory requirements and communicate relevant updates and changes to the LADWP Chief Safety Officer.
- Establish health and safety standards that are in compliance with applicable regulations, best practices and/or industry standards.
- Provide guidance in the development, implementation, and monitoring the effectiveness of health & safety programs.

SYSTEM SAFETY

Comprised of front line personnel with the primary responsibility for development and maintenance of the health and safety program throughout their respective organizations.

- Recommend control measures and advise on appropriate Personal Protective Equipment (PPE) issued to employees.
- Develop specific instructional materials and safety related programs.
- Assist management and supervision in investigating accidents and other unusual incidents in order to prepare preliminary reports, including any recommendations.

- Develop and administer safety recognition programs.
- Help evaluate and purchase necessary health and safety equipment, and keep current with state-of-the-art methods, work practices, and equipment as they relate to safety.
- Create and maintain the Systems' Injury and Illness Prevention Program(s) (IIPPs).
- Participate in AIC for Informal Investigations and chair committees for Formal Investigations.
- Conduct Quarterly Safety Meetings.
- Identify and recommend health and safety training needs to maintain compliance with changes in regulatory requirements.

MANAGERS

Have the responsiblity for maintaining a safe work environment for all personnel under their authority, including personnel who may be affected by the organization's activities. In particular they will:

- Ensure that systems are in place to train employees on their responsibilities and perform their duties in a safe and healthful manner.
- Ensure all employees are suitably trained/competent to carry out the prescribed task and that the necessary licenses/certificates are in force and appropriate.
- Ensure all employees are trained and directed to follow policies and procedures that are applicable to their work.

SUPERVISORS

Supervisor is responsible for the safety of all personnel under his/her authority, including personnel who may be affected by his/her organization's activities. In accordance with the applicable IIPP, responsibilities include:

- Ensure that all employees are provided with a copy of (or have immediate access to) the appropriate IIPP(s); receive identified training as defined in standards and procedures; are issued the appropriate PPE as required and perform their activities in alignment with health and safety policies, practices, and procedures.
- Understand and implement the LADWP safety policies.
- Acknowledge the responsibilities of personnel under their authority and ensure that each employee knows his/her responsibilities and performs their work in a safe and healthful manner.
- Conduct regular evaluation of work sites to identify work hazards, and devise means to reduce or eliminate said hazards.
- Ensure that all equipment complies with appropriate safety requirements and is approved for use.
- Emphasize to employees their responsibility to protect themselves, their co-workers, and the public through safe and healthful work habits.

EMPLOYEES

Employees are responsible to follow all health and safety rules, policies and procedures that are applicable to their work, at all times, and encourage co-workers to work safely. Additionally, employees must also cooperate with the LADWP in ensuring a safe and healthful work environment. Employees are expected to:

- Adhere to and follow all health and safety rules, policies and procedures that are applicable to their work, at all times.

- Immediately report any unsafe working conditions, practices, equipment, tools, “near miss” incidents, accidents and/or injuries to their supervisor.
- Use and/or wear appropriate safety equipment/PPE as required;
- Attend and participate in safety related training and meetings as required and assigned.
- Obtain and maintain necessary licenses/certificates as appropriate.
- Participate fully in all investigations.

ADMINISTRATIVE MANUAL	Section: **SAFETY**
	Subject: **Injury and Illness Prevention Program**

The Los Angeles Department of Water and Power (LADWP) is committed to providing a safe and healthful work environment and to eliminating or minimizing any hazards that may exist in the workplace. In addition, California regulations require employers to establish and maintain an effective Injury and Illness Prevention Program.

References:

Administrative Manual, Sections:
California Code of Regulations Title 8, section 3203, 1509
50-04, A Guide to Employee Discipline
110-01, Safety Related Roles and Responsibilities
110-04, Safety Recognition Awards — Guidelines
110-05, Coordination of Safety Documents
Intra-Departmental Letter, Injury and Illness Prevention Program, July 1, 1991
Applicable MOUs

RESPONSIBILITIES

For a more detailed discussion of safety and health related roles and responsibilities, refer to Section 110-01, Safety Related Roles and Responsibilities.

General Manager of the LADWP has the authority and responsibility to:

- Incorporate the Injury and Illness Prevention Program (IIPP) into the LADWP culture.
- Delegate authority to the Director of Corporate Health and Safety to oversee and lead the health and safety efforts at the LADWP.
- Work with the Board of Water and Power Commissioners to authorize the allocation of physical and financial resources necessary to maintain an effective IIPP.
- Ensure each System develops and maintains an effective IIPP in compliance with this Administrative Policy.

LADWP Chief Safety Officer has the responsibility to:

- Conduct legislative/regulatory review and develop LADWP Safety and Health Standards that are in compliance with applicable Federal, State, and Local laws, codes and regulations.
- Provide management with the information necessary to assist them in meeting their obligation of providing a safe and healthful work environment.
- Provide guidance and support to the Systems in the development, implementation and maintenance of their IIPPs, Documented Practices, and Job Hazard Assessments (JHAs) to ensure compliance with LADWP Standards.
- Assist management, supervisors, and employees by providing resources and support necessary to ensure that operations where employees encounter health and safety hazards are conducted safely and in accordance with LADWP safety rules and this IIPP.

Corporate Health and Safety Services (CHSS) has the responsibility to:

- Report work related fatalities and serious injuries to the appropriate Cal/OSHA district office within the appropriate time frame.
- Evaluate the health and safety related content and effectiveness of documented practices.
- Provide consultation services regarding health and safety related issues.
- Assist in conducting Job Hazard Assessments.

- Assist in documenting employee exposure to job related chemical or physical stressors.
- Assist in developing and implementing health and safety training.

System Safety Groups (Power, Water, and Joint) have the responsibility to:

- Implement and maintain System IIPP(s) consistent with LADWP policies, procedures, and directives of the LADWP Chief Safety Officer.

Project Managers/Contract Administrators have the responsibility to:

- Ensure contractor's compliance with IIPP requirements.

Each Division Director has the responsibility to:

- Establish, implement, and maintain an effective written IIPP for their respective Division and ensure approval by System Safety/CHSS.
- Identify the need for Safety Coordinators/Groups and assign responsibilities as appropriate ensuring collaboration with LADWP Safety/System Safety.
- Ensure supervisors and managers under their direction understand their responsibilities and effectively implement the IIPP and related safety programs within their span of control.
- Ensure a copy of the Division's IIPP is available to employees – this may be accomplished through electronic access.

- Ensure the development, maintenance and implementation of documented practices or standard operating procedures is in compliance with LADWP standards.
- Evaluate the effectiveness of the IIPP, update the program and provide feedback to CHSS as appropriate.
- Actively support the system implemented for communicating with employees on matters relating to employee health and safety.
- Ensure reports of major incidents, accidents, injuries, regulatory visits and communications are made as appropriate to the LADWP Chief Safety Officer.
- Apply appropriate disciplinary action for violations of health and safety rules, policies, or procedures.

Section Managers and Supervisors have the responsibility to:

- Maintain and implement the IIPP in their respective work area(s) and answer questions about the IIPP.
- Ensure employees are aware of and have access to the Division's IIPP. Electronic access is acceptable.
- Inform Division managers, other management and LADWP/CHSS of safety related issues to include major incidents, accidents, injuries, and regulatory visits.
- Be familiar with the safety program and ensure its effective implementation.
- Support and promote all safety & health programs and committees.

- Actively participate in safety committees.

- Inspect and audit work areas to detect unsafe conditions and work practices, and to ensure good job site housekeeping.

- Review serious accidents and incidents to ensure that proper reports are completed and appropriate training is given to prevent recurrence.

- Implement documented practices and standard operating procedures.

- Request the assistance of Safety Groups as needed to implement division documented practices.

- Ensure development of Job Hazard Assessments (JHAs) for new or existing tasks, including processes, procedures, equipment or exposure to hazardous substances performed by employees under their direct supervision.

- Identify employees to attend health and safety training and ensure documentation of such training is maintained. With the assistance of designated training personnel, ensure that subordinate employees receive adequate training and orientation including remedial and periodic safety training.

- Provide personal protective equipment and direct employees to properly use such equipment.

- Participate in the disciplinary process, as appropriate, for violations of safety related rules and/or regulations.

- Recognize individual and group safety achievements.

EMPLOYEES have the responsibility to:

- Follow all health and safety rules, policies and procedures that are applicable to their work, including the location of emergency response information and equipment.
- Immediately report any unsafe working conditions, practices, equipment, tools, “near miss” incidents, accidents and/or injuries to supervision.
- Wear appropriate safety equipment/personal protective equipment (PPE) as required.
- Properly use, inspect and care for equipment, hand and power tools, and ensure all safety guards are in place.
- Maintain good housekeeping.
- Encourage co-workers to work safely.
- Attend safety related training as required and assigned.

IIPP ELEMENTS

The following elements and methods of implementation will be included and described within each IIPP.

AUTHORITY AND RESPONSIBILITY

The IIPP shall identify a person within the Division with the authority and responsibility for implementing the program.

An organizational chart will be provided and updated as appropriate identifying the Division Director, managers, and supervisors with responsibilities for implementing and maintaining the IIPP within their areas of responsibility.

Designated responsibilities for each person or persons with authority and responsibility for program implementation shall be provided.

COMMUNICATIONS

Orientation — Each employee is to receive a safety and health orientation covering LADWP policies, procedures, and operating elements of the IIPP. Attendance is to be documented.

New employees will be given a safety orientation as identified in the Safety & Emergency section of the Formal Employee Orientation Guide First 90 Days of Employment. This document, or an equivalent, is to be completed and signed by the employee and supervisor.

Employees assigned to a new work location shall be provided the Emergency Response/Emergency Action Plan/Occupant Emergency Instructions and shall be informed of identified hazards for the new facility within 10 working days of arrival.

Meetings — Safety meeting shall be held as follows:

- Non-high hazard work – periodically as determined by organization management.
- Construction related – at least every ten (10) working days.
- High hazard non-construction – daily or more frequently. Tailgates may satisfy this requirement. Safety meetings shall be used as a means to communicate potential occupational hazards associated

with specific job-related tasks and encourage employees to discuss any safety concerns.

E-mail, Web Postings, Posters, Bulletins, and other Notices are to be distributed by CHSS/System/Division Safety as appropriate. Urgent action bulletins will be distributed to appropriate work groups, as required. Safety Guidelines, Policies, Bulletins, Procedures and Safety Communications shall be sent to employees via the LADWP's email system and Intra-departmental mail.

A safety bulletin board will be located on site at each organizations permanent reporting location that shall include all required Cal/OSHA notices, posters, and other safety information.

Safety Rules Book — A copy of the LADWP Safety Rules Book shall be available to each employee. In addition, organizations may develop appropriate safety rules specific to their operations.

Employee Input — Employees are to be encouraged to submit safety suggestions and report unsafe conditions without fear of reprisals.

Safety suggestions should be forwarded in writing, either anonymously or with the employee's name, to the Supervisor and/or designated Safety Coordinator/CHSS. The supervisor and appropriate safety section will evaluate the suggestion and take the appropriate action.

Major incidents, accidents, injuries and regulatory visits - Each supervisor shall communicate safety related issues to their chain of command as well as to LADWP Safety/CHSS and other management as appropriate.

TRAINING

LADWP or government mandated safety and health training, certification, review of policies, procedures and expectations will be provided to applicable job classifications during orientation, IIPP review, regular scheduled training, safety meetings, etc. Current records will be maintained for each employee who completes LADWP or outside training classes.

Retraining is required for employees whose safety performance has been found deficient. This retraining shall be documented with a Safety Instructional Memo and placed in the employee's personnel folder.

WORKPLACE HAZARDS ASSESSMENT AND INSPECTIONS

Workplace hazards including unsafe conditions and work practices are identified through documented Job Hazard Assessments and inspections.

All LADWP workplaces are to be periodically assessed and inspected. The assessments will be documented, and all deficiencies, corrective actions taken, and the name of the person responsible for the correction are to be recorded. Assessments and inspections shall include:

1. Continuous assessments - Employees are responsible for immediately reporting identified unsafe conditions, practices, and/or equipment to their supervisors and/or designated Safety Coordinator/CHSS .
2. Periodic site inspections and audits conducted by supervisors:
    - Daily walk-through inspections of hazardous operations to ensure established work practices are being followed and to identify unsafe

conditions and/or unsafe work practices.

- Regular job site safety and health inspections as part of routine duties of supervision and documentation of findings.

- Actions to correct unsafe conditions or unsafe practices shall be taken immediately.

- Actions taken to correct unsafe work practices or conditions shall be documented. A copy of the document must be kept on file on site in an accessible location in accordance with the LADWP Records Management Program, and the original forwarded as soon as possible to the Division Safety Coordinator or designee.

3. Semi-annual site inspections are conducted by managers or their designeeS.

All inspection documents and audit documents including those of contractors/consultants are kept on site, in accordance with the LADWP Records Management Program, by the supervisor or his/her designee. These documents shall be made available upon request to authorized personnel.

OCCUPATIONAL INJURY OR ILLNESS INVESTIGATION PROCEDURE

Employees shall report all accidents/incidents to their supervisors immediately. If the accident requires medical treatment, it shall be reported as per Cal/OSHA's and LADWP's requirements on Form 5020. Copies shall be sent to the Workers' Compensation Office, CHSS, and the appropriate safety organization. In addition, an Accident Analysis Form shall be completed by the supervisor and attached to the Cal/OSHA document. The Accident Analysis shall serve as a preliminary investigation. The supervisor shall also prepare the Initial Accident/Incident Report within eight hours of the accident/incident and forward it to System Safety.

In addition, the LADWP's policy set forth in Section 110-32. Accident/Incident Investigation shall be followed.

METHODS FOR CORRECTION OF UNSAFE OR UNHEALTHFUL CONDITION

When an unsafe practice, equipment, or condition is observed or is otherwise brought to the supervisor, the hazardous condition, practice or procedure shall immediately be corrected or eliminated when an imminent hazard is observed or discovered.

When an imminent hazard exists which cannot be immediately abated without endangering employee(s) and/or property, all exposed personnel will be removed from the area except those necessary to correct the existing condition. Employees who correct the hazardous condition shall be provided the necessary safeguards.

If elimination of the hazardous condition is not within the immediate supervisor's capability, the supervisor shall safeguard the hazard to prevent injury to personnel and/or damage to property, remove all personnel except those needed to correct the problem, and promptly report the nature and location of the hazardous condition to the next level of supervision. If elimination of the hazardous condition is not within the capability of the second level supervisor to correct, the problem should be reported to the next designated level, or to the Division Safety Office, System Safety Office, or CHSS.

Supervisors shall document corrective actions, including projected and actual completion dates. If necessary, supervisors can seek assistance in developing appropriate corrective actions by contacting the Division Safety Office, System Safety Office, or CHSS.

Techniques for Correcting Identified Hazards are documented in inspection findings, incident investigations, Job Hazard Assessments, documented procedures and standard operating procedures. Control techniques may include:

- Engineering Controls: machine guarding, ventilation, noise reduction at the source, and provision of material handling equipment. These are the first and preferred methods of control.
- Administrative Controls: The next most desirable method would include rotation of employees or limiting exposure time.
- PPE: back support belts, hearing protection, respirators and safety glasses. These are often the least effective controls for hazards, and should be relied upon in and of themselves only when other controls are ineffective or impractical.

Employees shall use prescribed PPE when required by policy, procedure or management. PPE is issued by the LADWP and shall be maintained according to the manufacturer's recommendations. Employees are to be trained as required in the proper use and maintenance of PPE.

DOCUMENTATION

A Cal/OSHA Log and Summary of Occupational Injuries and Illnesses (Form 300) is to be kept current at each designated log location.

An Employer's Report of Occupational Injury or Illness (Form 5020) is to be completed and retained following established guidelines.

All documentation associated with the implementation and operation of the IIPPs shall be retained in accordance with the LADWP Records Management Program.

RECOGNITION AND DISCIPLINE

The LADWP requires employee participation in the established IIPP, recognizes and acknowledges outstanding safety performance by DivisionS and encourages each Division to recognize organizational units and individual employees for safety performance specific to their operations (refer to Administrative Manual, Section 110-04, Safety Recognition Awards — Guidelines).

Disciplinary actions for safety violations shall be imposed in accordance with Administrative Manual, Section 50-04, A Guide to Employee Discipline when deemed necessary to ensure adherence to established policies, procedures and rules.

ADMINISTRATIVE MANUAL

Section

SAFETY

Subject

Video Display Terminal (VDT) Work Station Standards

It is the Department's policy to provide a proper work environment and to maximize productivity, In support of that policy, the Department will equip office computer work stations to maximize comfort, health, and safety and train users on the use of such equipment, in accordance with the following standards.

The Information Technology Services (ITS) Business Unit, the Safety, Health, and Environmental Protection (SHEP) Business Unit, and facility maintenance managers are responsible for working with the users to ensure that office computer work stations conform to these standards.

The ITS Business Unit and the Occupational Health and Benefits Business Team are responsible for establishing a basic training program and assisting users in modifying the basic program to meet their specific needs.

The ITS Business Unit is responsible for maintaining maintenance records for VDTs and associated equipment. Organizational units with other computer types are responsible for maintaining records for their equipment types.

Each user organization should adopt a plan to ensure that all office computer work stations meet these standards and work with those organizations responsible for purchasing, installing, and maintaining the computer equipment, furniture, lighting systems, and communication systems to ensure full compliance with the standards within a reasonable time period.

All VDT stations shall conform to the guidelines listed below.

References:
Administrative Manual, Section 10-01, Basic Policy Statement
Memorandum, dated November 7, 1991, Video Display Terminal (VDT) Standards
Applicable MOUs

CHAIR

- Shall be easily adjustable for seat height and angle and backrest height and angle.
- Shall be easily adjustable by the user while the chair is in an upright position without the use of tools.
- The chair backrest shall provide lumbar support.

- The chair base shall be equipped with casters.
- The chair seat, backrest, and any armrests shall be made of moisture absorbing material.

KEYBOARD

- The keyboard shall be detachable and adjustable to height and angle.
- The keyboard must be able to be situated at different levels, by use of an adjustable work surface (e.g., computer table, desk top, etc.), or appropriate accessory.

SCREEN

- The entire viewing area of the screen shall be adjustable to fit the operator's plane of vision, with the top of the screen at about eye level when the operator is sitting at the terminal.
- The screen is to be adjustable between zero and 60 degrees below the horizontal plane passing through the eyes of the operator.
- The screen must be able to be situated at different levels, by use of an adjustable work surface (e.g., computer table, desk top, etc.), or appropriate accessory.
- The screen shall be adjustable for brightness and contrast
- Color monitors shall be inspected as necessary for conformance with manufacturer's specifications.

GLARE

- The VDT work station shall be located to avoid excessive glare. Where such an arrangement is not possible, windows shall be fitted with tinting, blinds, or drapes.
- A glare-inhibiting work surface is desirable.
- The luminance of the VDT characters against their background shall be such that the characters are easily distinguishable.
- If the screen color and adjustable contrast are unable to reduce screen glare, a no glare screen overlay shall be fitted on the VOT.

ADMINISTRATIVE MANUAL

Section

SAFETY

Subject

Video Display Terminal (VDT) Work Station Standards

LIGHTING

- The lighting in the work area shall be from indirect or recessed sources (within 200-500 lux) with the exception of an adjustable task light

OTHER ACCESSORIES

- Document holders are to be available where required by the work activity.
- Footrests and wrist rests shall be available upon request

PRINTER

- Printers that produce excessive noise shall be in a separate room or equipped with noise suppression panels or furniture.

TRAINING AND EDUCATION

The proper use of equipment and the opportunity to stretch and perform at-the-work station exercises can relieve physical stress that may be due to prolonged terminal usage without the need for accessories.

- Training programs are to focus on informing each user on how to relieve musculoskeletal stress and how to adjust their equipment and furniture to maximize comfort, health, and safety.

- A guide for the proper operation of VDTs and associated equipment shall be made available to all users. The guide shall include instructions on exercises to relieve visual and musculoskeletal strain, the proper use of any footrests and wrist rests, proper posture, and other beneficial work habits.

- VDT operators and users shall also be trained in the use of VDTs and associated equipment and their safe and healthful operation. Training records shall be maintained by the user organizations.

TRAINING AND EDUCATION (continued)

- Priorities are to be established so that implementation of these standards and user training is provided first to those users whose duties require extended computer work hours (six to eight hours each day).

- Each user organization is to implement the training programs as soon as possible to achieve the flu? Benefits of these standards.

ADMINISTRATIVE MANUAL

Section

SAFETY

Subject

Safety Recognition - Guidelines

The Department presents safety incentives to work groups and to individual employees in recognition of safety achievement. Incentives may be made available to all employees within a facility or a functional group within a facility or to individual employees. Where the requirements for such incentives are specified in the organization's Injury and Illness

Prevention Program, the following guidelines cover the criteria, the type and frequency of incentives, the allowable types of presentation functions, and the appropriate cost of the incentives.

References:
Administrative Manual, Sections:
110-01, Basic Policy
110-02, Injury and Illness Prevention Program
lntra-Departrnental Letter, Safety Recognition Awards Guidelines, August 5, 1994
Applicable MOUs

CONSIDERATION

In determining the type, cost, and frequency of incentives, consideration should be given to:

Group — The risks faced by the employee group.

Individual — The individual's risk category. Recognition for individual safety performance may be given to employees who perform either high- or low-risk work.

CRITERIA FOR INCENTIVES

Group or Individual —The primary criterion is the achievement of no lost workdays over a defined period.

However, business unit management may apply additional or alternative criteria, such as achievement of specific safety goals and/or working without preventable vehicle accidents, recordable injuries, and safety rule violations.

TYPES OF INCENTIVES

Group — Recognition should be appropriate to the safety achievement. Safety plaques or certificates may be given to the group, with individual recognition to the employees who were part of the group. Typical incentives may include:

- Caps
- Coffee mugs
- Fire extinguishers
- Flashlights
- Jackets
- Survival/first aid kits

Individual — Typical incentives may include:

- Belt buckles
- Caps
- Certificates
- Flashlights
- Hard hat decals
- Key chains
- Pins

FREQUENCY OF RECOGNITION

Group or Individual — Recognition is to be based upon achieving the safety criteria for a defined time period such as quarterly or annually or group exposure hours (e.g., 100,000 work hours).

PRESENTATION FUNCTIONS

Group — Recognition may be given at events such as:

- On-site meetings with refreshments, breakfasts, or luncheons/barbecues.
- Off-site functions such as a dinner or family picnic.

— Off-site functions require approval of the business unit director.
— Group functions that may indude guests may be held for groups that achieved the group's established exposure hours with no lost workdays.
— Group functions may be held no more than once a year.
— The cost for the employee and guests combined must not exceed the employee cost limit shown below.

PRESENTATION FUNCTIONS (Continued)

Individual — Recognition may be given at either group safety award functions or at other on-site safety meetings.

ALLOWED EXPENDITURES

The level of expenditure should be appropriate for the level of achievement, subject to the following guidelines:

Group

- Expenditures for high risk groups should be limited to $100 per employee per year, including the cost of any functions.
- For exceptional accomplishments, such as 500,000 or more safe work hours or five or more safe work years, the $100 per employee per year limit may be increased to a limit of $150.
- Low-risk group expenditures are limited to $35 per employee per year.

Individual

- High-risk individual expenditures should be limited to $40 per employee per year.
- Low-risk individual expenditures should be limited to $20 per employee per year.

APPROVAL

Expenditures for safety recognition must be approved by the business unit director.

ADMINISTRATIVE MANUAL

Section

SAFETY

Subject

Coordination of Safety Documents

Copies of any documents pertaining to employee safety, whether originated by the Department or received from any industrial safety enforcement agency, shall be forwarded to the Department Safety Engineer in the Safety, Health and Environmental Protection Business Unit

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TYPES OF DOCUMENTS

- Citations, notices, information memorandums, or special orders issued by the Division of Occupational Safety and Health (DOSH), California Department of Industrial Relations.

- Survey reports issued by the California Department of Health Services or the Los Angeles County Health Services Department.

- Employee safety requirements issued by the Los Angeles City Fire Department or other fire jurisdictions.

- Requests issued by Department organizations to DOSH for variances in California Safety Orders.

Note: Employees who plan to comment before the Occupational Safety and Health Standards Board or any other body about proposed changes in the California Safety Orders must inform the Department's Safety Engineer.

ADMINISTRATIVE MANUAL	Section: HAZARDOUS SUBSTANCES
	Subject: Hazard Communication Program

The Los Angeles Department of Water and Power (LADWP) is committed to providing a safe and healthful work environment and to eliminating or minimizing hazards that may exist in the workplace. In addition, California regulations require employers to notify employees of hazardous substances present in their work place. Additional information, including the LADWP's Written Hazard Communication Program, may be accessed from the Corporate Health and Safety Services home page on the intranet.

References:
California Safe Drinking Water and Toxic Enforcement Act
Section 3204(e), "Access to Employee Exposure and Medical Records."
Hazard Communication Standard, Title 8, California Code of Regulations, Section 5194
LADWP's Hazardous Materials and Hazardous Waste Procedures, Appendix 4.2.6
LADWP's Hazardous Communication Program, December 1990
General Manager's Bulletin No. 85-30, Hazard Communications Act, November 7, 1985
Safety Administrator's Globally Harmonized System (GHS) Memo October 1, 2013

ABBREVIATIONS

CHSS – Corporate Health and Safety Services

OSHA - Occupational Safety and Health Administration

Cal/OSHA – California Occupational Safety and Health Administration

SDS – Safety Data Sheet - Written or printed material concerning a hazardous substance which is prepared in accordance with OSHA guidelines (formerly called Material Safety Data Sheet (MSDS)).

SCOPE

This Hazard Communication Program (Program) applies to LADWP work environments where hazardous chemicals are known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a reasonably foreseeable emergency resulting from workplace operations.

RESPONSIBILITIES

CHSS

- Maintain information related to acquiring SDSs.
- Maintain and update this Program.
- Develop and provide training as needed related to this Program.
- Respond to requests from regulatory agencies and medical personnel.
- Approve all chemical purchases that are new to the workplace.

MANAGEMENT AND SUPERVISION

- Ensure that employees comply with the requirements of this Program.
- Ensure that employees receive the appropriate training.
- Ensure SDS accessibility during each work shift.

PROJECT MANAGERS

- Inform contract staff of chemical hazards that they may encounter as a part of their work, and ensure contractual compliance.
- Provide contractors with a copy of chemical SDSs where required.

ENVIRONMENTAL AFFAIRS

- Provide training on proper labeling of hazardous materials.
- Update and distribute the Hazardous Materials Field Guide, which includes instructions on how to fill out labels for materials transferred to secondary containers.

EMPLOYEES

- Participate in training and all associated Program elements.
- Ensure that labels (including secondary container labels) are maintained as required on all hazardous chemical containers.
- Ensure that newly purchased chemicals are approved by CHSS and are checked for appropriate labels and label information prior to use.

- Review SDSs associated with chemicals used, and implement the appropriate work practices, controls and PPE as prescribed.
- Contact supervisors regarding chemical exposure concerns.
- Send any new/updated SDSs to CHSS.

MEANS OF COMMUNICATING HAZARD INFORMATION

The LADWP uses the following means of communicating information regarding hazardous substances to employees:

WRITTEN HAZARD COMMUNICATION PROGRAM

CHSS maintains a written program accessible on the CHSS webpage which includes a description of how the LADWP:

A. Maintains lists of chemical inventories.
B. Communicates and makes accessible hazard related information to employees and emergency responders through
   - Labels and other forms of warning;
   - SDSs; and
   - Information and training - including informing employees of the hazards of non-routine tasks.
C. Protects employees from hazardous substances brought into the workplace by a contractor's employees.
D. Informs other employers sharing the same work area of
   - The hazardous substances to which the contractor's employees may be exposed while performing their work.
   - Precautionary measures needed to protect employees during normal work as well as emergency conditions.
   - Access to SDS's during the normal operating conditions and in foreseeable emergencies.
E. Implements the requirements of the California Safe Drinking Water and Toxic Enforcement Act.
F. Performs periodic (e.g., annual) program evaluation to update the program and determine its effectiveness.

Note: The written Program is available upon request to employees, their representatives, Cal/OSHA representatives, and others in accordance with The California Safe Drinking Water and Toxic Enforement Act, Section 3204(e), “Access to Employee Exposure and Medical Records.”

WARNING LABELS

All containers of hazardous substances must be labeled, tagged, or marked with the identity of the chemical and the appropriate hazard warnings.

Labels must be prominently displayed, legible, in English and readily available in the work area throughout each work shift.

Employees are to ensure that existing labels are not removed or intentionally defaced on incoming containers of hazardous substances, unless the container is immediately marked with the required information.

TRAINING PROGRAMS

Employees who work with hazardous substances must be knowledgeable of the hazards and the necessary personal protective measures.

Hazard Communication training is required upon the initial assignment of a job, and whenever a new physical or health hazard is introduced into the work area and employees have not yet been trained.

Hazardous substance information is also provided at New Hire Orientation, through New Hire Orientation Forms, Hazard Specific Training classes, tailgate meetings, and Job Hazard Assessment (JHA)s.

SAFETY DATA SHEETS (SDS)

Provide detailed information about a specific product or substance and are organized to consistently provide the following information regarding the identified chemical:

1. Identification
2. Hazard(s) identification

3. Composition/information on ingredients
4. First-aid measures
5. Fire-fighting measures
6. Accidental release measures
7. Handling and storage
8. PPE
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological Information
13. Disposal considerations
14. Transport information
15. Regulatory information, and
16. Other information including date of preparation or last revision.

The LADWP maintains SDSs that are received with incoming shipments of hazardous chemicals. SDSs for hazardous substances used in each work place are available at various locations throughout the LADWP and CHSS maintains a contract to provide electronic access through the CHSS website.

The SDS Library may be searched by:

- Product Name
- Manufacturer Part Number
- Manufacturer Name

Note: The SDS is not required for consumer products when the products are used in the workplace in the same manner that a consumer would use them.

EMPLOYEE RIGHTS

The following rights are provided under the Program:

- Employees have the right to access their medical and exposure monitoring records.
- Employees, their physician or representative, have the right to receive information regarding hazardous substances to which the employee may be exposed.

- Employees shall not be retaliated against based solely on their exercise of these rights.

ADMINISTRATIVE MANUAL

Section

HAZARDOUS SUBSTANCES

Subject

Hazardous Substance Management Program

The Department is committed to ensuring the safe and proper management of hazardous substances, which include materials, wastes, and toxics, to protect its employees, the public, and the environment, and the City's water resources.

The Hazardous Substance Management Program (HSMP) established an HSMP Steering Committee to set goals and develop policies for the uniform management of hazardous substances and an HSMP Advisory Committee to develop plans, schedules, and procedures to implement the policies and achieve the goals.

References:
Intra-Departmental Letter, Formation of Hazardous Substance Management Program, January 10, 1986

ADMINISTRATIVE MANUAL

Section

HAZARDOUS SUBSTANCES

Subject

Hazard Management Policy

The water and electric systems that are owned and operated by the City of Los Angeles, Department of Water and Power (DWP), shall be designed, constructed, operated, and maintained to provide reasonable protection of life and to limit damage to property during a hazardous event, as well as to provide for the resumption of customer services in a reasonable and timely manner after a hazardous event occurs. The DWP will maintain an active emergency preparedness program that will be used as the basis for the safe restoration of all customer services with priority consideration for those customers that provide essential functions that are critical to public health and safety during an emergency.

Based on current understanding of hazards and risks, and the current technical capabilities and practices of the industry, DWP will develop, implement, and maintain long-term hazard management programs to mitigate, respond, restore, and recover from the damages caused by hazards. Such hazards include, but are not limited to, major earthquakes, fires, explosions, storms, floods, hazardous substance releases, civil disturbances, and sabotage.

It is the goal of this policy to fulfill DWP’s responsibilities to protect the public and to provide reliable customer service in the face of likely hazardous events. Although it is intended that compliance with this policy will provide reasonable public safety and customer service, it is not expected to prevent all loss of life, property damage, or loss of services.

GUIDANCE FOR POLICY INTERPRETATION

The phrase “provide reasonable protection of life and to limit damage to property” allows for the fact that it is not always feasible to improve existing facilities or design new facilities to prevent all losses of life or property damage.

The phrase “resumption of customer services in a reasonable and timely manner” allows for differences between the magnitude and severity of the disaster and the time of year or day and location of the hazardous event. It eliminates the need to state that customer services will be restored to a specific number of customers within a specified time period. It allows comparison of DWP’s post disaster performance with the performance of other utilities, to verify adequacy of mitigation and emergency response efforts.

GUIDANCE FOR POLICY INTERPRETATION (continued)

The phrase “restoration of all customer services with priority consideration for those customers that provide essential functions” allows for the consideration of priority restoration to essential customer services within the restoration process for all customer services. It recognizes that it is not always feasible to restore essential customers first, but is one of the considerations during planning and implementing the restoration of customer services.

The phrase “long-term hazard management programs” allows the implementation of this policy to be extended over a period of years. It also references programs that address specific hazard issues. The implementation of such programs provides measurability and evidence between disasters that DWP is actively and steadily improving its ability to serve its customers during and following major emergency and disaster events.

ADMINISTRATIVE MANUAL

Section

SAFETY INSPECTIONS

Subject

Division of Occupational Safety and Health Inspection Procedure

Representatives from the California Division of Occupational Safety and Health (DOSH) have the authority to inspect Department workplaces, equipment, and operations at any time. Safety inspections may occur at permanent Department facilities, construction sites, or wherever crews are working in the field. This procedure also applies when contract forces are working at a Department facility or in the field under Department supervision.

The following procedure is designed to:

- Assist supervisors and managers to become familiar with the inspection procedures
- Ensure that the appropriate foundation is developed for compliance, extension, or appeal in the event that a violation is identified and a citation is issued to the Department

Reference:
Administrative Manual, Section 110-21, Responding to a DOSH Citation

PROCEDURE

Responsibility	***Action***
DOSH INSPECTOR	
	1. Identifies self to the sith supervisor.
	2. Explains the nature of the visit
	3. Requests an opening conference.
	4. May request that an employee representative from the affected work unit or a Union/Assodation representative of the affected employees attend the opening conference.

SITE SUPERViSOR

1. Ask the DOSH inspector to wait until the Department's representative arrives.

2. Immediately notify business unit management, the Health and Safety Business Group of the Safety, Health and Environmental Protection (SHEP) Business Unit and, if appropriate, the contractor's representative of the DOSH inspector's visit

3. Arrange for an employee representative to participate in the inspection.

DEPARTMENT SAFETY ENGINEER

1. Immediately send a Safety representative to the site.

2. If necessary, dispatch a representative of Industrial Hygiene or Hazardous Materials.

3. Notify other business units which may be involved in the inspection of the DOSH inspector's arrival andcoordinate the associated activities.

BUSINESS UNIT MANAGEMENT

1. Proceed as directed by the Department Safety Engineer.

2. Prepare a monthly summary of significant inspections for the system head, including progress on abatement actions.

ADMINISTRATIVE MANUAL

Section

SAFETY INSECTIONS

Subject

Responding to a DOSH Citation

The Department is subject to inspection of its work sites by the Division of Occupational Health and Safety (DOSH). DOSH may take action, within six months of the date of inspection, against the Department on any violation of DOSH rules and regulations. The types of actions that may be taken by DOSH are the issuance of a Citation, Notice, Special Order, an Information Memorandum, and an Order to Take Special Action. The following procedure is to be followed when responding to a DOSH action taken against the Department.

Reference:
Administrative Manua~ Section 110-20, Division of Occupational Safety and Health Inspection Procedure

PROCEDURE

Responsibility	***Action***
DOSH SAFETY COMPLIANCE ENGINEER	Issues a citation or other notice of a violation to the immediate supervisor of the work group.
SITE SUPERVISOR	1. Accept the citation/notice of the violation and send the original to the Department Safety Engineer.
	2. Notify business unit management and the Department Safety Engineer in the Safety, Health and Environmental Protection (SHEP) Business Unit of the action taken by DOSH.
	3. Post the citation/notice at the work site for *three working days* or until the violation is abated, whichever is longer.
	4. Proceed as directed by the Department Safety Engineer.

ADMINISTRATIVE MANUAL	Section: ACCIDENTS/INJURIES
	Subject: Accident/Incident Response Procedure

The following procedure is to be followed whenever an accident/incident occurs. If the accident occurs in a Los Angeles Department of Water and Power (LADWP) facility, also consult the Emergency Procedures for that facility.

References:

California Code of Regulations, Title 8, Section 330 and 342
Administrative Manual, Sections:
50-04, A Guide to Employee Discipline
100-02, Interim Drug and Alcohol Policy
100-03, Supervisor's Guidelines for Employee Drug and Alcohol Abuse
100-13, Employee Assistance Program
110-31, Reporting a Injury or Fatality or Damage to Facilities or Equipment
110-32, Accident/Incident Investigation
110-33, Employee Assistance Program — Trauma Response Services
LADWP Driving Rules
Applicable MOUs

DEFINITIONS

OSHA Reportable Injury / Illness - any injury or illness occurring in a place of employment or in connection with any employment:

- Which requires inpatient hospitalization for a period in excess of 24 hours for other than medical observation;
- In which an employee suffers:
  - A loss of any member of the body; or
  - Any degree of permanent disfigurement; or
  - Fatality
- Which results in work-related hospitalizations of three or more employees.

Senior-level Employee — The highest ranking employee at the site.

WRITTEN REPORTS

Depending on the severity of the accident/incident, one or more reports may be required (refer to Administrative Manual, Sections 110-31 and 110-32).

PREPAREDNESS

RESPONSIBILITIES

DIVISION MANAGEMENT

- Ensure all Senior-level Employees understand and are trained in regards to their responsibilities during a incident.
- Determine what types of incidents are likely to occur.
- Identify potential responding agencies based upon potential locations, including contact information for a list of the nearest medical facilities/trauma centers, hours of operation and transport capabilities.
- Provide appropriate emergency response training (e.g., first aid, cardiopulmonary resuscitation (CPR), automated external defibrillator (AED), Fire Extinguisher, etc.) based upon potential emergency scenarios.
- Conduct or join training and simulation exercises where appropriate.

PROCEDURE

RESPONSIBILITIES

SENIOR-LEVEL EMPLOYEE AT THE LOCATION

- Make the accident scene safe and secure.
  - *Note:* Do not discuss the accident/incident with outsiders, except to obtain names of witnesses and to cooperate with any police investigation.
- Call for medical assistance.
  - Contact information will vary by location.
- Administer first aid and/or CPR, as appropriate. Check for any medical alert tags.
- In the absence of an approved local procedure, report the information as described in Administrative Manual, Section 110-31, Reporting Injury or Fatality or Damage to Facilities or Equipment to the appropriate entity:
    - Energy Control Center (ECC) at (818) 352-9981

  - Los Angeles Water System Data Acquisition Control (LAWSDAC) at (213) 367-5118
  - Water Trouble Board (WTB) at (855) 262-9880
- Shut down the work activity at the site, as appropriate, as soon as it is safe and practical to do so.
- Preserve the accident scene by protecting and securing all equipment, tools, and clothing that are related to the accident/incident until the on-site investigation is completed.
- Call in others to perform the work if operations need to be restored and it is safe and practical to do so.
- Transport those personnel who were at the accident site to a suitable location away from the site, preferably to district headquarters.
- Inform involved personnel that Employee Assistance Program (EAP) counselors will be arriving to offer assistance.

- Monitor the management of the incident. Be readily available to provide direction, guidance and support as needed.

- Order a medical evaluation for drugs and/or alcohol whenever one or more of the following occurs:

  - There are any injuries.
  - There is any damage to LADWP property or private property which may result in a claim.
  - The supervisor determines that the sequence, the behavior, or unusual actions exhibited by any involved employee prior to the accident supports the need.

  Note: If it is determined that a medical evaluation for drugs and/or alcohol is necessary, refer to Administrative Manual, Section 100-03, Supervisor's Guidelines for Employee Drug and Alcohol Abuse.

- As appropriate, update the supervisor/manager, organization safety, Corporate Health and Safety Services (CHSS), Chief Safety Officer, and Occupational Health Services regarding the accident/incident.

ECC/LAWSDAC/WTB

- Perform notifications as described in Administrative Manual, Section 110-31, Reporting Injury or Fatality or Damage to Facilities or Equipment.

DIVISION DIRECTOR

- Perform notifications as described in Administrative Manual, Section 110-31, Reporting Injury or Fatality or Damage to Facilities or Equipment.

- Work with the assistance of the EAP counselor, to notify the employee's family or other responsible party when appropriate.

- Discuss the follow-up investigation and action plans with CHSS as appropriate. Depending on the severity of the accident/incident, one or more reports may be required (refer to Administrative Manual, Sections 110-31 and 110-32).

CHIEF SAFETY OFFICER

Perform notifications as described in Administrative Manual, Section 110-31, Reporting Injury or Fatality or Damage to Facilities or Equipment.

If necessary, dispatch a representative of Industrial Hygiene or CHSS.

EAP COUNSELOR

- Coordinate EAP involvement and proceed to the appropriate location(s), which may include the treating hospital and the site of awaiting crew members.

  If the location is outside the Los Angeles area, the on-call counselors will either travel to the location or arrange with counselors who are in proximity to the location to respond.

- Consult with and assist Division management in notifying the employee's family.

ADMINISTRATIVE MANUAL	Section: ACCIDENTS/INJURIES
	Subject: Reporting Injury or Fatality or Damage to Facilities or Equipment

Relevant information regarding any injury, fatality or extensive damage to major facilities or major equipment must be obtained and consistently communicated to line management and other offices specified in this procedure in a timely manner, such that assistance to those involved can be provided with the appropriate sense of urgency.

This procedure does not supersede operation and maintenance reporting procedures used to facilitate the management and control of system operations and activities or any reporting procedures required by other governmental entities.

Organizational unit managers may establish their own procedures governing the reporting of accidents, provided that such procedures do not contradict or interfere with this procedure.

This procedure applies to incidents and accidents that involve Los Angeles Department of Water and Power (LADWP) personnel, contractors, or any third party working in or present at LADWP facilities, as well as fire events, environmental events and property damage as defined in this document. This procedure defines the process for ***initial*** reporting and investigation of such incidents at the LADWP.

References:

California Code of Regulations, Title 8, Sections 330 and 342
Administrative Manual, Sections:
- 110-30, Accident/Incident Response Procedure
- 110-32, Accident/Incident Investigation
- 110-33, Employee Assistance Program — Trauma Response Services

Applicable Memorandum of Understanding (MOUs)

TYPES OF EVENTS TO BE REPORTED

All newsworthy events, injuries, fatalities, or extensive damage to major facilities or major equipment are to be reported.

ABBREVIATIONS

DOSH – District Office of the Division of Occupational Safety and Health

ECC – Energy Control Center

ETB – Electric Trouble Board

LAWSDAC – Los Angeles Water System Data Acquisition Control

CHSS – Corporate Health and Safety Services

OSHA - Occupational Safety and Health Administration

WTB – Water Trouble Board

DEFINITIONS

Occupational Safety and Health Administration (OSHA) Reportable Injury/Illness - any injury or illness occurring in a place of employment or in connection with any employment:

- Which requires inpatient hospitalization for a period in excess of 24 hours for other than medical observation,
- In which an employee suffers:
  - A loss of any member of the body; or
  - Any degree of permanent disfigurement; or
  - Fatality
- Which results in work-related hospitalizations of three or more employees.

Fire Event - Fire event at an LADWP facility or to LADWP property, which meet any of the criteria below:

- Visible fire or extensive charring (for which the condition was not engineered into the process or equipment).
- Emergency response team or local agency response is required to control the fire.
- Production down time greater than one (1) day.

Environmental - Unplanned release of a regulated substance or other hazardous material which may result in an adverse impact to human health (i.e. the community) or the environment, or be of interest to the local media.

Property Damage or Business Interruption - Damage to facilities, equipment, or real estate as the result of an incident. Some examples may include:

- Damage to LADWP facilities, property, or equipment that causes interruption to any business operation greater than 1 day.
- Property or equipment damage in excess of $100,000.

DOCUMENTATION

Report of Major Accident or Unusual Occurrence – a standardized email sent by the System Control Facilities, which includes:

- Brief description of what happened.
- Location involved.
- Time and date of occurrence.
- Identification of seriously injured or fatalities.
- Location to which injured/deceased have been transported.
- Extent of damage sustained by LADWP facilities or equipment.
- Estimated time to repair/restore to service.
- Extent of damage to outside party facilities/equipment.

Managers of the System Control Facilities, (i.e. WTB, LAWSDAC, ETB, and the ECC), shall maintain a distribution list of key managers and support personnel designated to receive these reports.

Initial Investigation Report – Following an incident or accident, this report is initiated at the reporting facility responsible for the employee(s) or equipment involved and shall be forwarded to System Safety within 8 hours of the accident or incident. Standardized System forms can be found on the intranet.

REPORT PROMPTNESS

Unless otherwise stated, incidents and accidents as described in this document shall be reported to the appropriate System Control Facility (WTB, LAWSDAC, ETB, or the ECC), as appropriate.

All reports shall immediately be made by telephone, radio, electronic mail, or in person, whichever is fastest. Any oral reports shall be followed up in written form as soon as practical.

CHSS shall make a report to DOSH. This notification shall be made within eight (8) hours after the LADWP has knowledge of, or with diligent inquiry, would have known of the death, injury or illness. If the LADWP can demonstrate that extenuating circumstances exist, the time frame for the report may be extended to no longer than 24 hours after the incident.

Reports may be delayed only to the extent necessary to arrange for medical aid, restoration of operations, or elimination of a hazard. Such delays shall be kept to an absolute minimum.

Note: Incomplete information or uncertainty as to facts shall not constitute a valid reason for delaying a report. Areas of incomplete information and uncertainty should be indicated in the report.

Occupational Health Services (OHS) is the official contact with outside health care professionals. All inquiries regarding the condition of an injured employee should be referred to OHS.

PROCEDURE

RESPONSIBILITIES

SENIOR-LEVEL EMPLOYEE AT THE LOCATION

- Immediately make an oral report to the appropriate System Control Facility (ECC, LAWSDAC, ETB, or the WTB), by telephone, radio, or in person, whichever is the fastest as appropriate.

  - ECC at (818) 352-9981
  - ETB at (213) 367-4111
  - LAWSDAC at (213) 367-5118
  - WTB at (855) 262-9880

- When communicating by radio, provide only the minimum information necessary to obtain emergency assistance. The following information should be provided by telephone or in person as soon as possible:

  - Without assigning liability or fault, a brief description of what happened or is apt to happen.
  - Address/Location of site involved.
  - Time and date of occurrence.
  - Identification of individuals injured, ill or deceased, including addresses and telephone numbers, and whether they are LADWP employees or outside parties.

  Note: Identification of employees or outside parties will not be released to the news media until notification of next of kin.

  - Extent and type of injuries sustained.

- Location to which injured/deceased have been taken.
- Extent of damage sustained by LADWP facilities or equipment, and estimated time to repair or restore to service.
- Extent of damage to outside party facilities or equipment.
- Parties notified of the occurrence, time and date of such notification, and person giving such notification (e.g., list the identity of law enforcement agencies present at the accident site.
- Description of accident and whether the accident scene has been altered.
- Name and job title, or badge number of person reporting the accident.
- Name of person to contact at the accident site.

SYSTEM CONTROL FACILITIES (ECC, ETB, LAWSDAC, WTB)

- Notify the following as required:
    - Appropriate emergency services organization, if not yet performed by the Senior-Level Employee
    - Chief Safety Officer
    - Corporate Health and Safety
    - EAP Trauma Response Team
    - Environment and Efficiency
    - Fleet Services Division Director, as required
    - ISS HazMat Response
    - LADWP Risk Manager
    - LADWP Security Services
    - Management
    - Media Relations
    - Occupational Health Services (OHS)
    - Office of the City Attorney
    - System Safety Groups
    - Workers' Compensation Officer

DIVISION DIRECTOR

- Notify Organization management and ensure the Chief Safety Officer has been informed of any employee injury, illness or death associated with work-related activities.
- Review the Report of Major Accident or Unusual Occurrence completed by the Division Senior-Level Employee and Senior Level Employee at the affected location. Forward the report to the Assistant General Manager/Unit Manager and Chief Safety Officer.
- Within 24 hours complete an Initial Investigation Report.
- Transmit copies of the initial report to affected work units within the Division and to all other Division Directors involved in similar work situations.

ASSISTANT GENERAL MANAGER/DIVISION MANAGER

- Meet with the Division Director and selected employees to discuss serious incident/accident reports.
- *Within FIVE working days of the meeting,* review and transmit a copy of the initial report to the Union/Association involved.

CHIEF SAFETY OFFICER

- Ensure that CHSS reports by telephone to the nearest District Office of the DOSH any injury or illness, or death, of an employee occurring at a LADWP facility or in connection with LADWP employment.
    - Include, specifically, the reports: any injury or illness occurring in a place of employment or in connection with any employment which requires:

- Inpatient hospitalization for a period in excess of 24 hours for other than medical observation; or in which an employee suffers:
  - A loss of any member of the body, or
  - Any degree of permanent disfigurement.

- Does not include any injury or illness or death caused by the commission of a Penal Code violation, except the violation of Section 385 of the Penal Code, or an accident on a public street or highway.

- Perform an evaluation, determine initial severity, and identify immediate corrective actions needed.

- Make a final determination, in conjunction with the Division Director, as to whether the incident is considered serious or potentially serious.

- Determine with the Division Director, if an Initial Investigation Report (within 24 hours) is warranted. If so,
  - Partner with the Division Director and Division Manager to develop an Initial Investigation Report.
  - Distribute the Initial Investigation Report within 24 hours of the occurrence to appropriate groups within the subject Division, and include the Assistant General Manager/Unit Manager.

- Follow up with an Accident /Incident Investigation Committee (AIC), as appropriate.

SYSTEM CONTROL FACILITIES (ECC, ETB, WTB, LAWSDAC)

- Prepare the Report of Major Accident or Unusual Occurrence (email).

  Note: An amended Report shall be made promptly when needed to correct or complete any prior Report.

- Send the completed Report to all personnel on the System's current distribution list, including the Chief Safety Officer.

LINE MANAGERS OF INVOLVED ORGANIZATIONS

- Review and distribute the Initial Investigation Report as appropriate.

All accidents/incidents shall be investigated and documented in accordance with this section.

References:

Administrative Manual, Sections:
50-04, A Guide to Employee Discipline
100-02, Interim Drug and Alcohol Policy
100-03, Supervisor's Guidelines for Employee Drug and Alcohol Abuse
110-01, Safety Related Roles and Responsibilities
110-30, Accident/Incident Response Procedure
110-31, Reporting Injury or Fatality or Damage to Facilities or Equipment
110-33, Employee Assistance Program — Trauma Response Services
Working Rule 8.8(a)-Employee Conduct While Giving Evidence or Testimony

DEFINITIONS

Serious Accident/Incident — An accident/incident that results in one or more of the following:

- Fatality
- Injuries that require medical treatment greater than first aid
- An unusual traumatic event.

Near Miss – An incident that MAY have resulted in injury or equipment damage, BUT DID NOT. All of the following criteria must be met:

- No loss of service (water or power)
- No equipment damage
- No injury

Self-reporting of near misses is highly encouraged and adds to the potential for success of an effective near miss program, however, it is not an absolute requirement.

Initial Investigation – The investigation conducted by the affected manager or supervisor as soon as practical following any accident/incident for the purpose of gathering pertinent facts, and determining the need for immediate operational changes which shall not be delayed until completion of any ensuing investigation.

Initial Accident/Incident Report – Following an accident/incident, this report is initiated at the reporting facility responsible for the employee(s) or equipment involved and shall be forwarded to System Safety within eight (8) hours of the accident or incident.

Informal Investigation – An investigation performed by System Safety Groups aimed at fact finding and prevention of recurrence.
This is not a disciplinary investigation.

Formal Investigation - An investigation performed by System Safety Groups where deemed necessary by the LADWP Chief Safety Officer. An Accident Investigation Committee (AIC) will be formed. See procedure below for AIC composition. This type of investigation may be required by, but not limited to, a serious accident or incident. **This is not a disciplinary investigation.**

Local Investigation - An investigation conducted by local management/supervision that may lead to disciplinary action.

Contributing Factor - Immediate or apparent factors that led to the accident or incident. There may be multiple Contributing Factors. This term is related to all Safety Investigations.

Root Cause Analysis (RCA) – A process to identify underlying deficiencies in the policies, procedures, training, expectations, communications, and/or equipment that allowed the Contributing Factors to occur or exist. This term is related to all Safety Investigations.

PROCEDURES

INITIAL ACCIDENT/INCIDENT REPORT

An initial Accident/Incident Report shall be forwarded to System Safety within eight (8) hours of the accident/incident.

INITIAL INVESTIGATION

The objectives of the Initial Investigation are to:

- Promptly gather the pertinent facts.
- Identify the information that is to be disseminated to appropriate groups within the subject organization.
- Determine the need for any immediate operational changes which should not be delayed until the formal investigation is completed.

LOCAL INVESTIGATION

Local Investigations shall be initiated by Supervisor(s)/Manager(s) in the involved employee(s) chain of command within two (2) working days of the accident or incident. The local investigation shall be completed within **30 calendar days** of the occurrence. The 30-day time limit may be extended with the approval of the Assistant General Manager (AGM) or his/her designee, when a justifiable cause is presented.

RESPONSIBILITIES FOR INITIAL AND LOCAL INVESTIGATIONS

EMPLOYEES

- Cooperate with any investigation.
- Be open and honest while answering questions, keeping in mind that the intent of the investigation is to prevent reoccurrence and maintain a safe and healthful work environment.
- Maintain confidentiality until the results of the investigation are complete and made public.
- Refer to Administrative Manual, Section 110-01, for specific employee responsibilities not covered in this section.

MANAGER OR SUPERVISOR

- Gather and obtain all pertinent evidence including, but not limited to, complete set of photographs, maps, diagrams, logs, written statements from all witnesses, and tailgate forms.
- Conduct Initial Investigation, including preparation of the Initial Accident/Incident Report which shall be forward to System Safety within eight (8) hours.
- At a minimum the following information is required:
    - Who (Who was involved, observed or impacted?).
    - What (Describe the problem, issue, or event. Expected vs. Actual).
    - Where (Site, building, area, equipment, process).
    - When (When was the problem observed or when did it start? Date, time, shift, etc.).
    - How Much/Many (Quantify the event).
    - How Often (Frequency of event).
- Immediately notify the Chain of Command when the investigation indicates any employee's:
    - Use or being under the influence of alcohol or drugs.
    - Obvious misconduct.
    - Deliberate abuse of LADWP equipment.

SECTION MANAGER

- Review Manager/Supervisor investigation and any corrective actions that were recommended.
- Prepare recommendation for corrective actions, including any employee discipline.
- Based on level of discipline, it will be carried out by local management or forwarded to the Division Director for approval.

DIVISION DIRECTOR

- Review and approve final recommendations for corrective actions.

INFORMAL INVESTIGATION

The System Safety Superintendent/Manager is empowered with the approval from the Chief Safety Officer, to determine if there is a need for an Informal Investigation. It will be conducted by representatives from System Safety and coordinated with any Divisional Safety Groups.

Beginning the Investigation

IDENTIFY POTENTIAL CAUSAL FACTORS

- System Safety shall:
  - Identify potential causal factors by reviewing relevant data and facts gathered.
  - Consider potential causal factors that may occur in the following categories, but are not limited to:
    - Staffing
    - Environment (Workplace),
    - Machinery/Equipment/Materials, Method.

CONFIRM CAUSAL FACTORS

- Each potential causal factor shall be evaluated and an explanation provided to confirm how:
  - It is based on fact, not opinion or speculation.
  - It provides a logical explanation of why the event occurred.
- Data or facts provide strong evidence that causal factor(s) led to the event occurrence.
- The rationale for confirming causal factors shall be documented in a Summary Report.

ANALYZE FOR ROOT CAUSE ON CONFIRMED CAUSAL FACTORS

- If appropriate, perform an analysis for each confirmed causal factor.
- Ensure that the root cause identified is at an actionable level.

DETERMINE IF ROOT CAUSE IS SATISFACTORY

- Determine if the identified root cause(s) are satisfactory using the following as guidance:
  - The root cause is the underlying explanation for why the causal factor existed which led to the event.
  - Root cause is fact based and actionable by LADWP, and effective actions can likely be generated to prevent recurrence.
  - There is no unexplained data that could indicate additional root cause(s).

RECOMMEND CORRECTIVE AND PREVENTIVE ACTIONS

- The Investigators shall develop and recommend corrective and preventive actions aimed at each root cause identified, to be documented in the Root Cause Analysis (RCA) Summary Report.

FORMAL INVESTIGATION

ACCIDENT INVESTIGATION COMMITTEE(S) (AICs)

Formation of the AIC

Based on information provided by System Safety from the Initial Accident/Incident Report, the LADWP Chief Safety Officer may call for an AIC to investigate and prepare a report.

Composition of the AIC

System Safety shall convene an AIC and appoint the chairperson. This committee shall be comprised of at least one representative of the following:

- Corporate Health and Safety Services
- System Safety
- Supervisor from the craft or class involved
- Journey level employee(s) from the craft or class involved
- Union or Association involved
- A Manager who is not part of the involved employee(s)' chain of command

Beginning the Investigation

The AIC shall begin its investigation within two (2) working days of its formation.

INVESTIGATION PRIORITY

AIC members shall be authorized the time required to complete the investigation within the required 30-calendar day time limit.

When assistance is required from other LADWP units or specialists, such as Test Lab, photographers, or engineers, top priority shall be given to the AIC's request to complete the investigation in an expeditious manner.

RESPONSIBILITIES

AIC

For serious incidents, without risking public/employee safety, preserve the scene of the incident until sufficient data can be gathered to support the investigation. (For example, disassembling equipment involved in an incident can destroy valuable evidence that points to the root cause. Local management should make this decision immediately upon learning of a serious incident.)

- At the scene of the incident, gather environmental factors present at the time of the incident (e.g., lighting, working surface conditions, equipment condition, etc.).
- Interview witnesses, staff involved, and subject matter experts as soon as practical.
- Review available documents, process maps, and/or other relevant evidence.
- Review and ensure awareness of all Immediate Actions Taken as a result of the event.

IDENTIFY POTENTIAL CAUSAL FACTORS

- The AIC shall identify potential causal factors by reviewing relevant data and facts gathered through "Collect and Analyze Data."
- The AIC shall consider potential causal factors that may include, but are not limited to, the following categories:

  - Staffing,
  - Environment (Workplace),
  - Machinery/Equipment/Materials, Method.

CONFIRM CAUSAL FACTORS

- Each potential causal factor shall be evaluated and an explanation provided to confirm how:
  - It is based on fact, not opinion or speculation.
  - It provides a logical explanation of why the event occurred.
- Data or facts provide strong evidence that causal factor(s) led to the event occurrence.
- The rationale for confirming causal factors shall be documented in the AIC Summary Report.

DETERMINE IF ROOT CAUSE IS SATISFACTORY

- The AIC shall determine if the identified root cause(s) are satisfactory using the following as guidance:
  - The root cause is the underlying explanation for why the causal factor existed which led to the event.
  - Root cause is fact-based and actionable by LADWP and effective actions can likely be generated to prevent recurrence.
  - There is no unexplained data that could indicate additional root cause(s).

ANALYZE FOR ROOT CAUSE ON CONFIRMED CAUSAL FACTORS

- Ensure that the root cause(s) identified are at an actionable level.

RECOMMEND CORRECTIVE AND PREVENTIVE ACTIONS

- The AIC shall develop and recommend corrective and preventive actions aimed at each root cause identified in the results of the investigation.
- These actions shall be documented in the RCA Summary Report.

COMPLETE DOCUMENTATION

- Using the Accident Investigation Summary Report Template, document the results of the RCA performed.

SYSTEM SAFETY MANAGER

- Within one (1) working day of receipt of the AIC Report, review and transmit copies, along with any comments, to the LADWP Chief Safety Officer.

CHIEF SAFETY OFFICER

- Review and distribute the final AIC Report.
- Track status of implementation of recommendations within the Divisions.

DIVISION DIRECTOR

- Review the AIC report and any other relevant information.
- Prepare the Division’s response to the AIC's findings and recommendations, including actions taken or proposed to prevent the recurrence of similar accidents/incidents.
- Within five (5) working days of receipt of the AIC's report from the LADWP Chief Safety Officer, prepare a letter to the Assistant General Manager transmitting the original and three copies of the AIC's final report and the Division's response to the AIC report.

  Note: If the time limit cannot be met, inform the AGM of the reasons and provide an expected completion date.
  Prepare a cover letter for the AGM’s signature, transmitting a copy of the AIC's final report to the Union/Association involved.

ASSISTANT GENERAL MANAGER OR DESIGNEE:

- Within seven (7) working days of receipt, review the AIC Report and the Division Director’s Response Report.
- Sign the cover letter transmitting the AIC Report to the Union/Association involved.
- Notify the affected Division that the report has been transmitted.

DIVISION DIRECTOR

- Within thirty 30-calendar days after the AGM has distributed the official AIC Report, the Director shall submit an action plan detailing the implementation of the AIC's recommendations.

ADMINISTRATIVE MANUAL	Section: ACCIDENTS AND INJURIES
	Subject: Employee Assistance Program – Trauma Response Services

The Employee Assistance Program (EAP) offers services to employees and their families after a workplace traumatic accident or incident.

References:

Administrative Manual, Sections:
100-13, Employee Assistance Program
110-30, Accident/Incident Response Procedure
110-31, Reporting Injury or Fatality or Damage to Facilities or Equipment

RESPONSIBILITIES

SYSTEM/DIVISION

- As the circumstances warrant, assign an individual to serve as the designated point of contact during the trauma response. This designated point of contact shall do the following as soon as becoming aware of the incident:

- Contact an EAP Counselor at (213) 367-3562. In cases where no EAP Counselor is available, follow the instructions provided in the voicemail message.

- To the extent known, provide the following information to the EAP Counselor:

    - Date, time, location and other details of the traumatic incident.
    - Number of employees involved, both injured and witnesses to the traumatic incident.
    - The requested services.
    - The address(es) and the on-site contact(s) to whom the EAP counselor can report.

EAP COUNSELOR

- Respond to the traumatic incident, as requested.
- Meet with the on-site contact and determine the appropriate course of action.
- Meet with the employees affected by the traumatic incident to provide counseling services or resources, as appropriate.
- Determine if additional EAP resources are needed.
- Assist supervisors and senior-level employees in determining whether the involved personnel should return to work for the remainder of the shift, or be sent or taken home.
- Conduct discussions with supervisors to offer support and assistance and to arrange for follow-up meetings as needed.
- Provide crisis counseling and possible referral(s) for continued assistance to the injured worker, family members, and affected employees, as appropriate.

ADMINISTRATIVE MANUAL	Section: ACCIDENTS/INJURIES
	Subject: Safety Alert Process

Whenever a serious accident/incident occurs, or could have occurred, it shall be investigated and a decision made whether to issue a Safety Alert based upon relevant actions, severity, and the likelihood of recurrence at other locations.

References:

Administrative Manual, Sections:
110-01, Safety Related Roles and Responsibilities
110-02, Injury and Illness Prevention Program
110-30, Accident/Incident Response Procedure
110-31, Reporting Injury or Fatality or Damage to Facilities or Equipment

DEFINITION

Safety Alert - a form used to facilitate learning by summarizing the key events, problems, systemic issues, share lessons learned and communicate LADWP-wide actions and requirements from an event which meets pre-defined triggers. Predefined triggers include, but are not limited to, injuries, near misses, regulatory actions, or as directed by the LADWP Chief Safety Officer. Any actions identified to be performed in a Safety Alert shall be used to develop the Action Plan to drive resolution of the issue.

Safety Alert Action Plan – Developed by affected Division management in partnership with subject matter experts, System Safety, Division Safety, and Corporate Health and Safety Services (CHSS) to address specific corrective and preventative action items, including implementation timelines. Action Plans shall be submitted to LADWP Chief Safety Officer and CHSS within ten (10) working days of the Safety Alert issuance.

RESPONSIBILITIES

LADWP Chief Safety Officer and Corporate Health and Safety Services (CHSS)

- Within three (3) working days of the LADWP Chief Safety Officer’s determination, CHSS shall create and issue a Safety Alert.

- The LADWP Chief Safety Officer and CHSS shall provide a summary of findings, corrective and preventative actions taken, lessons learned, and a metric of Safety Alert action status to affected Division Directors, Assistant General Manager(s) and the General Manager, as appropriate.
- The LADWP Chief Safety Officer and CHSS will discuss issuing a Safety Alert with System Safety and Division Director(s).

Division Management

- Distribute Safety Alert through chain of command. Share information and lessons learned with appropriate employees and management.
- Within ten(10) working days of the Safety Alert issuance, coordinate with System Safety and Division Safety to conduct an evaluation and develop a Safety Alert Action Plan.
- Ensure Safety Alert actions are implemented.

PROCEDURE

Preparing and Distributing Safety Alert
A Safety Alert shall be prepared at the discretion of the LADWP Chief Safety Officer and issued by CHSS to the affected Division Management.

Required actions documented in the Safety Alert will be assigned to a specific individual or organization by the affected Division Management.

Division Management will distribute the Safety Alert within their Divisions to share lessons learned and communicate actions required as appropriate.

Preparing Safety Alert Response and Action Plans
Affected Divisions shall conduct a review to determine applicability to their operations, identify potential for similar incident occurrence, and share

lessons learned. This review can be accomplished through communication at Safety Meetings.

Division Management, in coordination with System Safety and Division Safety, will evaluate and determine the Safety Alert Action Plan needed. The Safety Alert Action Plan will be submitted to the LADWP Chief Safety Officer and CHSS Manager within ten (10) working days of the Safety Alert issuance.

Any deviation from a Safety Alert Action Plan must be submitted to the LADWP Chief Safety Officer for approval.

The approval and rationale shall be documented and a copy shall be provided to and maintained by the CHSS Manager.

Conducting Safety Alert Follow Up and Closure of Actions
Each corrective and preventative action identified in the Safety Alert shall be assigned to a responsible party identified by the Division for implementation. Closure of the corrective and preventative action shall include clear documentation (evidence) of action taken.

Evidence of appropriate closure may include: standards, standard operating procedures, guidance, risk assessments, reports, engineering studies, training, photographs, and facility or equipment changes/modifications. The evidence shall be attached to the corrective and preventative action record.

The Division Director is accountable to assure that actions taken meet the letter and intent of the Safety Alert actions. CHSS shall: facilitate follow-up of corrective and preventative action closure; collect Division actions taken; and report status to the LADWP Chief Safety Officer.

The LADWP Chief Safety Officer shall provide oversight including escalation of unresolved issues and/or conflicts.

Conducting Safety Alert Audits
CHSS shall verify completion (or on-target progress toward completion) of actions in response to Safety Alerts.

CHSS may audit any Safety Alert corrective and preventative action to determine effectiveness of actions taken.

CHSS will verify and document that Divisions asserting no action needed for a particular Safety Alert either already have adequate controls in place or inherently do not have the potential for similar events.

Safety Alert

To: Distribution **Date:**
From: Executive Director of Safety

Subject: Safety Alert: Year - # Title

ACCIDENT/INCIDENT DESCRIPTION:

Enter brief headline, location, event, etc.

INCIDENT DETAILS

Executive summary of incident. Provide additional relevant details and facts.

IMMEDIATE System/Organization ACTIONS

Enter if applicable.

ATTACHMENT C

LADWP ADMINISTRATIVE MANUAL
WORK PERFORMANCE SAFETY SECTION 50-04

ADMINISTRATIVE MANUAL

SECTION **WORK PERFORMANCE**

SUBJECT **A Guide to Employee Discipline**

Guidelines for employee discipline in the Department are contained in Policy 33, adopted by the Civil Service Commission, and are applicable to all City employees. This policy is based on Section 1 of Civil Service Commission Policy 33, and contains rules for initiating and implementing disciplinary action, standards for employee conduct, and suggested actions for noncompliance.

This policy and procedure is intended as a guide to constructive discipline to be used by supervisors in determining the extent of corrective action applicable to the particular breach in behavior after discussion and oral reprimands have failed. Instances of undesirable performance or behavior should be considered as cumulative even though they differ in nature.

Policy 50-04 includes a sampling of the most common offenses with a range of penalties suggested for first, second, and third actions. These are suggested penalties only and the supervisor is not bound by them. The appropriate penalty may be greater or lesser in individual cases depending on the circumstances. Repeated offenses should carry more severe penalties than initial offenses.

The term "supervisor" refers to the employee's immediate supervisor or anyone acting in that capacity. Circumstances may occur that require the initiation of disciplinary action in the absence of the employee's regular supervisor.

References:

Civil Service Commission Policy 33
Administrative Manual, Sections:
- 50-01, Notice of Commendation, Form Gen. 79
- 50-02, Notice to Correct Deficiencies (NTCD), Form Gen. 78
- 50-03, Disciplinary Pay Status
- 80-04, Suspension or Discharge for Cause
- 90-01, Departmental Personnel Files
- 90-12, Use of Law Enforcement Information
- 100-02, Interim Drug and Alcohol Policy
- 100-03, Supervisor's Guidelines for Employee Drug and Alcohol Abuse

Department's Safety Rules
Department's Driving Rules

INTRODUCTION

Discipline is orderly behavior that results from the training and development of a work force for the realization of goals and objectives. Constructive discipline is achieved by creating a climate of respect through sound leadership. Discipline in the work force is best demonstrated by self-disciplined people working in harmony, and on their own, abiding by Department rules and standards of good conduct.

Corrective measures for rule infractions require skill and consistency in application. Occasionally, an employee does not respond to the best and most positive corrective actions. Failure to take action when subordinates do wrong may be interpreted as condoning the violation and may result in harm to the group's productivity.

Although it may seem to the supervisor that a disproportionate amount of time is being spent with a wrongdoer, these efforts not only have a corrective effect on the wrongdoer, but they have a salutary effect on the remainder of the group. Therefore, the time spent is actually applied to the entire group and not merely to one individual.

It is estimated that more than 95 percent of the Department's employees are able not only to bring their varied skills to effective use in common effort, but also to arrange their personal lives, their attitudes, and their behavior in an acceptable pattern through the normal associations with supervisors, fellow employees, and others.

These employees study and understand the working rules, possess the necessary job skills, and accept the necessity for self-discipline. These employees also understand that discipline is a normal business practice.

INTRODUCTION (continued)

For the less than five percent who do not develop these patterns by positive processes, it is necessary to take corrective action in varying degrees, even including discharge. This may be an unpleasant task for all concerned, but when it becomes necessary, it should be undertaken promptly, fairly, and equitably.

In the application of corrective discipline, the judgment of the first level of supervision should be given considerable weight, subject to review and confirmation by higher levels of supervision. Once started, the action should be processed as rapidly as possible, whether it ranges from a Notice to Correct Deficiencies to discharge.

STATEMENT OF RESPONSIBILITY

The basic responsibility for achieving and maintaining discipline lies with the employee's immediate supervisor. The responsibility of management is to see that the supervisor is properly trained to apply the techniques of sound and consistent discipline.

In addition, it is the responsibility of the higher levels of supervision to support the immediate supervisor when a sound and consistent approach to disciplinary actions has been demonstrated.

PURPOSE AND PRACTICES

ENSURE UNIFORMITY OF DISCIPLINE

This policy and procedure is a guide to constructive discipline to be used in selecting the corrective action for improper conduct by employees after discussion and oral reprimands have failed. It should be followed closely to ensure uniformity of discipline in all City departments.

ENSURE FAIR TREATMENT

This policy is also designed to ensure fair treatment to all employees — to prevent impulsive and unreasonable punishment for improper conduct. The rights of the individual must be protected. However, this does not give any employee the right to disobey rules, to fail to be productive, to be insubordinate, to be discourteous, to endanger others, or to engage in conduct unbecoming a City employee.

DEFINE THE PROBLEM

Initial problems may be minor and not easily definable offenses. This behavior should not be overlooked, as it can grow more serious with time. A private conference can often resolve the problem and give the individual an opportunity to correct the behavior.

RECOGNITION

Recognition should be given to the employee who has received discipline and who has demonstrated that the problem has been corrected.

It is equally important that recognition be given to the good employee, to the employee who does a job exceptionally well, or even goes beyond the normal demands of the job. Management is encouraged to give commendations to such employees by using the Notice of Commendation, Form Gen. 79 (sample, page 36).

PRIMARY GOAL

The primary goal of this disciplinary policy is to correct employee behavior or performance. Achievement of that goal requires a mutual understanding among City management, employees, and the Civil Service Commission that the following criteria apply:

1. Behavior and performance standards must relate to the job to be done, and employees should be made aware of such standards.
2. Employees are expected to adhere to standards of reasonable and prudent conduct.
3. Employees are subject to corrective action when they violate those standards.
4. Penalties must be appropriate to the type and seriousness of the offenses.
5. Employees who commit serious offenses, or who show a pattern of offenses after successive efforts at corrective action, must not remain in City service.

PROCEDURE PRIOR TO TAKING DISCIPLINARY ACTION

CONDUCT AN OBJECTIVE INVESTIGATION

When it is suspected that a violation of a behavior or performance standard has occurred, and before deciding whether correction action is necessary, Department management should conduct a thorough, objective investigation and get all available facts, including the employee's side of the story.

If the investigation shows that an offense occurred, the actions required by the Department's discipline policies and procedures should be taken. However, if management determines that an offense did not occur or that the allegation is lacking in substance, a record of the incident is not to be placed in the employee's file where it might prejudice future actions.

PREDISCIPLINE PROCEDURE (SKELLY PACKAGE)

The purpose of the prediscipline (Skelly) procedure is to minimize the risk of error in the manager's initial decision. The procedure allows the employee to provide his or her version of the facts surrounding the proposed discipline and gives the manager an opportunity to reevaluate the proposed decision before it is irreversibly made.

If a discharge or a suspension is being considered for an employee who has completed probation, the courts have ruled that a prediscipline procedure (Skelly package) is required. This is the case even when an appeal procedure, including a post-discharge evidentiary hearing, is available.

PROBATIONARY TERMINATION

A Skelly package is not required for a probationary termination; however, management should document any such actions. Management should use the probationary period as the working test period of fitness to perform the duties of the job and to meet the standards of performance.

OFFENSES DURING OFF-DUTY HOURS, NOT ON CITY GOVERNMENT PROPERTY

The following guidelines are provided for offenses that occur during off-duty hours, not on City government property.

Corrective actions taken should be:

- Related to the job performed by the employee
- Related to the effect of the offense on departmental operations
- In accord with any other applicable directives

PAY STATUS

For employee offenses that result in the employee being unable to perform job duties (detention and booking or incarceration for a period of time, loss of driver's license, etc.), periods of absence from work should be treated as absence without pay.

In cases that are not felonies or serious misdemeanors, and are not related to the job performed by the employee, the supervisor may consider the propriety of granting authorized time off (vacation, accumulated overtime, leave without pay) for the employee to consult with an attorney, to appear in court, or to otherwise resolve the problem.

Denying time off could require some prejudgment by the supervisor. Line management should consult with the Employee Relations Office (refer to Administrative Manual, Section 90-12).

RECEIPT OF ARREST REPORT OR COURT RECORD

When an arrest report or a court record is received relating to an alleged offense or incident and the employee has been exonerated or otherwise cleared, the information that clears the employee is also to be included in the employee's personnel file.

OPTION OF RESIGNING TO AVOID DISCHARGE

In some circumstances, such as inability to perform satisfactorily, the employee, without coercion, may be afforded the option of resigning to avoid discharge.

The decision to resign in lieu of discharge must be voluntary and the employee should be allowed a full working day in which to exercise this option.

When explaining to the employee the option of resignation in lieu of discharge, the Department representative must outline the consequences of resignation:

- The employee loses the right of appeal of the discharge to the Civil Service Commission.
- The separation will be coded as "resignation in lieu of discharge" in official City records.
- The resignation cannot be withdrawn after the acceptance by the appointing authority.
- Restoration of the employee's name to the eligible list may not be recommended.
- Future reemployment cannot be guaranteed.

ABANDONMENT OF POSITION

When an employee is absent without authorization for seven or more calendar days, the supervisor may consider the absence a resignation under Civil Service Commission Rule 7.2 (abandonment of position), or proceed toward recommending discharge.

Abandonment of position under Civil Service Commission Rule 7.2 is not to be used if discharge is appropriate.

Abandonment of position procedures may be followed when the employee has been absent from duty without explanation and then only after reasonable efforts to contact the employee have been made.

It is strongly recommended that supervisors seek the advice of an Employee Relations representative before such proceedings are begun.

TAKING DISCIPLINARY ACTION

The appropriate steps for any supervisor, administrator, or manager to follow in taking disciplinary action are outlined in Sections A through E, below. For advice and guidance related to these procedures and in emergencies, contact the Employee Relations Office.

A. MAKING THE INVESTIGATION — NONEMERGENCY CIRCUMSTANCES

INITIATION

Investigation of activities that may require disciplinary action should be initiated by the employee's supervisor on the advice of the Employee Relations Office and should conform to all applicable departmental work rules, policies, etc.

It is strongly recommended that supervisors seek the advice of an Employee Relations representative before such proceedings are begun.

MANAGEMENT NOTIFICATION

The investigating supervisor should notify, by confidential memorandum, higher management levels and/or the business unit personnel office of the initiation and progress of the investigation and should be guided by instructions on whether to continue the investigation.

PURPOSE OF THE INVESTIGATION

The purpose of the investigation is to ensure that the supervisor has considered all relevant facts by:

1. Reviewing any available written documentation, including police reports and citizen complaints.
2. Interviewing supervisors, other employees, or citizens who may have knowledge of the incident(s).
3. Determining the work rules, practices, job performance standards of behavior involved, and the extent to which the employee could reasonably have been expected to know and follow them.

PURPOSE OF THE INVESTIGATION (continued)

4. Reviewing the employee's total work record, including records of past performance, conduct, and attendance.
5. Discussing the findings and conclusions with the employee and obtaining the employee's explanation.
   - This interview should be private, informal, and as provided under departmental rules.
   - The interview may include the employee's representative.
   - The supervisor should be careful in these discussions to avoid any argument or statement that could later be used to show that a fair investigation was not conducted.
   - The supervisor should remain objective in determining the facts.
   - The supervisor should prepare a memorandum or other suitable document of what occurred in the interview.

B. MAKING THE INVESTIGATION — EMERGENCY CIRCUMSTANCES

EMERGENCY SITUATION

Circumstances may occur that require the removal of the employee from the work situation before final decisions can be reached on disciplinary action to be taken. This can include behavior that creates an immediate hazard to the employee, other employees, the public, or the City.

NOTIFYING APPROPRIATE PERSONNEL

The supervisor should immediately notify the next level supervisor, the Employee Relations Office, and any other office designated by the business unit concerning this action. Such removal from the job is subject to review through applicable departmental rules and prompt processing under the Prediscipline (Skelly) Procedure, below.

C. MAKING THE DECISION ON DISCIPLINARY ACTION

FACTORS TO CONSIDER

The decision on whether to take disciplinary action and the form of such action requires consideration of several factors. These factors include the following:

1. Departmental policies, practices, and general standards of conduct applicable to the incident involved
2. Uniformity and currency of past departmental disciplinary actions
3. Reference to the Guide to Disciplinary Standards (page 16)
4. Reference to the appropriate MOU for additional guidelines

D. PREDISCIPLINE (SKELLY) PROCEDURE FOR DISCHARGES OR SUSPENSION

INITIATING THE SKELLY PROCEDURE

When a discharge or suspension of an employee who has completed probation is being considered, the following basic prediscipline procedures should be followed for all cases except genuine emergency situations (see No. 7 below for emergency procedures).

1. Give the employee written notice of the proposed action by Department letterhead, memorandum, or other appropriate form. The notice must include the reason for the proposed disciplinary action and the date and time the notice was served. (Refer to Administrative Manual, Section 80-04.)

   Have the employee sign a copy of the written notice to acknowledge receipt. If the employee refuses to sign, indicate that fact on the copies of the letter.
2. Show the employee the documents or materials on which the disciplinary action is based, and supply the employee with a copy of these documents.

INITIATING THE SKELLY PROCEDURE (continued)

3. After being given a reasonable opportunity to review the above documents and materials, the employee may respond, either orally or in writing (at the option of the employee).

   One to five days, depending on the complexity of the case, is considered a reasonable notification of impending disciplinary action.

4. The employee's side of the facts may be provided in a predicipline response. This is not intended to be an adversary proceeding. It does not require calling or cross-examining witnesses or formally presenting a case against the proposed discipline.

   An employee may have a representative present when responding. Employees are to be informed of their right to representation before beginning any discussions.

5. The person who takes the actions in Items 1 through 4, above, may be either the appointing authority under the Charter or a designated representative who has the authority to effectively recommend the action to be taken by the appointing authority.

6. The appointing authority or designee reviews both sides of the case and decides what action is to be taken. If the decision is to continue processing of papers for suspension or discharge, present the employee with a copy of Form Gen. 77, Notice of Discharge, Suspension, or Probationary Termination (sample, page 37), signed by management.

7. If it is felt that an emergency situation (as in B, above) exists, which requires immediate removal of the employee from the work site, the reasons for the decision should be carefully documented and the above procedures followed to the extent feasible under the circumstances.

   An emergency could involve a situation that would be hazardous to the employee, other employees, the City, or the public if the person were to continue working.

E. IMPLEMENTING THE DISCIPLINARY ACTION

ADMINISTRATION

Corrective actions should be administered as follows, with time to assess whether the employee has corrected the deficiencies.

Oral Warning

1. Give in private.
2. Conduct on a one-to-one basis between the supervisor and the employee. Explain to the employee the Department's standards and requirements, what is expected in the future, and the possible consequences if the behavior or performance is not corrected.

   In some cases, the supervisor may feel the need for an observer, or the employee may wish a representative to be present.
3. Prepare a personal reminder documenting the conversation. In some cases, a memorandum to the employee summarizing the discussion, including what was agreed, may be in order.

Written Notice

1. Use Form Gen. 78, Notice to Correct Deficiencies (sample, page 38). It should contain a full statement of the reason for the notice and include any documen- tation of previous discipline. (Refer to Administrative Manual, Section 50-02, and applicable MOU.)
2. Give the NTCD to the employee in private. Explain to the employee the Department's standards and requirements, what is expected in the future, and the possible consequences if the behavior or performance in question is not corrected.

   Have the employee sign the form to acknowledge receipt. If the employee refuses to sign, indicate that fact on the remaining copies of Form Gen. 78.
3. Send copies of the NTCD to the business unit office and the Employee Relations Office to be placed in the employee's personnel file.

ADMINISTRATION (continued)

Suspension or Discharge

1. Review the Notice of Discharge, Suspension or Probationary Termination (Form Gen. 77). Be sure a full statement of the reason for the action is included. (Refer to Administrative Manual, Section 80-20.)

2. Obtain approval and signature of the appointing authority (only after Step D above has been completed).

3. Give notice to the employee personally.

   a. A suspension should be discussed when the notice is served. Explain to the employee the reasons for the suspension, what is now expected, and what further disciplinary action might result from lack of compliance.

   b. A discharge notice should be served personally, unless after a diligent search the employee cannot be found. If the employee cannot be personally served, the notice may be left at the employee's last known address. (Service by mail cannot be made except for a discharge during probation.)

4. Certify that the notice was served on the employee and return it as soon as possible to Personnel Records which sends the original copy to the Civil Service Commission. The action is effective only when the notice is filed with the Commission.

Suspension or Discharge (continued)

Under the Administrative Manual, Section 80-20, the following copies are required:

- Signed original for the Personnel Department via Personnel Records
- One signed copy to be served on the employee
- One signed copy for the Personnel Records Business Team
- One stamped copy for the Manager of Payroll and Timekeeping
- One stamped copy for the Assistant General Manager/Unit Manager
- One stamped copy for the Business Unit Director
- One unstamped copy for the Employee Relations Office

Any additional copies required by the business unit should also be made.

GUIDE TO DISCIPLINARY STANDARDS

COMMON OFFENSES SUBJECT TO DISCIPLINE

The guide lists various offenses and job performance or behavior standards that should be considered in determining whether an employee's actions constitute an offense subject to discipline. Not all possible offenses are listed; only those that are of greater significance and/or are most common.

CORRECTIVE ACTIONS

Various kinds of corrective actions for first, second, and third offenses are also presented. These corrective actions are recommendations only and are offered for general reference. The appropriate action may be either more or less severe, depending on the circumstances of a case.

For instance, management should exercise its discretion in recognizing that a single minor offense by a long-term employee with a good work record could be less severe than if committed by a relatively new employee with a poor work record.

PROGRESSIVE DISCIPLINE

Progressive discipline requires that repeated offenses should normally carry more severe corrective actions than first offenses. If the suggested corrective action for a third offense is less than discharge, and a fourth offense occurs, the principle of progressive discipline should be followed and a more severe corrective action appropriate to the situation should be imposed. A pattern of offenses after successive corrective actions ultimately results in discharge.

SUCCESSIVE OFFENSES

An offense is considered a "first" offense the first time formal action is taken by the supervisor under the applicable section of this guide.

When a previous offense has occurred, the time elapsed between that offense and the current offense should be considered in determining the corrective action.

MORE THAN ONE OFFENSE AT THE SAME TIME

One some occasions, an employee may commit more than one kind of offense at the same time. Generally, the discipline imposed should not be determined by simply adding together the corrective actions for each offense. In such cases, the appropriate corrective action should be selected from the range of actions applicable for the most serious offense, and the severity of the disciplinary action should be determined after considering the less serious offenses.

VARIOUS OFFENSES OVER A PERIOD OF TIME

Similarly, an employee may commit various kinds of offenses over a period of time. In the absence of any intervening pattern of good conduct, all past offenses are indicative of a pattern of unsatisfactory behavior and should be considered when determining an appropriate corrective action. Including a statement, such as "requiring excessive supervision", in the list of specific charges may be appropriate as a means of connecting unrelated types of offenses committed by a problem employee.

GUIDE TO DISCIPLINARY ACTIONS

A. CONDUCT UNBECOMING A CITY EMPLOYEE

Standard: Employees must perform their duties in a manner which earns and maintains the trust and respect of their supervisors, other employees, and the public.

		Suggested Actions		
	Offense	First Offense	Second Offense	Third Offense
1.	Using official position or office for personal gain or advantage	Written Notice to Discharge	6 to 10 days Suspension to Discharge	Discharge
2.	Engaging in any employment, activity, or enterprise which constitutes a conflict of interest	Written Notice to 30 days Suspension	6 days Suspension to Discharge	Discharge
3.	Accepting favors or gratuities for services required on the job	Written Notice to Discharge	6 days Suspension to Discharge	Discharge
4.	Disclosing confidential information	1 day Suspension to Discharge	10 days Suspension to Discharge	Discharge
5.	Using City time, property or equipment without authorization	Written Notice to Discharge	6 days Suspension to Discharge	Discharge
6.	Malicious destruction of City property or equipment	10 days Suspension to Discharge	Discharge	
7.	Misconduct, on or off the job, seriously reflecting on City employees or employment	1 day Suspension to Discharge	10 days Suspension to Discharge	Discharge

A. CONDUCT UNBECOMING A CITY EMPLOYEE (continued)

		Suggested Actions		
	Offense	First Offense	Second Offense	Third Offense
8.	Commission of acts which, if proved, constitute a felony or misdemeanor as established by proper investigation	1 day Suspension to Discharge	10 days Suspension to Discharge	Discharge
9.	Unauthorized possession of City equipment or property	1 to 20 days Suspension	6 days Suspension to Discharge	Discharge
10.	Unauthorized use of equipment or material to fabricate articles for private use	Written Notice to 10 days Suspension	11 days Suspension to Discharge	Discharge

B. JOB PERFORMANCE BELOW STANDARD

Standard: Employees must provide a high quality of service to the public and must consistently perform their duties effectively and efficiently.

		Suggested Actions		
Offense		First Offense	Second Offense	Third Offense
1.	Violating Department rules	Oral Warning to 5 days Suspension	6 days Suspension to Discharge	Discharge
2.	Requiring excessive supervision or instruction in performance of duties after completion of training for the position	Oral Warning or Written Notice	Written Notice to 5 days Suspension	6 days Suspension to Discharge
3.	Misusing, or failing to use, delegated authority in the performance of duties	Oral Warning to 20 days Suspension	6 to 30 days Suspension	Discharge
4.	Personal appearance not appropriate for the job in terms of community standards and job safety	Oral Warning or Written Notice	Written Notice to 5 days Suspension	6 days Suspension to Discharge
5.	Failing to carry out assigned work or supervisory responsibilities adequately, directly, or promptly	Oral Warning to Discharge	1 day Suspension to Discharge	Discharge

C. NEGLECT OF, OR INEXCUSED ABSENCE FROM DUTY

Standard: Employees must perform all duties reasonably required of them, and report for work as scheduled, unless ill, injured, or involved in an emergency.

		Suggested Actions		
	Offense	First Offense	Second Offense	Third Offense
1.	Neglect of duty	Oral Warning to Discharge	6 days Suspension to Discharge	Discharge
2.	Inexcused, excessive, or patterned absenteeism	Written Notice to 5 days Suspension	6 days Suspension to Discharge	Discharge
3.	Failing to make a reasonable effort to notify supervisor of inability to report for work	Oral Warning or Written Notice	Written Notice to 5 days Suspension	6 days Suspension to Discharge
4.	Leaving assigned work location without proper approval or appropriate reason	Written Notice to Discharge	1 day Suspension to Discharge	10 days Suspension to Discharge
5.	Frequent and inexcused tardiness	Oral Warning or Written Notice	Written Notice to 10 days Suspension	10 days Suspension to Discharge
6.	Sleeping on the job	Written Notice to Discharge	5 days Suspension to Discharge	10 days Suspension to Discharge

D. IMPROPER BEHAVIOR IN RELATIONS WITH SUPERVISORS, FELLOW EMPLOYEES, OR THE PUBLIC

Standard: Since most employees work daily with other employees or the public, they must cooperate and work well with others.

		Suggested Actions		
Offense		First Offense	Second Offense	Third Offense
1.	Flagrantly refusing to perform reasonable work assignments or to cooperate with supervisors or management in the performance of duties (insubordination)	6 days Suspension to Discharge	Discharge	
2.	Failure to cooperate with, or use of abusive language toward, other employees or the public	Oral Warning or Written Notice	Written Notice to 5 days Suspension	6 days Suspension to Discharge
3.	Unnecessarily disrupting the work of other employees	Oral Warning or Written Notice	Written Notice to 5 days Suspension	6 days Suspension to Discharge
4.	Using threats or attempting to harm another employee or the public	6 days Suspension to Discharge	Discharge	
5.	Making false, vicious or malicious statements about any employee, City Government, or management	Oral Warning to 30 days Suspension	6 days Suspension to Discharge	Discharge
6.	Possessing unauthorized dangerous weapons, such as firearms or knives, on City property	Oral Warning to 30 days Suspension	6 days Suspension to Discharge	Discharge

D. IMPROPER BEHAVIOR IN RELATIONS WITH SUPERVISORS, FELLOW EMPLOYEES, OR THE PUBLIC (continued)

		Suggested Actions		
Offense		First Offense	Second Offense	Third Offense
7.	Using unauthorized dangerous weapons, such as firearms, knives, or tools, which could result or results in harm to another employee or the public	30 days Suspension to Discharge	Discharge	
8.	Actions on the job intended to destroy property or to inflict bodily injury (whether or not the destruction or injury actually occurs)	Written Notice to Discharge	10 days Suspension to Discharge	Discharge
9.	Creating unsanitary conditions	Oral Warning to 5 days Suspension	6 to 10 days Suspension to Discharge	Discharge

E. UNFIT TO WORK DUE TO USE OF ALCOHOL OR DRUGS; GAMBLING

Standard: While at work, employees must not do anything which would impair their ability to perform their duties, or discredit the City and its employees.

		Suggested Actions		
Offense		First Offense	Second Offense	Third Offense
1.	Using alcohol or drugs on the job site during the work period	20 days Suspension to Discharge[1]	30 days Suspension to Discharge	Discharge
2.	Using alcohol or drugs which results in unfitness to work at reasonable efficiency or which may endanger the employee, other employees, City property, or the public	20 days Suspension to Discharge[1]	30 days Suspension to Discharge	Discharge
3.	Reporting for duty unfit for work due to use of drugs or alcohol	20 days Suspension to Discharge[1]	30 days Suspension to Discharge	Discharge
4.	Operating City vehicles or other equipment while under the influence of alcohol or drugs which could impair operation capability	20 days Suspension to Discharge[1]	Discharge	

[1] The suggested action may be reduced to 10 days suspension if the employee signs a Supervisor's Letter of Agreement (refer to Administrative Manual, Section 100-03, Appendix H).

The supervisor should make every effort to transport the employee home safely and to ensure that the employee is released to the custody of another responsible person.

E. UNFIT TO WORK DUE TO USE OF ALCOHOL OR DRUGS; GAMBLING (continued)

		Suggested Actions		
Offense		First Offense	Second Offense	Third Offense
5.	Illegally possessing drugs on the job site or on City property	20 days Suspension to Discharge	Discharge	
6.	Gambling on the job, on City property, or using City equipment	Written Notice to 10 days Suspension	6 to 30 days Suspension	Discharge
7.	Operating or conducting organized gambling for profit on the job, on City property, or using City equipment	10 days Suspension to Discharge	Discharge	

F. SAFETY

Standard: A basic requirement for all employees is that they perform their duties in a safe manner. This requirement is not restricted to operating equipment or motor vehicles.

		Suggested Actions[2]		
Offense		First Offense	Second Offense	Third Offense
1.	Operating City equipment unsafely or carelessly	Oral Warning or Written Notice	Written Notice to 5 days Suspension	5 days Suspension to Discharge
2.	Failing to use, wear, inspect, or properly care for and maintain safety equipment	Oral Warning to 5 days Suspension	5 to 20 days Suspension	10 days Suspension to Discharge
3.	Playing tricks or jokes or engaging in horseplay on the job which may lead to physical injury to employee or others, or damage to equipment or property	Written Notice to 10 days Suspension	5 to 10 days Suspension	10 days Suspension to Discharge
4.	Failing to enforce safety rules, practices, or procedures, or allowing unsafe practices or conditions to continue	Written Notice to 10 days Suspension	5 to 30 days Suspension	15 days Suspension to Discharge

[2] Crew members who are injured or traumatized because of their own violations of safety rules and procedures may be placed on disciplinary pay status on actions that involve suspensions.

F. **SAFETY** (continued)

		Suggested Actions[2]		
	Offense	First Offense	Second Offense	Third Offense
5.	Violating safety rules procedures, or accepted practices which could have resulted in injury, damage to equipment, or degradation of electric or water services	Written Notice to 10 days Suspension	5 to 20 days Suspension	10 days Suspension to Discharge
6.	Violating safety rules, procedures, or accepted practices which results in injury, disability or death, interruption or degradation of electric or water services, or damage to equipment or property	Written Notice to 30 days Suspension	10 days Suspension to Discharge	20 days Suspension to Discharge
7.	Knowingly violating safety rules, procedures or accepted practices which results in injury, disability, death or interruption or degradation of electric or water services, or damage to equipment or property	6 days Suspension to Discharge	20 days Suspension to Discharge	Discharge

2 Crew members who are injured or traumatized because of their own violations of safety rules and procedures may be placed on disciplinary pay status on actions that involve suspensions.

G. FRAUD, DISHONESTY, THEFT, OR FALSIFICATION OF RECORDS

Standard: City employees must be characterized by high personal integrity both in securing employment and in the performance of their duties.

Offense		Suggested Actions: First Offense	Suggested Actions: Second Offense	Suggested Actions: Third Offense
1.	Soliciting, accepting or offering a bribe	Discharge		
2.	Theft of, or aiding or encouraging the theft of, cash or City property or equipment, as established by proper investigation	Discharge		
3.	Intentionally falsifying or destroying City records without proper authorization	Discharge		
4.	Intentionally falsifying application for employment or medical information which would have otherwise caused employment disqualification	Discharge		
5.	Deliberately withholding work-related information from supervisors or others who require the information	Written Notice to 10 days Suspension	6 to 30 days Suspension	Discharge
6.	Falsifying time or mileage reports, reasons for absence, expense accounts, or similar work-oriented documents; falsely claiming sick or allowed pay	5 days Suspension to Discharge	Discharge	

H. DISCRIMINATION/HARASSMENT

Standard: City employees are expected to comply with Federal and State laws and regulations and City policies regarding equal employment opportunity, affirmative action, and a discrimination/harassment free workplace. City employees are expected to demonstrate sensitivity to and respect for individual and personal differences when working with other employees and the public.

		Suggested Actions		
	Offense	First Offense	Second Offense	Third Offense
1.	Failure to comply with City policies on equal employment opportunity and affirmative action, including but not limited to, the recruitment, selection, promotion, training, or disciplining of employees equally regardless of a particular race, national origin, sex, age, religion, sexual orientation, or disability (not related to job performance)	Oral Warning to Discharge	1 day Suspension to Discharge	Discharge
2.	Demonstrating insensitivity to others by making derogatory comments, epithets, jokes, teasing, remarks, or slurs based on race, ethnicity, national origin, gender, religion, sexual orientation, or disability	Oral Warning to 10 days Suspension	5 to 20 days Suspension	20 days Suspension to Discharge

H. **DISCRIMINATION/HARASSMENT** (continued)

		Suggested Actions		
Offense		First Offense	Second Offense	Third Offense
3.	Demonstrating insensitivity to others through nonverbal actions, such as making suggestive gestures, or displaying cartoons or images that derogatorily depict or describe differences associated with race, ethnicity, gender, religious groups, nationalities, sexual orientation, or the disabled	Oral Warning to 10 days Suspension	5 to 20 days Suspension	20 days Suspension to Discharge
4.	Harassment — repeated and/or multiple actions as described in #2 and/or #3 above which created or could lead to a hostile, offensive, threatening, or intimidating work environment	5 days Suspension to Discharge	10 days Suspension to Discharge	Discharge
5.	Retaliating against an employee for filing a discrimination complaint, for participating in a discrimination complaint investigation, or for opposing discriminatory actions	5 days Suspension to Discharge	10 days Suspension to Discharge	Discharge

H. DISCRIMINATION/HARASSMENT (continued)

Offense		Suggested Actions: First Offense	Second Offense	Third Offense
6.	Supervisory Standard: (a) Failure to fulfill supervisory responsibilities as specified in City policies and in the City's Affirmative Action Program	Oral Warning to Discharge	1 day Suspension to Discharge	Discharge
	(b) Failure to maintain a harassment free workplace for subordinates; failure to foster a discrimination free workplace by one's own individual actions or conduct; or allowing subordinates to retaliate against an employee for filing a discrimination complaint, for participating in a discrimination complaint investigation, or for opposing discriminatory actions	1 day Suspension to Discharge	10 days Suspension to Discharge	Discharge

I. SEXUAL HARASSMENT

Standard: City policy and Federal and State law prohibit sexual harassment in the workplace. Supervisors are required to ensure and maintain a working environment free of sexual harassment, intimidation, and coercion. City employees are expected to conduct themselves in a manner which fosters a discrimination/harassment free workplace which is free from conduct that is hostile, offensive, threatening, or intimidating, or that interferes unreasonably with an individual's work performance.

Action: Employees who believe this policy has been violated should contact their Business Unit Equal Employment Opportunity Coordinator, the Department's Equal Employment Opportunity Coordinator, or the Equal Employment Opportunity Division of the City's Personnel Department at (213) 847-9800.

		Suggested Actions		
	Offense	First Offense	Second Offense	Third Offense
1.	Sexual Favors: Implicit or explicit coercive pressure for sexual favors	20 days Suspension to Discharge	Discharge	
2.	Physical: (a) Any physical conduct or act of a sexual nature, involving the use of force or the threat of force. *Examples: rape, attempted rape, sexual assault, stalking*	Discharge		
	(b) Unwelcome physical contact in sexual areas, including but not limited to, breasts, buttocks, or genitalia. *Examples: grabbing, groping, kissing*	20 days Suspension to Discharge	Discharge	

I. **SEXUAL HARASSMENT** (continued)

		Suggested Actions		
	Offense	First Offense	Second Offense	Third Offense
2.	(c) Unwelcome touching, rubbing, or any type of physical contact and/or conduct toward other employees which is sexually suggestive. *Examples: pinching, patting, caressing, massaging, stroking, hugging, violating space, impeding/blocking movement*	1 day Suspension to Discharge	10 days Suspension to Discharge	Discharge
3.	Verbal: Demonstrating insensitivity to others by making derogatory comments, epithets, jokes, teasing, remarks, slurs, or questions of a sexual nature.	Oral Warning to 10 days Suspension	5 to 20 days Suspension	20 days Suspension to Discharge
4.	Visual: Demonstrating insensitivity to others through nonverbal actions, such as making sexually suggestive gestures; displaying sexually explicit objects, pictures, cartoons, or posters; leering, unwanted letters, gifts, and/or materials of a sexual nature.	Oral Warning to 10 days Suspension	5 to 20 days Suspension	20 days Suspension to Discharge

I. SEXUAL HARASSMENT (continued)

Offense		Suggested Actions: First Offense	Second Offense	Third Offense
5.	Hostile Work Environment: Repeated, unwelcome, unwanted actions as described in #1, #2, #3, and/or #4 which created or could lead to a hostile, offensive, threatening, or intimidating work environment	5 days Suspension to Discharge	10 days Suspension to Discharge	Discharge
6.	Retaliation: Retaliating against an employee for filing a sexual harassment complaint, for participating in a sexual harassment complaint investigation, or for opposing discriminatory actions	5 days Suspensions to Discharge	10 days Suspension to Discharge	Discharge

I. **SEXUAL HARASSMENT** (continued)

		Suggested Actions		
	Offense	First Offense	Second Offense	Third Offense
7.	Supervisory Standard: Failure to take appropriate action to correct and eliminate sexual harassment from the workplace; failure to foster a discrimination free workplace by one's own actions or conduct; or allowing subordinates to retaliate against an employee for filing a sexual harassment complaint, for participating in a sexual harassment complaint investigation, or for opposing discriminatory actions	1 day Suspension to Discharge	10 days Suspension to Discharge	Discharge

Form Gen. 79
Notice of Commendation

Form Gen. 79

CITY OF LOS ANGELES

NOTICE OF COMMENDATION

COPIES: 1. Employee (white)
2. Dept. Personnel Office (blue)
3. Personnel Dept. (pink)

NAME	EMPLOYEE NO.	DATE
DEPARTMENT	DIVISION	POSITION TITLE

This commendation is extended for the following actions:

In meriting this commendation you have given exceptional public service to your department and to the City. Such performance in the long run helps the reputation of all City employees with its citizens. A copy of this notice will be placed in your employee folder and in your personnel file.

Supervisor	Approved

Form Gen. 77
Notice of Discharge, Suspension or Probationary Termination

Form Gen. 77 (Rev. 6-80)
ORIG.—Personnel Dept.
DUP —Employee
TRIP —Department

CITY OF LOS ANGELES

NOTICE OF DISCHARGE, SUSPENSION, OR PROBATIONARY TERMINATION

1. EMPLOYEE NAME	LAST	FIRST	MIDDLE	2. EMPLOYEE NUMBER
3. DEPARTMENT, BUREAU, OFFICE, OR MAJOR DIVISION				4. CLASS TITLE AND CODE
5. RESIDENCE ADDRESS				

6. **TYPE OF ACTION**
(CHECK APPROPRIATE BOX)

A. Probationary Termination.
EFFECTIVE ____________
THERE IS NO APPEAL FROM THIS ACTION. However, you may request restoration of your name to the eligible list as described in item 18c below.

B. Suspension—lack of work or lack of funds.
EFFECTIVE ____________
THERE IS NO APPEAL FROM THIS ACTION. If you have completed probation, your name will be placed on a reserve list for preferential rehire. If you did not complete probation, your name will be placed on the eligible register until the list expires. If the list has expired at the time of layoff, it will be necessary to retake the examination.

C. Suspension (disciplinary — more than 5 working days)
From ____________ to ____________ inclusive
YOU MAY APPEAL THIS ACTION in accordance with the procedure outlined in 18b below.

D. Suspension (disciplinary — 5 working days or less).
From ____________ to ____________ inclusive
THERE IS NO APPEAL FROM THIS ACTION **UNLESS** this suspension combined with other suspensions you have received within the preceeding 12 months totals more than five (5) working days in which case the appeal procedure outlined in 18b below is available to you.

E. Discharge. EFFECTIVE ____________
YOU MAY APPEAL THIS ACTION in accordance with the procedure outlined in 18b below.

7. Action pending before the Worker's Compensation Appeals Board? ☐ YES ☐ NO ☐ UNKNOWN

8. Cause of action (continue on reverse side if required):

9. TYPED NAME AND TITLE OF APPOINTING AUTHORITY	10. SIGNATURE	11. DATE

12. **SERVICE OF NOTICE**

INSTRUCTIONS: A copy of this notice must be served upon every person who is suspended or discharged for cause after completing his probationary period. Service must be made personally or by leaving a copy at his last known place of residence if said person cannot be found after making reasonable efforts to find him. Service by mail cannot be made except where there is a termination during probation. The completed original of this notice must be filed immediately with the Board of Civil Service Commissioners. If this notice is not served personally, indicate on reverse side what efforts were made to find the employee.

13. I hereby certify that a copy of this notice was served on the subject employee on DATE ____ at TIME ____ ☐ A.M. ☐ P.M.

14. ☐ Served Personally ☐ Copy Left at Last Known Residence ☐ Mailed (only for probationary term.)	15. EMPLOYEES LAST KNOWN RESIDENCE
16. PRINTED NAME OF PERSON WHO SERVED NOTICE	17. SIGNATURE OF PERSON WHO SERVED NOTICE

UNEMPLOYMENT INSURANCE/APPEAL/RESTORATION PROCEDURE

18. a. **UNEMPLOYMENT INSURANCE ELIGIBILITY.**
See reverse for statement regarding your right to apply for unemployment insurance benefits.

b. **DISCHARGE FOLLOWING PROBATION OR DISCIPLINARY SUSPENSION.**
Your signed written appeal must be filed with the City of Los Angeles Civil Service Commission, Room 206, City Hall South, 111 East 1st Street, Los Angeles, within five (5) calendar days, including Saturday, Sunday, and holidays, after this notice was served on you. (Section 112 of the Los Angeles City Charter, governing discharges and disciplinary suspensions, is reprinted on the reverse side.)

c. **RESTORATION TO ELIGIBLE LIST FOLLOWING PROBATIONARY TERMINATION.**
Your signed written request must be filed with the Personnel Department within five (5) calendar days, including Saturday, Sunday, and holidays after receiving this notice. Restoration can be made only if your eligible register is still active. If the list has expired, it will be necessary to retake the examination.

ADMINISTRATIVE MANUAL

SECTION **WORK PERFORMANCE**

SUBJECT **A Guide to Employee Discipline**

Form Gen. 78
Notice to Correct Deficiencies

Form Gen. 78
ORIG.—Employee
DUP.—Personnel Dept.
TRIP.—Department
QUAD.—Department

City of Los Angeles
NOTICE TO CORRECT DEFICIENCIES

EMPLOYEE'S NAME 1 (First) (Middle) (Last)	DATE 2
CLASS TITLE 3	CLASS CODE 4
DEPARTMENT/PUBLIC WORKS BUREAU 5	BUREAU/DIVISION 6

STATEMENTS OF DEFICIENCY (Use Reverse Side if Necessary)
7

IMMEDIATE SUPERVISOR SIGNATURE 8	APPROVED BY 9	TITLE 10

The purpose of this notice is to call the above deficiency to your attention, and give you an opportunity to correct it. A copy of this notice will be placed in your personnel file and may be considered in future disciplinary actions.

Without agreeing with the above, I certify that I have received a copy of this notice.	EMPLOYEE SIGNATURE 11	DATE 12

ATTACHMENT D

SAFETY ROLES AND RESPONSIBILITIES

CITY OF LOS ANGELES
DEPARTMENT OF WATER AND POWER
INTRADEPARTMENTAL CORRESPONDENCE

Date: July 19, 2018

To: Distribution

From: Richard F. Harasick, Senior Assistant General Manager – Water System

Subject: Safety Roles and Responsibilities Specific to Water System Safety and Water System Divisions

---

Distribution

Anselmo G. Collins
Karyn Y. Grime
Andrew L. Linard
Breonia L. Lindsey
David R. Pettijohn
Susan Rowghani
Steve P. Torres

This memorandum is to distinguish the responsibilities between Water System (WS) Safety and WS divisions and to identify gaps and recommendations.

Responsibility of WS Divisions

Specific safety responsibilities of divisions include, but are not limited to:

- Develop and maintain a division Injury and Illness Prevention Program (IIPP) and ensure its effective implementation.
- Provide support, leadership, and direction for the IIPP.
- Support all programs and committees whose function is to promote employees safety and health.
- Actively participate in, or delegate representation to, safety committees as required.
- Review serious accidents to ensure that proper reports are completed, workplace hazards are identified and corrected, and appropriate training is given to prevent recurrence.

- Ensure that recommendations from Accident Investigation Committee (AIC) are followed and implemented, as appropriate.

- Provide equipment, tools, and other devices for the safe performance of the employee's job.

- Dedicate adequate personnel to division and/or section safety function.

- Encourage acknowledgement of employees who consistently engage in safe and healthful work practices or make significant contribution to ensuring a safe work environment for their peers.

- Develop local health and safety recognition programs.

- Discipline employees at all levels for failure to comply with safety policies, procedures, rules, and work practices.

- Ensure that employees receive applicable training prior to assignment of duties and any time new workplace hazards are identified.

- Report all accidents and incidents (injuries) to WS Safety.

<u>Responsibility of WS Safety</u>

Specific responsibilities of WS Safety include, but are not limited to:

- Develop and maintain WS IIPP consistent with LADWP policies, procedures, and directives.

- Review and maintain WS Safety Rule Book.

- Recommend and approve control measures and advise on appropriate Personal Protective Equipment issued to employees.

- Identify and recommend health and safety training needs to maintain compliance with changes in regulatory requirements.

- Participate in AIC for informal investigations and chair committees for formal investigations.

- Assist management and supervision in investigating accidents and other unusual incidents in order to prepare preliminary reports, including recommendations.

- Represents WS in all Cal-OSHA investigations, coordinates Cal-OSHA interviews with WS employees, and interprets Cal-OSHA rules, laws, and regulations. Also, acts as a liaison between WS and Cal-OSHA.

- Develop specific instructional materials, policies, procedures, and programs involving WS-wide health and safety.

- Help evaluate and purchase necessary health and safety equipment, and keep current with methods, work practices, and equipment as they relate to safety.

- Review completed divisions IIPPs and recommend revisions as needed.

- Support management in the health and safety legislative review process.

- Review 'near-miss' incidents with divisions and oversee/assist with mitigation activities.

- Serve as the WS Liaison with Corporate Health and Safety (CHS) and with the Joint Safety Institute.

- Oversee and coordinate WS's activities and participation in LADWP/CHS safety programs, attend meetings, assist with logistical planning, and perform other program tasks as needed.

- Review, research, and interpret safety-related-governing rules, regulations, and policies affecting the WS to ensure proper policies, protocols, procedures are in place.

If you have any questions or require additional information, please contact me at Extension 71022.

BLL/vf

ATTACHMENT E

FACILITY/JOB SITE SAFETY INSPECTION FORM

City of Los Angeles Department of Water and Power

FACILITY/JOB SITE SAFETY INSPECTION

Facility location ______________________________ Date ____________

Address ______________________________

Section/Group ______________________________

Work activity ______________________________

____

Contact Person ______________________________ ______________________________

Inspected by ______________________________ ______________________________

(X) SAFE (O) UNSAFE (A) AVAILABLE (NA) NOT AVAILABLE/APPLICABLE

Safety Programs/Documentation

Injury Illness & Prevention Program		State/Federal Labor Law	
Safety Rules Book		Worksite Permits (Const. only)	
Hazard Communication		Cal/OSHA 300A Log (Feb 1 – Apr 30)	
MSDS and Inventory Index		Emergency Response Plan	
Bloodborne Pathogen Program		Fire Protection Evacuation Plan	
Safety meeting/tailgate(sign-in sheet)		Operating Instruction - Industrial trucks	
Training Records		Emergency Phone Numbers	
Facility Floor Plan/Site Layout		Other	

Safe Practices

Tools Appropriate for Work		Confined Space	
Tools Properly Used		Crane/Rigging	
Body Positioning		Electrical/Lockout/Tagout	
Material Handling		Fall Protection	
Flammable materials and storage		Ladder Usage	
Trenching/Shoring		Soil Type (circle one)	A B C NA
Machine Guarding		Other	

Personal Protective Equipment

Head Protection		Respiratory Protection	
Eye/Face Protection		Safety Vest	
Hearing Protection		High Visibility Clothing	
Hand Protection		Fall Protection (harness, safety line)	
Foot Protection		Other	

Safety Conditions/Hazards

Work Area Protection		Slip/Trips/Fall Hazards	
Electrical/GFCI Power		Fire Extinguisher	
Gas Cylinder Storage		First Aid Kit/AED	
Vehicle/Equipment Placement		Aisles/Floors/Exit clearances	
Tools/Equipment condition		Ergonomics	
Traffic Control/Delineation		Housekeeping/Material Storage	
Pedestrian Safety		Other	

NOTE: *State/Federal Labor Law Posting* - California and Federal Labor Laws, Access to Medical and Exposure Records, FMLA, Discrimination and Disability Act, etc.

Worksite Construction Permits (if applicable) – air compressors, generators, etc.

Observations and Comments:

City of Los Angeles Department of Water and Power

FACILITY/JOB SITE SAFETY INSPECTION

Item	Location	Code	Description	Priority (1, 2, 3, 4)	Corrective Action Taken	Completed Date
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

PRIORITY:
1 = IDLH, 2= 48 Hours, 3 = 7 Days, 4 = 30 Days

CODES:

01 = Access/Egress Aisles & Exits	06 = Construction Safety	11 = Ergonomics	16 = Hazard Communication	21 = Laboratory Safety	26 = Respiratory Protection
02 = Asbestos/Lead	07 = CPR/First Aid	12 = Excavation & Shoring	17 = HAZWOPER	22 = Lasers/Radiation	27 = Signage
03 = Bloodborne Pathogens	08 = Crane, Hoist & Rigging	13 = Fall Protection	18 = Hearing Protection	23 = Lockout/Tagout	28 = Traffic Control
04 = Chemical Storage	09 = Electrical Safety	14 = Fire Prevention	19 = Housekeeping	24 = Machine Guarding	29 = Welding
05 = Confined Space Program	10 = Emergency Response	15 = Fleet Safety	20 = Industrial Trucks (Forklifts)	25 = Medical Monitoring	30 = Other

FACILITY/JOB SITE SAFETY INSPECTION

Item	Location	Code	Description	Priority (1, 2, 3, 4)	Corrective Action Taken	Completed Date
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						

PRIORITY:
1 = IDLH, 2= 48 Hours, 3 = 7 Days, 4 = 30 Days

CODES:
01 = Access/Egress Aisles & Exits
02 = Asbestos/Lead
03 = Bloodborne Pathogens
04 = Chemical Storage
05 = Confined Space Program
06 = Construction Safety
07 = CPR/First Aid
08 = Crane, Hoist & Rigging
09 = Electrical Safety
10 = Emergency Response
11 = Ergonomics
12 = Excavation & Shoring
13 = Fall Protection
14 = Fire Prevention
15 = Fleet Safety
16 = Hazard Communication
17 = HAZWOPER
18 = Hearing Protection
19 = Housekeeping
20 = Industrial Trucks (Forklifts)
21 = Laboratory Safety
22 = Lasers/Radiation
23 = Lockout/Tagout
24 = Machine Guarding
25 = Medical Monitoring
26 = Respiratory Protection
27 = Signage
28 = Traffic Control
29 = Welding
30 = Other

City of Los Angeles Department of Water and Power

FACILITY/JOB SITE SAFETY INSPECTION

Diagram Sheet

ATTACHMENT F

ROOM EMERGENCY ASSIGNMENT BOARD POLICY

CITY OF LOS ANGELES
DEPARTMENT OF WATER AND POWER
INTRADEPARTMENTAL CORRESPONDENCE

Date: June 7, 2018

To: Distribution

From: Richard F. Harasick, Senior Assistant General Manager, Water System

Subject: Room Emergency Assignment Board Policy

Distribution:

Anselmo G. Collins	Karyn Y. Grime	David R. Pettijohn	Steve P. Torres
Andrew L. Linard	Breonia L. Lindsey	Susan Rowghani	

LADWP seeks to provide a safe environment for employees and visitors. Water System Safety has identified the Room Emergency Assignment Board policy as a means to improve communication that is critical to a prompt effective response in emergency situations.

The following is the Water System policy for use of proper implementation and adoption of these tools:

1.0 Purpose of the Policy

To facilitate a timely and effective response to any emergency that occurs during the course of any meeting conducted at a Water System controlled location and/or hosted by Water System personnel.

2.0 Scope/Applicability

Policy requirements apply to all persons conducting or participating in any meeting conducted at any Water System controlled facility and to all Water System employees hosting any meeting regardless of location.

3.0 Policy

To increase the likelihood of a timely and effective response to environmental or medical emergencies that may occur without warning. Complete a Room Emergency Assignment Board or Room Emergency Assignment Form at the beginning of any meeting hosted by Water System personnel regardless of location.

4.0 Roles and Responsibilities at Meetings

Meeting organizer is responsible for:

1. Determining availability and location of emergency response equipment prior to the beginning of the meeting.
2. Identifying emergency evacuation routes prior to the beginning of the meeting.
3. Filling in as many of the fields on the Room Emergency Assignment Board/Form as possible at the beginning of the meeting.
4. Clearly communicating to all meeting participants:
   a. Evacuation routes.
   b. Locations of emergency response equipment.
   c. Responsibilities of individuals who accept assigned roles identified on the Board/Form.

Meeting attendees are:

1. Encouraged to volunteer for an assigned role.
2. Expected to carry out any accepted responsibilities should an emergency situation arise.
3. Expected to follow the directions of individuals who are fulfilling responsibilities of their assigned role.

5.0 Water System Safety Roles and Responsibilities

1. Provide the blank Room Emergency Assignment Board forms on the Water System Intranet.

2. Assist with production of custom forms and/or boards for frequently used Water System meeting rooms with pre-filled fields indicating location, nearest AED, fire extinguisher, First Aid Kit, and other information as required (sample attached).

If you need further information, please contact Steve P. Torres, Manager of Water System Safety, at Extension 72099 or by email at Steve.Torres@ladwp.com.

AD/pm
Attachment

Sample of Room Emergency Assignment Board

ROOM EMERGENCY ASSIGNMENTS

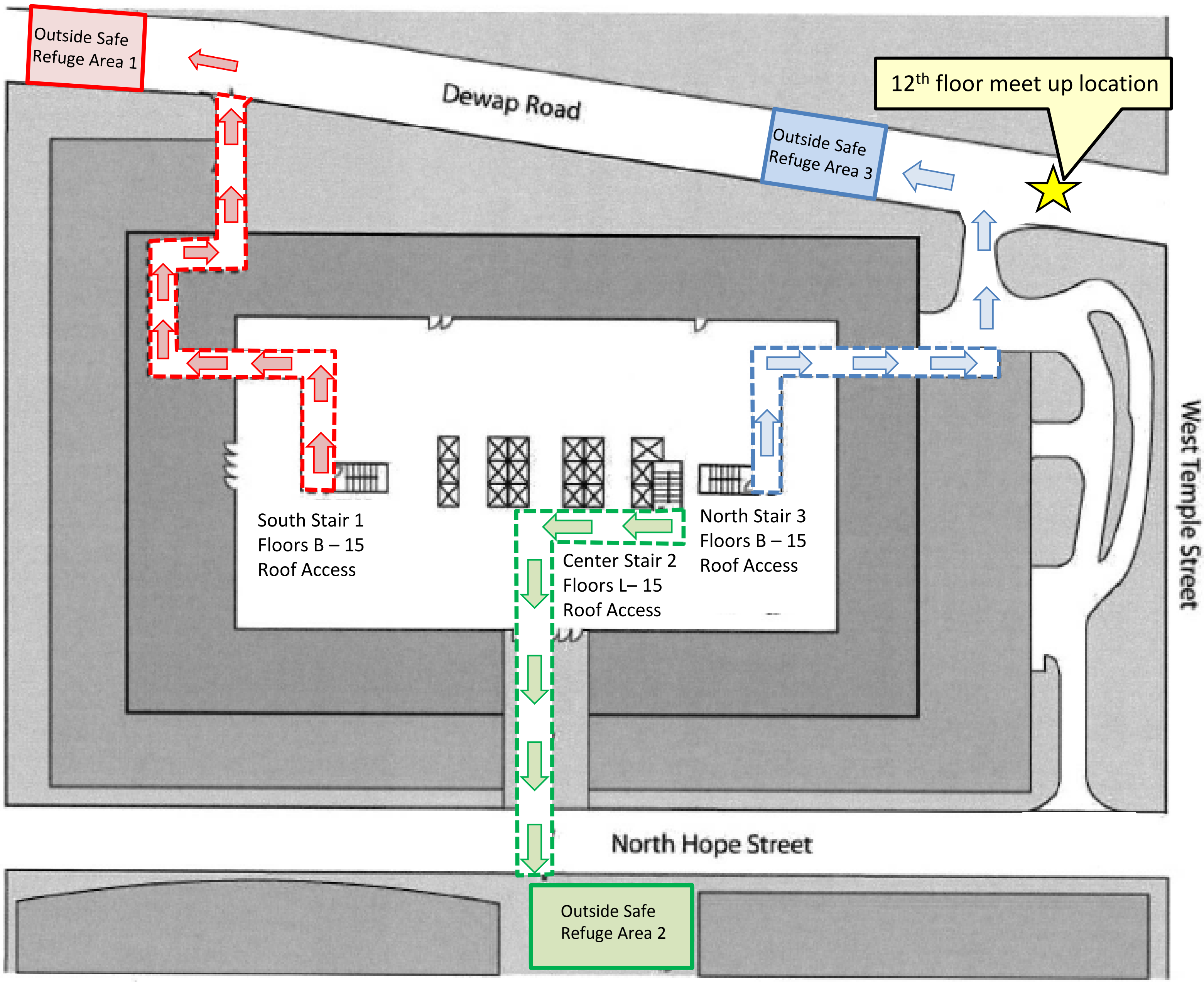
OUR LOCATION	
EMERGENCY LEADER	
EMS CONTACT Who to call	
SWEEPER Person to ensure everyone vacated the room	
FIRST AID PROVIDER	
EVACUATION COORDINATOR Person to set location and route for evacuation	
NEAREST AED 	
NEAREST FIRE EXTINGUISHER 	
NEAREST FIRST AID KIT 	
OTHER DIRECTIONS AS NEEDED	

Revised April 9, 2018

ATTACHMENT G

SAFE REFUGE AREAS MAP

STAIRWELLS AND OUTSIDE SAFE REFUGE AREAS MAP



Step 1. Please go to the appropriate Safe Refuge Area based on stairwell taken, as seen on the map.

Step 2. After safely reaching your Safe Refuge Area, please move to the 12th floor meet up location designated with the star on the map.

IMPORTANT

In the event of an earthquake or other emergency such as a bomb threat where evacuation is necessary, alternate Safe Refuge Areas will be determined and announced at that time.

ATTACHMENT H

REMOTE AND ISOLATED WORKER POLICY

CITY OF LOS ANGELES
DEPARTMENT OF WATER AND POWER
INTRADEPARTMENTAL CORRESPONDENCE

Date: June 16, 2015

To: Water Quality Division Personnel

From: Albert G. Gastelum, Director of Water Quality

Subject: Update to Water Quality Division "Remote and Isolated Worker Policy"

The attached updated Water Quality Division "Remote and Isolated Worker Policy" will take effect immediately. This policy supersedes the previous group-specific policies. Supervisors should review this policy with each of his/her employees. Following these procedures will help protect the safety of each employee, particularly those who are working in isolation or in a remote area.

Should you have any questions or comments about the policy, please bring them to the attention of your supervisor and the Water Quality Division Safety Committee. Your cooperation and compliance with the new and revised policies will make for a safer workplace and will be appreciated by all.

AGG:lsf
c: Steve P. Torres
Jonathan K. Leung
Alma De Garcia
J. Don Christie
Jay Negrin

Water Quality Division Remote/Isolated Facility Worker Safety Policy

The purpose of this policy is to provide measures to protect the health and safety of those who work in remote locations or work alone in the field, where assistance is not readily available to employees in the event of an injury, illness, or other emergency. Adherence to this policy helps demonstrate due diligence to meet health and safety requirements when working alone or in remote locations. The Water Quality Division will utilize two basic work alone policies. The first is for employees who have a work reporting location that is common to others (such as JFB or the WQ Lab). The other policy is for employees who normally report to remote/ isolated locations without other staff present.

I. Reporting Location is a Common Work Facility:

a. Employee and supervisor shall establish a set work schedule, including work days and work start/ finish times. This should be identified in the timesheet (Worktech) and the employee's MS Outlook Calendar (if the employee has an e-mail account). The group or section manager and timekeeper should also have a copy of the employee's work schedule (e.g. Fair Labor Standards Act Record).

b. If an employee must leave the facility to perform a work assignment that is performed alone or remote, then the schedule for this work assignment shall either be indicated in the employee's MS Outlook Calendar or on a visible staff "In/Out" Board. The employee should indicate what time he/she is leaving and expected to return to the office, and provide the Supervisor with an emergency contact phone number or contact method. When determining a contact procedure, consider whether the site has cell phone coverage.

c. If the employee intends to end the shift in the field or alone, the supervisor and employee must develop a plan or process for the employee to notify the supervisor that he/she has safely ended the work shift. This may include phone call, voicemail, email, messaging system, or other reliable method. To the extent practicable, this notification shall be provided before the end of the supervisor's shift.

d. If the supervisor is unavailable (ASDO, vacation, out of town), then the Employee shall develop the notification plan with an alternate supervisor or lead.

e. The supervisor (or alternate supervisor) is responsible for checking on the condition of the employee if the employee is not heard from within one hour of the established end-of-shift notification time.

f. If an assignment requires the employee to be out-of-office for multiple days or extended periods, then a start/finish check-in procedure and itinerary shall be developed by supervisor and employee, in accordance with Section 2 below.

g. To the extent practicable, Supervisors shall establish work schedules and coverage such that there are two or more employees at the facility during each work shift.

II. Reporting Location is an Isolated Field Location or Facility

a. Supervisors are responsible for assessing work-alone situations or remote locations. The supervisor should develop, communicate, and implement procedures for remote work assignments. The employee and supervisor should discuss any safety concerns prior to the employee leaving the office for the remote work assignment.

b. The supervisor should have contact information for their employees (cell phone numbers, satellite phone numbers, and/or radio call numbers). If necessary, the supervisor should provide the employee with a portable radio or satellite phone.

c. The supervisor and employee shall develop situation specific contact plans. The plan should identify the primary and backup contact person in the office.

d. The employee should develop routes for specific work assignments or "runs". Routes and itineraries should be communicated to the supervisor in advance to facilitate locating the employee, if that becomes necessary.

e. The employee should call the supervisor at or near the beginning of the work day to check in and discuss any changes to their run or work location.

f. During the morning call, the supervisor and employee should agree on an approximate check-in time at the end of the day. If the supervisor will not be available to receive the end-of-shift notification, the supervisor should identify and notify an alternate supervisor.

g. The employee should call the supervisor if there are any changes to the route for the day. This may be due to bad weather or inaccessibility to certain locations.

h. The employee should call at the agreed upon time, near the end of the shift, to notify the supervisor that he or she is OK.

i. The supervisor (or alternate supervisor) is responsible for checking on the condition of the employee if the employee does not check in within one hour of the planned end-of-shift notification time.

ATTACHMENT I

REPORT OF UNSAFE CONDITION OR HAZARD

City of Los Angeles Department of Water and Power

REPORT OF UNSAFE CONDITION OR HAZARD

Employee Name (Optional) ______________________ Section/Group: __________

Job Title: ______________________ Phone Number: __________

Location of Unsafe Condition or Hazard: ______________________

Description of Unsafe Condition or Hazard: ______________________

What changes would you recommend to correct the condition or hazard? ______________________

Date and Time Condition Observed: ______________________

Priority Based on Severity of Hazard: ______________________
e.g. Imminent Hazard, High Priority, Low Priority

Corrective Action

Manager/Supervisor Response:

Supervisor Receiving: ______________________ Investigation Date: __________

Investigation Results: What was found? Was condition unsafe or hazardous? (attach additional sheets if necessary):

Action to Correct Hazard or Information provided to Employee why condition is safe:

Name of Investigator: ______________________ Phone Number: __________

Signature: ______________________ Date: __________

Copy to: Group Supervisor
Safety Coordinator

ATTACHMENT J

TAILGATE/GROUP SAFETY MEETING

	WATER SYSTEM SAFETY	LOS ANGELES DEPARTMENT OF WATER & POWER
		Water System Safety Tailgate Record

IN CASE OF AN EMERGENCY CALL (855) 262-9880

Water System								
☐Central	☐East Valley	☐Harbor	☐Western	☐West Valley	☐Metro	Aqueduct:	☐North	☐South

Lead Person/Crew (Radio call number):	Work Order:	Date:
Work Address:		Map #:
Descriptive Location: (ex. GPS, cross streets, vault, facility, etc.)	Time in:	Time out:
Nearest Emergency Medical Facility:		

Purpose of Visit/Scope of Work (Discuss any site-specific job plans with crew)	
Field Contact:	Phone:

Possible Hazards Associated with the Job/Visit:

General	Electrical	Mechanical	Special Precautions
☐Hazardous conditions	☐Electrical hazard proximity	☐Equipment failure	☐Adjacent structures
☐Ergonomics	☐Overhead power line	☐Lockout/Tagout	☐Condition of structures
☐Confined space	☐Underground power	☐Moving parts	☐Lighting conditions
☐Tunnel Safety	☐Arc flash	☐Pinch points	☐Terrain
☐Trenching/Shoring	☐Lockout/Tagout:	☐Valves restrained	☐Hazardous spills and leaks
☐Falling objects	☐Other:	☐Sharp objects	☐Trenching and shoring
☐House-keeping	☐Other:	☐Hoisting/rigging	☐Power line clearance

Work Area Protection		**Environmental**	
☐Traffic conditions	☐Pedestrian hazards	☐Weather conditions	☐Hazardous air
☐Mobile crane	☐Lighting	☐Asbestos or Lead	☐Treatment chemicals
☐Ventilation	☐Air monitoring	☐Insects/Rodents/Snakes	☐Noise >90 Decibels
☐Other contractors at job-site	☐Fall hazards > 6 feet	☐Slips/Trips/Falls	☐

Safety Considerations		**Safe Start**	
Work Procedures	**Tools/Equipment**	**State:**	**Critical Errors:**
☐Isolation of equipment	☐Hand Tool Use & inspections	➢Rushing	➢Eyes not on Task
☐Dig Alert/USA	☐Fall protection equipment	➢Fatigue	➢Mind not on Task
☐High 5 Ergo lifting	☐Correct tools for the job	➢Frustration	➢Line-of-Fire
☐	☐Special equipment	➢Complacency	➢Balance/Traction/Grip

Safety Checklist

☐Hard hat	☐Gloves	☐Blue Pouch	☐IIPP (Injury Illness Prevention Program)
☐Safety eyewear	☐Electrical safety clothing	☐First Aid Kit/AED	☐Safety equipment for the job
☐Hearing protection	☐Flashlight	☐Water	☐W.A.T.C.H. handbook
☐Vest	☐Inspection tools	☐Sunscreen	☐SDS (Safety Data Sheets)
☐Appropriate footwear	☐Cell phone	☐GPS/Locator	☐Fall protection equipment
☐Respirator	☐Handheld radio	☐SCBA	☐Snake protective clothing
☐	☐	☐	☐DWP Safety Rules Book

Additional information:

NO JOB IS SO IMPORTANT, OR SERVICE SO URGENT, THAT WE CANNOT TAKE TIME TO PERFORM OUR WORK SAFELY

	WATER SYSTEM SAFETY	LOS ANGELES DEPARTMENT OF WATER & POWER
		Water System Safety Tailgate Record

IN CASE OF AN EMERGENCY CALL (855) 262-9880

Other Safety Concerns:

Time	First and Last Name (Print)	Signature

SEE SOMETHING…SAY SOMETHING

Reference Telephone Numbers		
LADWP Operator	213-367-4211	
LAWSDAC	213-367-5118	
LAAFP Control Room (Los Angeles Aqueduct Filtration Plant)	818-771-6020	
LADWP Security	213-367-3373	
(Owens Valley) Control Gorge	800-992-8344	760-873-0450
Steve Torres	213-367-2099	Cell: 213-798-5732
Michael Cosenza	213-367-8873	Cell: 213-798-5196
Kirk Fortson	213-367-6761	Cell: 213-216-4597
Bradley Walker (Corporate Health and Safety)	213-367-8629	Cell: 213-216-3839
Workers' Compensation	213-367-1942	
Employee Assistance Program (EAP)	888-439-7327	
Customer Service	213-367-2484	
Public Affairs	213-367-1361	213-367-3176 (after 4:00pm)
Hazardous Waste Operations Emergency Response	213-367-5118	311 (off DWP property)
Water Trouble Boards:		
Central	213-367-6789	
East Valley	818-771-4305	
Harbor	310-522-1455	
Western	213-367-5665	
West Valley	818-775-5476	
All Districts after 3:00pm (24/7)	213-367-6821	855-262-9880
Electrical Trouble Board (24/7)	213-367-8247	

ATTACHMENT K

OFFICE ERGONOMICS

Los Angeles Department of Water & Power

BULLETIN

Office Ergonomics Program and Equipment Recommendation Procedures

Office of Safety

Bulletin #2018-090
September 27, 2018

Los Angeles Department of Water & Power

BULLETIN

A Message from the Office of Safety

OFFICE ERGONOMICS PROGRAM AND EQUIPMENT RECOMMENDATION PROCEDURES

It is the policy of the Los Angeles Department of Water and Power (LADWP) to provide and maintain a safe and healthy work environment for all its employees. LADWP recognizes the importance of proper body mechanics and workplace design (ergonomics) in the prevention of Repetitive Stress Injuries (RSIs) as part of its overall health and safety effort.

Because managers and supervisors are agents of LADWP, it is incumbent upon them to provide a safe and healthful work environment for all LADWP employees. Corporate Health and Safety Services (CHSS) has the responsibility of providing management with information necessary to assist them in meeting this obligation. In an effort to achieve this obligation, CHSS and the Joint Safety Institute (JSI) launched new ergonomic software called Enviance. This program provides interactive training, feedback, and a self-evaluation intended to provide immediate support to employees in need of an ergonomic evaluation. The goal is to increase ergonomic awareness, identify risks associated with development of injury, and provide solutions that advance employee health and safety.

On top of training and self-assessment, Enviance provides immediate access to LADWP-specific resources designed to reduce turnaround time for delivery and installation of ergonomic equipment. Resources include contact information to request installation, procurement, and warranty services. Enviance also provides a Pre-Approved Ergonomic Equipment list. CHSS collaborated with Supply Chain Services, IT, and LEED Facility Design to remove the evaluation requirement historically necessary to secure approval for purchase.

Going forward, managers and supervisors are able to order ergonomic equipment for their employees without need for an evaluation so long as the equipment is on the CHSS Pre-Approved Equipment Catalog. Items on this list have been reviewed for quality, compatibility with existing furniture, and promotion of best practices. CHSS will continuously monitor the Pre-Approved Equipment Catalog in the event revision is necessary to reflect

LADWP need and/or current industry standards. Moreover, in the rare instance of need for equipment not on the list, a CHSS Industrial Hygienist will always be available to provide additional assistance at ergo@ladwp.com. The CHSS Pre-Approved Equipment Catalog is also available on the CHSS website at the following link:

https://insidedwp.ladwp.com/cs/groups/sg_dl_joint_corpsafety_web/documents/document/cm9k/mje0/~edisp/prod214630.pdf

The implementation of Enviance and the removal of the ergonomic evaluation requirement for equipment serve to lower the rate of ergonomic-related injuries by engaging employees and their managers/supervisors in the ergonomic process. Enviance simultaneously addresses all of the elements of an in-person evaluation while empowering each office to order equipment as needed. The following summarizes the ergonomic evaluation process.

Ergonomic Evaluation Process

It is important to note, the following process does not apply to employees with doctor-recommended work restrictions, limitations, or other medical-related injuries; open workers' compensation claims; or closed workers' compensation claims with "future medical" status. For these employees, please seek assistance from Workers' Compensation for work-related claims or designated Reasonable Accommodations Coordinator for accommodations-related requests.

To request an ergonomic evaluation, the employee or supervisor shall place the request for an evaluation using one of the two options listed below:

Option 1. Submit an email to ergo@ladwp.com requesting an evaluation. The email shall include the requesting employee name, employee number, supervisor name, and a brief description of ergonomic-related concerns. CHSS will enroll the employee in Enviance and the employee will receive an email invitation from InjuryPrevention@remedyinteractive.com that contains a temporary password and a link to access Enviance. You may change the password later. Save your login information for future use. More information is available on the CHSS website at the following link:

https://insidedwp.ladwp.com/webcenter/portal/corpsafety/home/chs-indHyg/chs-i-ergo/chs-i-ergo-ew?_adf.ctrl-state=2sx1ronpk_433&_afrLoop=1364226955289006#

Option 2. Enroll using https://login.remedyint.com/ladwp, which is also available on the new CHSS website. Locate and select the *"Click Here"* button to receive an email containing a temporary password to use to log in. You may change the password later. Save your login information for future use. More information is available on the CHSS website at the following link:

https://insidedwp.ladwp.com/cs/groups/sg_dl_joint_corpsafety_web/documents/document/cm9k/mjex/~edisp/prod211982.pdf

Upon employee completion of Enviance's self-evaluation, employees will receive personalized recommendations that may be viewed in Enviance's Issue Resolution tab. The Issue Resolution tab will generate a list of "to-do" items that will assist employees with step-by-step guidance to address specific ergonomic issues that were identified during the self-evaluation.

If it has been identified that new/additional/alternative equipment is needed to resolve any ergonomic issue, employees may review the CHSS Pre-Approved Ergonomic Equipment Catalog for ordering information, and procure equipment as needed with supervisor approval. Be sure to follow the procurement instructions specified in the catalog.

CHSS requires employees to complete Enviance and attempt to implement the resulting recommendations. If employees are unable to resolve any issues, please email ergo@ladwp.com and a CHSS Industrial Hygienist will provide additional assistance.

If the additional assistance leads to recommendations not addressed by Enviance, CHSS will submit a report of findings and recommendations to the employee and their supervisor. It is incumbent upon managers/supervisors to ensure that the identified risk factors in the report are addressed. CHSS does not purchase recommended items for the employee. It is important to note that in many cases the recommendations are not intended to be the sole solution to an identified risk factor. Moreover, each respective Division/Office reserves the discretion to exceed CHSS' recommendations. If a manager or supervisor wishes to inquire about alternative solutions, she or he may contact CHSS.

Once an employee receives his/her equipment, CHSS asks that the employee update his/her Enviance profile to reflect the modification of his/her workstation. Updating your employee profile ensures that in the event equipment does not successfully address symptoms associated with development of injury, CHSS may investigate alternative solutions and continuously monitor employee risk.

For more information about the LADWP Ergonomics Program, please contact Chris Cadena at (213) 367-8639 or Ryan Asanuma at (213) 367-8636.

FRANK C. NAGLICH
Chief Safety Officer

ATTACHMENT L

PERIODIC OFFICE SAFETY INSPECTION FORM

Water Quality Division
PERIODIC OFFICE SAFETY INSPECTION

Facility location ______________________________ Date __________
Address ______________________________
Section/Group ______________________________
Conducted by ______________________________ ______________________________
______________________________ ______________________________

Inspection categories are as follows:

1. Required Labor Law Postings..........	California and Federal Labor Laws, Access to Medical and Exposure Records, FMLA, Discrimination and Disability Act, etc.
2. Plans/Policies/Permits....................	Fire and Emergency Evaluation Plan, IIPP, Code of Safe Practices, MSDSs, Permits (air compressors, generators, etc.) if applicable.
3. Aisles..	Clear walkways. No tripping hazards, debris, or obstructions.
4. Floors..	Not cluttered, littered, or slippery. Rugs and mats in good condition. No loose threading or holes.
5. Exits..	Not blocked. Clear egress route.
6. Chairs/Desks/Filing Cabinets...........	Proper arrangement. No broken seat backs, casters, or drawers. File cabinets not top heavy. Remove all 4-legged chairs with wheel casters.
7. Office equipment..........................	General working condition. Electric cords not broken or patched. Ground connection secure.
8. Housekeeping/Material Storage.......	Office orderly. No tripping, falling, or obstruction hazards.
9. Electrical panels...........................	Clear from obstructions and 3 feet clearance in front of panels.
10. Electrical safety............................	Remove broken, spliced, exposed wiring cables. Extension cords must be plugged directly to an outlet and not another extension cord.
11. Lighting..	Light bulbs installed and properly working.
12. Fire safety......................................	Ashtrays, wastebaskets, coffee makers, portable heaters, etc. Fire extinguishers location identified by signs, mounted, and inspected monthly.
13. First Aid Kit/AED...........................	Stock fully replenished if missing items. AED's location identified by signs and inspected monthly.
14. Unsafe employee practices..............	Improper lifting, use of equipment, etc.

INSPECTION LOG

Location	Description of Hazards	Date Corrected
Location	**Description of Hazards**	**Date Corrected**

PERIODIC OFFICE SAFETY INSPECTION

ATTACHMENT M

VEHICLE BACKING-UP POLICY

ANNOUNCEMENT

WATER SYSTEM EXECUTIVE OFFICE

February 10, 2017

There is a recent increase in preventable vehicle accidents in the Water System. Many of these accidents involve vehicles backing-up into other vehicles or objects.

Vehicles backing-up are inherently less safe than driving forward, due to having a limited vantage point. The page following is the Water System Vehicle Backing Policy (Policy). This Policy is aimed at mitigating some of the hazards involved when backing a vehicle.

All LADWP employees are to adhere to the Rules and Regulations Governing the Care and Operation of Automotive Equipment. This Policy is being issued to all Water System employees. Adherence is required for any Water System employee operating a LADWP-owned vehicle or rented equipment. This Policy also applies to drivers of vehicles operated under mileage contracts during the hours that such drivers are legally acting as LADWP employees.

This Policy supersedes any Division level policy regarding vehicles backing-up.

Failure to follow the attached Policy may result in disciplinary action.

Richard F. Harasick
Senior Assistant General Manager – Water System

Water System
Department Vehicle Backing-up Policy
February 10, 2017

1) **When possible, avoid backing into traffic.** Opt for parking spaces where you can pull forward into the space or back into the space (using a spotter and the steps outlined below) to enable the driver to go forward out of the parking space.

2) **When backing cannot be avoided, ensure the vehicle is in the best position to allow you to back safely.** Some considerations include: view of oncoming traffic, pillars in parking structures, and proximity to other parked vehicles.

3) **Observe your path of travel before backing.** Get out and walk around the vehicle, check clearance to the sides and overhead, and look for any hazards that may impede your vision or motion of the vehicle.

4) **Check your mirrors and adjust to optimize the driver's view.** Familiarize yourself with the vehicle's blind spots.

5) **If there are multiple occupants in the vehicle, or on a worksite, a spotter must be used to assist in backing.** The spotter and driver should use hand signals they both understand. The spotter will stand near the back of the vehicle, usually on the driver's side, where the driver can see and hear the spotter clearly.

6) **Ensure safety of the spotter at all times.** When using a spotter, ensure the spotter can maneuver safely while avoiding physical barriers and oncoming traffic. If at a construction site, the spotter will wear a traffic vest.

7) **Roll down the window and turn off the radio while backing so that directions are clearly heard.**

8) **Ensure that backing alarms are functional. If your vehicle is not equipped with a reverse alarm, honk your horn three times to warn everyone that you are backing.**

9) **Back and turn toward the driver's side.** Backing-up to the driver's side increases your line of sight. This enables you to watch the rear of your vehicle through the side window.

10) **Back Slowly.** Do not back at speeds greater than 5 miles per hour. Slower speeds enable quicker stops and better correction of steering errors.

ATTACHMENT N

CELLULAR TELEPHONE/PERSONAL ELECTRONICS DEVICE POLICY CHANGES

LOS ANGELES DEPARTMENT OF WATER AND POWER

GENERAL MANAGER
bulletin

2015-05 January 20, 2015

Cellular Telephone and Personal Electronics Device Policy Changes

The use of cellular telephones (cell phones) and other personal electronic devices while driving at any time and/or performing other work activities is a dangerous, if not deadly, combination.

This General Manager Bulletin serves as a notice to all employees that the cell phone policy has changed. This policy has been updated to include a complete ban on the use of cell phones and/or other personal electronic devices, including hands-free devices, while operating company-owned or leased vehicles, equipment or machinery, and this prohibition will include such items as the use of personal electronic devices (e.g. tablets, texting on smartphones, etc.) during working situations where absolute attention to safety is a must.

Effective immediately, the use of cell phones and/or personal electronic devices, including hands-free devices, is completely prohibited while operating a motor vehicle or performing safety-sensitive operations, under any of the following circumstances:

- When an employee is operating a vehicle-owned, leased or rented by the Los Angeles Department of Water and Power (LADWP).
- When an employee is operating a personal motor vehicle in connection with LADWP business.
- When the cell phone and/or personal electronic device is company-owned or leased.
- When an employee is using a cell phone and/or personal electronic device to conduct LADWP business.
- When an employee is in a field location and/or performing hazardous work activities under the conditions defined by the attached policy which may include, but are not limited to, electrical work environments, work around toxic substances, work on public roads, construction work, operating machinery or testing equipment.

Further, employees shall comply with the General Manager Bulletin of January 13, 2015 regarding the use of cell phones and personal electronic devices on LADWP property. The policy prohibits the use of cell phones and/or personal electronic devices,

(Continued)

SOURCE	DISTRIBUTION	MANUALS REFERENCE	SERIES	DISPOSITION
MLE:mle	Global Email	110-01	3005	Post Until February 20, 2015

including hands-free devices while driving on LADWP property. This policy applies to visitors, contractors, fellow City employees, and LADWP employees.

Updates to the following LADWP updated policy, usage guidelines and usage agreement form have been developed and included below for immediate implementation:

1. Revised Cellular Telephone and Personal Electronic Device Acquisition and Usage Policy

2. Employee Cellular Telephone and Personal Electronic Device Usage Agreement

3. Cellular Telephone/Personal Electronic Device Usage Guidelines

All Division Directors are responsible for:

1. Overseeing compliance with the revised Cellular Telephone and Personal Electronic Device Acquisition and Usage Policy (Attachment) within their Divisions; and

2. Developing, implementing, and providing clarification where necessary regarding the revised cell phone usage within their Division that is consistent with the revised Cellular Telephone and Personal Electronic Device Acquisition and Usage Policy. This includes securing and maintaining signed copies of the Employee Cellular Telephone and Personal Electronic Device Usage Agreement for employees assigned a cell phone within their Division.

To assist the Divisions in their compliance effort, an electronic copy of the revised Employee Cellular Telephone and Personal Electronic Device Usage Agreement will soon be made available on the Department's Intranet site under "DWP Forms." In the interim, an electronic copy will be sent via Email to the System and Division administrative managers.

I expect these new policy changes will further ensure the safety of our employees and the public by prohibiting use of any hand-held device while driving.

Any questions should be referred to directly to your System or Division safety staff. Additional information regarding usage may be obtained from Corporate Safety.

Thank you for your assistance and cooperation.

Marcie L. Edwards
General Manager

This supersedes General Manager Bulletin numbers 2004-10 dated April 13, 2004, 2008-19 dated July 11, 2008, and 2013-35 dated September 4, 2013.

Attachments

Los Angeles Department of Water and Power
Revised Cellular Telephone and
Personal Electronic Device Acquisition and Usage Policy

It is the policy of the Los Angeles Department of Water and Power (LADWP) that the assignment and usage of a cellular telephone (cell phone) or personal electronic device (defined as any lightweight, electrically or battery-powered piece of equipment, typically capable of communications and data processing) must be based on the critical needs of LADWP and not upon the preference of the user. The use of LADWP-issued cell phones and/or personal electronic devices shall be in compliance with the identified business justification, shall be restricted for the purpose of work-related communication or documentation that is specifically related to "Official City Business" only, and shall be, at all times dedicated to this task.

The use of cell phones and/or personal electronic devices is prohibited while operating a motor vehicle or performing a safety sensitive operation, under any of the following situations, regardless of whether a hands-free device is used:

- When an employee is operating a vehicle-owned, leased or rented by the LADWP.
- When an employee is operating a personal motor vehicle in connection with LADWP business.
- When the cell phone and/or personal electronic device is company-owned or leased.
- When an employee is using a cell phone and/or personal electronic device to conduct LADWP business.
- When an employee is in a field location and/or hazardous work activities under the conditions defined by below which may include, but are not limited to, electrical work environments, work around toxic substances, work on public roads, construction work, operating machinery or testing equipment.

The use of personal cell phones and/or personal electronic devices by LADWP employees in field locations and/or hazardous work activities is limited during work hours. In these situations, personal cell phones and/or electronic devices are to be turned off and stored during working hours and are not to be kept on person, but may be used during break periods away from the work site(s). Examples of these types of hazardous work activities may include, but are not limited to, electrical work environments, work around toxic substances, work on public roads, construction work, operating machinery or testing equipment.

Employees shall also comply with the General Manager Bulletin of January 13, 2015 regarding the use of cell phones and personal electronic devices on LADWP property. The policy prohibits the use of cell phones and/or personal electronic devices, including hands-free devices while driving on LADWP property. This policy applies to visitors, contractors, fellow City employees, and LADWP employees.

Cell phones and/or electronic devices owned by LADWP and issued to employees may be used for business purposes only, and only for work-related communication or documentation that is specifically related to LADWP business. If it becomes necessary to use a cell phone or personal electronic device while driving or during field operations, the employee shall remove himself or herself from the flow of traffic or work area to avoid self-injury, as well as to avoid becoming a distraction to others in the traffic or work area.

Employees performing the functions of a "safety observer" must issue an "all stop" and stop work until the attention of the "safety observer" can be returned to the work task.

It is acceptable for Divisions to use a signal thereby alerting an employee of a need to receive a phone call. This signal should direct the driver to pull over to legally park.

Once the vehicle is safely pulled over, the driver may either answer the phone or return the call. Examples of such signal systems may include a series of phone calls and "hang ups," special ring tones, or any other technology approved by LADWP and the Division.

Criteria for Assignment of a Cell Phone

The following criteria shall be applied consistently by LADWP Management when determining whether or not any LADWP employee should be assigned a cell phone. These criteria are not meant to apply to the assignment of cell phones only. It is important to recognize that there are other available wireless devices, including pagers and radios that can meet many operating needs at a much lower cost compared to a cell phone, and these should be considered where feasible.

- The employee's day-to-day functions include:
  1. Critical operation and maintenance activities;
  2. Immediate customer service or public communication responsibilities;
  3. Security of LADWP facilities/equipment; or
  4. Safety of LADWP personnel and/or the public.

- The employee must be reachable via two-way voice communication at all times; and

- The job assignment requires the employee to be away from their assigned reporting location for a significant period of time to where a desktop LADWP telephone is not available or for which there is no reasonable, cost-effective alternative technology.

Loss or Theft

If an employee loses or damages an LADWP-issued cell phone, the cost will be passed onto the assigned employee unless the loss or damage occurred while the employee was performing assigned duties and the loss or damage was not due to the fault or negligence of the employee. Final determination as to whether or not reimbursement will be required will be made by the employee's Division Director in accordance with this policy and all existing MOU provisions. Approximate cost for reimbursement will be based on the current replacement cost of the unit as determined by LADWP. Lost or stolen telephones must be reported to Information Technology Services (ITS) immediately by either the employee or the employee's Division so that ITS can terminate the phone service. If the device is stolen, the employee will be required to file a police or theft report with LADWP Security within five (5) working days of the incident and prior to ITS issuing the employee a replacement device.

Return/Reassignment of Cell Phones

LADWP equipment must be returned upon expiration of employment. Devices not returned or unaccounted for will be reported as theft of LADWP property. It is the responsibility of the employee's immediate supervisor to ensure that all LADWP-issued equipment is returned to the Division. Upon termination of employment by an employee with an assigned cell phone, ITS must be notified immediately by the Division so that the cell service can be terminated, and the cell phone must be returned to ITS within ten (10) working days of the employee's termination.

When an employee with an assigned cell phone experiences a change in his or her job responsibilities/functions due to reassignment, transfer, promotion, etc., the manager in charge must evaluate the continued need for the cell phone against the established criteria above. Should the employee no longer require an assigned unit, ITS must be notified immediately by the Division so that the cellular service can be terminated and the unit must be returned to ITS within ten (10) working days. If a Division elects to reassign a cell phone to another employee within the Division, ITS must be notified within ten (10) working days so that the user assignment can be changed in the inventory to ensure accurate reporting and accounting.

Los Angeles Department of Water and Power
Employee Cellular Telephone and Personal Electronic Device Usage Agreement

I, the undersigned, hereby acknowledge receipt of a cellular telephone (cell phone) provided by the Los Angeles Department of Water and Power (LADWP) and agree to utilize the unit for "Official City Business Use" only and not for any personal use.

I understand that I will be required to reimburse LADWP if the unit is lost or damaged due to fault or negligence on my part. Final determination as to whether or not reimbursement will be required will be made by my Division Director in accordance with the LADWP's Revised Cellular Telephone and Personal Electronic Device Acquisition and Usage Policy and all existing MOU provisions. The cost for replacement will be based on the current replacement cost of the unit as determined by LADWP. Should my assigned cell phone be lost or stolen, I understand that I am to report the incident immediately to my supervisor. If the device is stolen, I will also file a police or theft report with LADWP's Security Services Division within five (5) working days of the incident.

I understand that I will not be reimbursed by LADWP for any unauthorized upgrades or enhanced services. Additionally, LADWP is not obligated to support any external or additional services after my Division determines the unit is no longer required to perform my assigned duties. Any device no longer in use must be returned immediately to my assigned Division.

I understand that LADWP may monitor cell phone usage to ensure the appropriate use of such devices and that LADWP reserves the right to review, audit, and disclose all usage as it deems appropriate.

Failure to comply with any of the terms and conditions outlined above as well as other related LADWP policies and/or standards will result in the removal or termination of service and the pursuit of further action, if necessary, including discipline.

My signature below indicates that I have read, understood, and accepted the terms and conditions of this Agreement.

Employee Name: ____

Employee Signature: ____

Employee ID Number: ________________________ Date: ____________________

Division: ___________________________________ Section: __________________

*Divisions are responsible for ensuring completion of the Agreement and retaining all signed copies.

Los Angeles Department of Water and Power (LADWP)
Cellular Telephone/Personal Electronic Device Usage Guidelines

Employees assigned a cellular telephone (cell phone) and/or personal electronic device shall use the unit for necessary, LADWP business-related purposes only. The use of LADWP-assigned cell phones for personal, private, commercial or consulting purposes is not permitted.

The following guidelines have been developed in order to reduce costs associated with employee usage and promote safe, proper cell phone usage throughout LADWP.

- Employees shall utilize existing mobile and radio systems (900MHz, Low Band and UHF) where available.
- Employees shall not distribute cell phone numbers on business cards, e-mail or voicemail except in those cases where an employee must be accessible to customers or external parties for emergencies and urgent matters.
- Employees shall use a desk-top phone or convenience phone whenever available.
- Divisions are to notify ITS immediately when requesting termination of cell service due to lost or stolen phones, employee termination, employee reassignment, etc. Cell phone units no longer in service must be returned to ITS within ten (10) working days. Divisions electing to reassign cell phone units must notify ITS within ten (10) working days so that the user assignment can be changed in the inventory to ensure accurate record keeping and accounting.
- A cell phone is to be used only by the employee to whom it is assigned based on the ITS user-assignment record except where one or more cell phones are pooled for employee-use on an as-needed basis. In that case, the designated employee-of-record to whom the unit(s) is(are) assigned shall be responsible for the proper use and care of the cell phone(s).
- Employees shall be responsible for the safekeeping, care and custody of the cell phone assigned to them.
- Any theft or loss of a cell phone shall be immediately reported to LADWP Security Services Division and ITS, respectively.
- Managers shall comply with the established criteria for determining the appropriateness of assigning a cell phone.
- Managers shall be responsible for monitoring employee usage of cell phones to ensure compliance with established LADWP policy and are responsible for taking the appropriate corrective action as necessary.
- The use of cell phones and/or personal electronic devices is prohibited while driving or while involved in hazardous field operations or any of the situations listed in the policy, regardless of whether a hands-free device is used.

ATTACHMENT O

ACCIDENT/INCIDENT NOTIFICATION TO WATER SYSTEM SAFETY MEMORANDUM

CITY OF LOS ANGELES
DEPARTMENT OF WATER AND POWER
INTRADEPARTMENTAL CORRESPONDENCE

Date: November 20, 2014

To: Distribution

From: Martin L. Adams, Deputy Senior Assistant General Manager – Water System

Subject: Accident/Incident Notification to Water System Safety

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Distribution:

Gregory Algorri
Jeff R. Bray
Joe A. Castruita
David E. Christensen
Steven R. Cole
Anselmo G. Collins
Evelyn Cortez-Davis
John Cox
Mark Cox
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Ruben L. Garcia
Albert G. Gastelum
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Jonathan K. Leung
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Clarence E. Martin
Nora Masuo
Michael R. Miller
David R. Pettijohn
Susan Rowghani
Keith D. Session
M. Cora Siacunco
Robert W. Smith
Julie M. Spacht
Milad Taghavi
Michael V. Taylor
Stephan D. Tucker
William T. Van Wagoner
Gregory Williams
James G. Yannotta

Effective immediately, report all incidents and accidents to Water System Safety. Please note, this does not preclude supervisors from following other reporting procedures. Supervisors are responsible for proper notifcation to Water System Safety, Corporate Safety, and/or Worker's Compensation Office in accordance with established procedures.

All accidents, incident notifications and general communication can be made via e-mail at watersystemsafety@ladwp.com.

The following circumstances require immediate telephonic notification to the Water System Safety Manager; if he is not available, leave a voice message on his mobile phone and contact the Safety Supervisor until a dialog is established:

- Serious injury or fatality to a Water System employee
- Declared emergency
- Large main line breaks

- Hazardous material spill or large fire in a Water System facility
- Los Angeles Department of Water and Power vehicle accidents
- Any incident requiring medical treatment or hospitalization
- Major equipment or facility damage

Contact numbers for Water System Safety Manager and Safety Supervisor are below:

		Office Phone	Mobile Phone
Water System Safety Manager	**Steve P. Torres**	**Ext. 72099**	**(213) 798-5732**
Safety Supervisor	**Michael Cosenza**	**Ext. 78873**	**(213) 798-5196**

When reporting an accident/incident, include the following information:

- Time and date of accident/incident
- Name and job title of person(s) involved in accident/incident
- Address where accident/incident occurred
- Nature and extent of damage and/or injuries
- Description of accident/incident
- Specific action taken (i.e., employee transported to Kaiser – West Los Angeles)
- Name and contact information for further information or follow-up

If you have any questions, please contact Steve P. Torres.

ST:vnc
c: James B. McDaniel
Martin L. Adams
Bradley Walker
Steve P. Torres
Michael Cosenza
FileNet

ATTACHMENT P

EMPLOYEE AND VEHICLE ACCIDENT FORMS AND GUIDELINES

and

WATER SYSTEM SAFETY ACCIDENT/INCIDENT FORMS FLOW CHART

LOS ANGELES DEPARTMENT OF WATER AND POWER

CORPORATE HEALTH & SAFETY

bulletin

2010-31 October 1, 2010

EMPLOYEE AND VEHICLE ACCIDENT FORMS AND GUIDELINES

It is the policy of the Los Angeles Department of Water and Power (Department) to provide and maintain a safe and healthy work environment for all its employees. Timely receipt of accurate information is a very important element in our accident prevention efforts. The following forms have been updated and will replace the old accident reporting forms. The forms are available on http://dwpforms/.

As a reminder, all incidents resulting in employee injury and/or illness or involving Department mileage, contract, and rental vehicles resulting in damage to property of the Department or property of outsiders must be reported and forms completed within three (3) days of occurrence. Also, forms need to be distributed as outlined below. Incomplete forms will be returned to the business organization and delay processing. We would appreciate your assistance in emphasizing the importance of complying with this policy within your organization.

Questions concerning the Employee and Mobile Vehicle Accident Reporting may be directed to Brad Walker on Extension 78629.

Accident Analysis Form – The accident analysis form shall be completed for all occupational injuries or illnesses attached to the 5020 distributed as noted on the form. http://dwpforms/Forms/AccidentAnalysis.doc

Statement of Accident - Mobile Equipment Accident Form – This form must be completed for all accidents involving mobile equipment. http://dwpforms/forms/StatementofAccident_Mobile.doc

Supervisor's Analysis of Mobile Equipment Accident Form – This form is also to be completed in conjunction with the "Statement of Accident, Mobile Equipment" form when ever there is a mobile vehicle accident. The direct supervisor of the employee involved in the accident is responsible for completing this form. http://dwpforms/forms/AnalysisofMobileEquipmentAccident.dot

Employer's Report of Occupational Injury and Illness (OSHA 5020) – The direct supervisor of the employee involved in the accident is responsible for completing the Employer's Report of Occupational Injury and Illness (OSHA 5020) within 5 days of knowledge for every work related or occupational illness or disease which results in lost time beyond the date of the incident or requires medical treatment beyond first aid. The Cal-OSHA Form 5020 applies to LADWP employees only (full and part-time, daily rate and exempt employees) but will not be completed for independent contractors.

This form must be completed and submitted to the Workers' Compensations Office at Room 553, JFB, to establish the accuracy of injury reports. This form is available at: http://dwpforms/forms/Osha_FORM5020.pdf.

Employee's Claim for Workers' Compensation Benefits (DWC 1) – State law requires the DWC1 Claim Form and the accompanying benefits information sheets be provided to employees injured on the job within 24 hours of injury or knowledge of the injury. Failure to comply with the state requirements may impose significant fines and penalties which would be charged to the appropriate department.

Division supervisors are responsible for immediately providing the DWC1 Claim Form to the injured employee, either in person or by mail. The injured employee completes the top section of the DWC1 Claim Form (lines 1-8) and returns the form to their supervisor. The injured employee's supervisor is then responsible for completing the bottom section of DWC1 Claim Form (lines 11-18) of the form. The completed DWC1 Claim Form must be submitted to the Workers' Compensation Office within one (1) working day of the supervisor's receipt of the completed DWC Claim Form.

The DWC1 Claim Form and a detailed instruction sheet are available at: http://dwpforms/forms/DWC1.pdf

Employee Accident Reporting
Distribution of Documents

Division and Section Managers

- OSHA 5020 – Employer's Report of Injury — Original
- Accident Analysis Form — Original
- Workers Compensation DWC 1 Form — Original

Corporate Health and Safety - 1350 S. Wall Street

- OSHA 5020 – Employer's Report of Injury — Copy
- Accident Analysis Form — Copy

Worker's Compensation - 111 N. Hope St. Rm. 553

- OSHA 5020 – Employer's Report of Injury — Copy
- Accident Analysis Form — Copy
- Workers Compensation DWC 1 Form — Copy

Fleet Accident Reporting
Distribution of Documents

Office of City Attorney, Claims Investigation Section
John Ferraro Building - Room 340

- Statement of Accident - Mobile Equipment (Form 8702364) — Original
- Analysis of Mobile Equipment Accident — Original
- Police Report — Original
- Photographs (if outside party is involved and Photos available) — Original

Division and Section Managers

- Statement of Accident - Mobile Equipment (Form 8702364) — Copy
- Analysis of Mobile Equipment Accident — Copy
- Police Report — Copy

• Photographs (if available)	Copy

Driving Rules Committee (Corporate Health and Safety)
1350 S. Wall Street

• Statement of Accident - Mobile Equipment (Form 8702364)	Copy
• Analysis of Mobile Equipment Accident	Copy
• Police Report	Copy
• Photographs (if available)	Copy

Fleet Maintenance - 433 E Temple St, Building 6, 4th Floor

• Statement of Accident - Mobile Equipment (Form 8702364)	Copy

Note: Older versions of Form 8702384 contain space for an analysis by the supervisor. This portion of the form need not be completed. Use only the separate Analysis of Mobile Equipment Accident Form.

original signed by
BRADLEY WALKER
Corporate Health and Safety Manager

Previous Bulletins

Los Angeles Department of Water and Power

WATER SYSTEM SAFETY ACCIDENT/INCIDENT FORMS FLOW CHART

09/20/2018

Injury/Illness

Injury/Illness
Water Trouble Board
(855) 262-9880
If at JFB (213) 367-3373

Initial Incident/Accident Report
Received By: Water System Safety as soon as possible, but no later than 8 hours
Copy - Corporate Health and Safety
Division Safety and Managers

DWC-1 Workers' Comp
Provide to Employee: within **24 hours** of Knowledge of Injury or Illness
Original – Workers' Comp
Copy – Water System Safety
Corporate Health and Safety
Division Safety and Managers

OSHA 5020
Received By: Workers' Comp within **5 days**
Copy – Water System Safety
Corporate Health and Safety
Division Safety andManagers

Accident Analysis Form
Due: within **5 Days**
Original – Division Safety and Managers
Copy – Water System Safety
Corporate Health and Safety

Mobile Equipment Accident

Mobile Equipment Accident
Water Trouble Board
(855) 262-9880

If Injury → Injury/Illness

Initial Incident/Accident Report
Received By: Water System Safety as soon as possible, but no later than 8 hours
Copy - Corporate Health and Safety
Division Safety and Managers

Statement of Mobile Accident
Due: within **5 Days**
Original – Office of City Attorney Claims
(Include Original Police Report and photographs)

Copy – Water System Safety
Division Safety and Managers
Corporate Health and Safety
(Include Copies of Police Report and photographs)

Copy of Report – Fleet Maintenance Office

Supervisor's Analysis of Mobile Accident
Due: within **5 Days**
Original – Office of City Attorney Claims
(Include Original Police Report and photographs)

Copy – Water System Safety
Division Safety and Managers
Corporate Health and Safety
(Include Copies of Police Report and photographs)

Property Damaged

Property Damaged
Service Interruption

Accidents Involving any Third Party
Notify: Office of City Attorney Claims
(213) 367-4578

Immediately Notify Most Appropriate
Water Trouble Board (855) 262-9880
LAWSDAC (213) 367-5778
LAAFP (818) 771-6020

Initial Incident/Accident Report
Received By: Water System Safety as soon as possible, but no later than 8 hours
Copy - Corporate Health and Safety
Division Safety and Managers

No Injuries

No Injuries

No Mobile or Equipment Damaged

No Loss of Service

Near Miss Report
JSI

Water System Safety 8801 Arleta Ave. Arleta, CA 91331

watersystemsafety@ladwp.com (213) 367-2099 Cell: (213) 798-5732
Workers' Comp JFB 111 N. Hope St Rm 553 Los Angeles (213) 367-1942
Corporate Health and Safety Central Power Yard 1350 S Wall St Los Angeles (213) 367-8635
Office of City Attorney Claims JFB 111 N. Hope St Rm 340 Los Angeles (213) 367-4578
Fleet Services 14401 Saticoy St Bldg.6 Van Nuys, CA 91405 (818) 771-3960
JSI 11801 Sheldon St. Sun Valley, CA 91352 (818) 771-4696
EAP 111 N. Hope St. Rm 511 Los Angeles (888) 439-7327
Employees' Association Downed Workers Program (213)367-3163
Grossman Burn Center 7300 Medical Center Drive West Hills, CA 91307 (888) 676-2876

Supporting Documents:
Administrative Manual - Volume 2 - Section 110-30-Accidents and Injuries - Serious Accident or Incident Response Procedure
Administrative Manual - Volume 2 - Section 110-31-Accidents and injuries - Reporting Serious Injury or Fatality or Damage to Facilities or Equipment
Bulletin 2003-02 Reporting Serious Injuries-Illnesses
Bulletin 2010-28 Role of Occupational Health Services
Bulletin 2010-31 Employee and Vehicle Accident Forms and Guidelines
Bulletin 2010-36 Guidelines for Processing Updated Workers' Comp Forms

Initial Accident/Incident Report

Supervision Responsibility:

Make notification to Water System Safety, Division Safety, Section Managers, and Corporate Health and Safety as **soon as possible, but no later than eight (8) hours**, without the delay of medical services: Reports may be delayed only to the extent necessary to arrange for medical aid, restoration of operations, or elimination of a hazard. Such delays shall be kept to an absolute minimum. Note: Incomplete information or uncertainty as to facts shall not constitute a valid reason for delaying a report. Areas of incomplete information and uncertainty should be indicated in the report.

Employee's Claim for Workers' Compensation Benefits (DWC 1)

Employee Responsibility:

Complete Employee Section (lines 1-8).

Return the form to your supervisor. Keep a copy and mark it "Employee's Temporary Receipt", you will receive a signed and dated copy from your employer.

Supervision Responsibility:

California law requires employer to provide the employee with Workers' Compensation claim Form (DWC-1) within **(24) hours** of knowledge of the injury, either in person or by mail. After receiving the form back from the employee, complete Employer Section (lines 9-18).

- Line # 9 - City of Los Angeles Department of Water & Power
- Line # 10 - 111 N. Hope St. Los Angeles CA 90012
- Line # 14 - Self Insured
- Line # 15 - N/A

DWC 1 Claim Form must be submitted to the Workers' Compensation Office within **one (1) working day** of the supervisor's receipt of the completed DWC 1 Claim Form.

Employer's Report of Occupational Injury and Illness (OSHA 5020)

Supervision Responsibility:

California law requires employers to report within **five (5) working days** of knowledge every occupational injury or illness which results in lost time beyond the date of the incident OR requires medical treatment beyond first aid. If an employee subsequently dies as a result of a previously reported injury or illness, the employer must file within **5 days** of knowledge an amended report indicating death. In addition, every serious injury, illness, or death must be reported immediately by telephone to the nearest office of the California Division of Occupational Safety and Health.

Accident Analysis Form

Supervision Responsibility:

Complete for all occupational injuries or illnesses within **five (5) working days**

Statement of Accident Mobile Equipment Accident

Employee Responsibility:

Complete for all accidents involving any mobile equipment

Supervision Responsibility:

Review, sign and distribute within **five (5) working days**.

Supervisor's Analysis of Mobile Equipment Accident

Supervision Responsibility:

Complete for all accidents involving mobile equipment within **five (5)working days** of knowledge.

ATTACHMENT Q

LADWP ACCIDENT ANALYSIS FORM

Accident Analysis Form

These instructions and questions are to help you fill out the Incident Analysis Form and to assist you in adding necessary comments. Be sure to interview all witness to the event before filling out this form. You may use the employee's job class titles instead of the names. Use and attach additional documents or information as is necessary (Send copy of completed report and Form 5020 to Corporate Safety within 5 days).

Here are some questions to ask when filling out this form:

WHO - Who did or did not do "something"?
WHAT - Define the "something" that happened
WHERE - Give the physical location of the event (e.g., 34.5 rack, RS-D, Yard, Address, etc.)
WHEN - Time and Date
HOW - Each accident or incident is the end result of a chain of events. This "chain" is the HOW.

1. Briefly describe the Accident or Incident:		
2. Describe work/task being performed:		
3. Classification of employees involved:		
4 .Date:	Time:	Location:
5. Was anyone injured? ☐ YES ☐ NO		
If yes, describe including name of injured (employee, non-employee), type of injuries, medical care and disposition:		
Name(s) of injured Employee(s):		
Name(s) of others injured:		
Name of employee's Supervisor(s):		
6. Was employee working alone? ☐ YES ☐ NO		
7. Is IIPP on or available at the facility/job site? ☐ YES ☐ NO		
8. Was a tailgate meeting held and documented pertaining to this job's specific hazards? ☐ YES ☐ NO		
9. Were employee(s) involved present for the tailgate meeting? ☐ YES ☐ NO		
10. Was there a deviation from the day's work plan? ☐ YES ☐ NO		
If yes, explain:		
11. Make assessment of accident/incident scene:		
12. Was safety equipment required? ☐ YES ☐ NO	Supplied? ☐ YES ☐ NO	Used? ☐ YES ☐ NO
13. Was work Authority (CLEARANCE or OK TO) necessary? ☐ YES ☐ NO	If yes, was it issued? ☐ YES ☐ NO	
14. Were hazardous materials involved? ☐ YES ☐ NO		
15. Was a vehicle involved? ☐ YES ☐ NO	Info:	
16. Was a "Statement of Accident – Mobile Equipment" Form filled out? ☐ YES ☐ NO		
17. Heavy Equipment? ☐ YES ☐ NO	Info:	
Describe damage:		

Supervisory or Group Analysis

Contributing factors (as determined by analysis of data):

Guidance list of sample contributing factors (many possible factors not listed)

- Adequate equipment provided but not used
- Personal protective equipment not used
- Unsafe floors, stairs, or other walkways
- Poor house keeping
- Inexperience
- Excessive noise
- Unsafe work condition by contractor
- Inadequate personal protection devices supplied
- Inadequate traffic control
- Inadequate light or ventilation used
- Rules or instruction not enforced
- Inadequate job inspection
- Actions of another employee
- Defective tools or material
- No Work Authority
- Unsafe position or posture
- Improper type or design of tools
- Improper assignment of personnel
- Faulty training
- Unguarded equipment
- Haste or short cuts
- Unsafe work practices
- Defective equipment
- Toxic exposure
- Insufficient work space
- Natural hazards (exposure, wild animals)
- No tailgate or improper job planning

Explain contributing factor(s), (use additional sheet if necessary:
Corrective action(s) taken to mitigate hazard (if any):

Name of person completing this form:		
Reviewed by Supervisor: Date	Reviewed by Section Manager: Date	Approved by Division Manager: Date

Distribution: Section Manager
Division Manager
Corporate Health and Safety

ATTACHMENT R

INITIAL ACCIDENT/INCIDENT REPORT

RESET FORM

WATER SYSTEM
INITIAL ACCIDENT / INCIDENT REPORT

REPORTING FACILITY: ______________________________

DATE: ______________________________ **TIME:** ____________

INCIDENT LOCATION: ______________________________

DESCRIPTION OF ACCIDENT / INCIDENT

Prepared By:
(Supervisor) ____________________

Reviewed By:
(Facility Manager) ____________________

E-mail to Water System Safety within 8 hours of the Accident/Incident. watersystemsafety@ladwp.com

Revised 11/01/2016

ATTACHMENT S

STATE OF CALIFORNIA
EMPLOYER'S REPORT OF OCCUPATIONAL INJURY OR ILLNESS (FORM 5020)

State of California **EMPLOYER'S REPORT OF OCCUPATIONAL INJURY OR ILLNESS**	Supervisors complete and make 2 copies. Send copies to: Workers' Compensation Office, JFB Room 553 or email PDF to: workerscomp553@ladwp.com Corporate Health and Safety: 1350 S. Wall Street, Los Angeles, CA 90015	**OSHA CASE NO.** **FATALITY** ☐

Any person who makes or causes to be made any knowingly false or fraudulent material statement or material representation for the purpose to obtaining or denying workers' compensation benefits or payments is guilty of a felony.

California law requires employers to report within **five days** of knowledge every occupational injury or illness which results in lost time beyond the date of the incident **OR** requires medical treatment beyond first aid. If an employee subsequently dies as a result of a previously reported injury or illness, the employer must file within **five days** of knowledge an amended report indicating death. In addition, every serious injury, illness, or death must be **reporte**d **immediately** by telephone or telegraph to the nearest office of the California Division of Occupational Safety and Health.

EMPLOYER

		Please do not use this Column
1. FIRM NAME Los Angeles Department of Water and Power	1A. Policy Number	
2. MAILING ADDRESS (Number and Street, City, ZIP) P.O. Box 51111, Room 553 Los Angeles CA 90051	2A. Phone Number (213)367-1942	CASE NUMBER
3. LOCATION If different from Mailing Address (Number And Street, City, ZIP)	3A. Location Code	
4. NATURE OF BUSINESS, e.g. Painting contractor, wholesale grocer, sawmill, hotel, etc. Utility	5. State unemployment insurance acct. no.	OWNERSHIP
6. TYPE OF EMPLOYER ☐ Private ☐State ☐County ☒CITY ☐School Dist. ☐ Other Government, Specify: ____________		INDUSTRY

INJURY OR ILLNESS

7. DATE OF INJURY/ONSET OF ILLNESS (mm/dd/yy)	8. TIME OF INJURY/ILLNESS OCCURRED ☐ AM ☐ PM	9. TIME EMPLOYEE BEGAN WORK ☐ AM ☐ PM	10. IF EMPLOYEE DIED, DATE OF DEATH (mm/dd/yy)	
11. UNABLE TO WORK FOR AT LEAST ONE FULL DAY AFTER DATE OF INJURY ? ☐ Yes ☐ No	12. DATE LAST WORKED (mm/dd/yy)	13. DATE RETURNED TO WORK (mm/dd/yy)	14. IF STILL OFF WORK, CHECK THIS BOX: ☐	OCCUPATION
15. PAID IN FULL DAYS WAGES FOR DATE OF INJURY OR LAST DAY WORKED? ☐ Yes ☐ No	16. SALARY BEING CONTINUED? ☐ Yes ☐ No	17. DATE OF EMPLOYER'S KNOWLEDGE / NOTICE OF INJURY/ILLNESS (mm/dd/yy)	18. DATE EMPLOYEE WAS PROVIDED CLAIM FORM (mm/dd/yy)	SEX
19. SPECIFIC INJURY/ILLNESS AND PART OF BODY AFFECTED, MEDICAL DIAGNOSIS if available, e.g.. Second degree burns on right arm, tendonitis on left elbow, lead poisoning.				AGE
20. LOCATION WHERE EVENT OR EXPOSURE OCCURRED (Number, Street, City, Zip)		20a. COUNTY	21. ON EMPLOYER'S PREMISES?	DAILY HOURS
22. DEPARTMENT WHERE EVENT OR EXPOSURE OCCURRED, e.g., Shipping department, machine shop.			23. Other Workers Injured/Ill in this event? ☐Yes ☐ No	DAYS PER WEEK
24. EQUIPMENT, MATERIALS AND CHEMICALS THE EMPLOYEE WAS USING WHEN EVENT OR EXPOSURE OCCURRED, e.g., Acetylene, welding torch, farm tractor, scaffold:				WEEKLY HOURS
25. SPECIFIC ACTIVITY THE EMPLOYEE WAS PERFORMING WHEN EVENT OR EXPOSURE OCCURRED, e.g., Welding seams of metal forms, loading boxes onto truck.				WEEKLY WAGE
26. HOW INJURY/ILLNESS OCCURRED. DESCRIBE SEQUENCE OF EVENTS. SPECIFY OBJECT OR EXPOSURE WHICH DIRECTLY PRODUCED THE INJURY/ILLNESS, e.g., Worker stepped back to inspect work and slipped on scrap material. As he fell, he brushed against fresh weld, and burned right hand. USE SEPARATE SHEET IF NECESSARY.				COUNTY
27. NAME AND ADDRESS OF PHYSICIAN (Number, Street, City, Zip)			27a. PHONE NUMBER	NATURE OF INJURY
28. HOSPITALIZED AS AN INPATIENT OVERNIGHT? ☐ If yes, then, NAME AND ADDRESS OF HOSPITAL (Number, Street, City, Zip).			28a. Phone Number	PART OF BODY
			29. Employee treated in Emergency Room? ☐	SOURCE

EMPLOYEE

ATTENTION: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes. See CCR Title 8 14300.29 (b)(6)-(10) & 14300.35(b)(2)(E)2.
Note: Shaded boxes indicated confidential employee information as listed in CCR Title 8 14300.35(b)(2)(E)2.*

30. EMPLOYEE NAME	31. SOCIAL SECURITY NUMBER/Employee #	32. DATE OF BIRTH (mm/dd/yy)	EVENT
33. HOME ADDRESS (Number, Street, City, Zip)		33a. PHONE NUMBER	SECONDARY SOURCE
34. SEX / 35. OCCUPATION (Regular job title, NO initials, abbreviated or numbers)		36. DATE OF HIRE (mm/dd/yy)	
37. EMPLOYEE USUALLY WORKS ____ hours per day, ____days per week, ____ total weekly hours	37a. EMPLOYMENT STATUS	37b. UNDER WHAT CLASS CODE OF YOUR POLICY WERE WAGES ASSIGNED?	EXTENT OF INJURY
38. GROSS WAGES/SALARY $ ____________ per ____________	39. OTHER PAYMENTS NOT REPORTED AS WAGES/SALARY (e.g. tips, meals, overtime, bonuses, etc.)? ☐Yes ☐ No		

Completed By (type or print)	Signature & Title	DATE (mm/dd/yy)

*Confidential information may be disclosed only to the employee, former employee, or their personal representative (CCR Title 8 14300.35), to others for the purpose of processing a workers' compensation or other insurance claim; and under certain circumstances to a public health or law enforcement agency or to a consultant hired by the employer (CCR Title 8 14300.30). CCR Title 8 14300.40 requires provision upon request to certain state and federal workplace safety agencies.

FORM 5020 (DWC Rev 7 - June 2002) – MUST BE COMPLETED BY SUPERVISOR

FILING OF THIS FORM IS NOT AN ADMISSION OF LIABILITY

ATTACHMENT T

WORKERS' COMPENSATION CLAIM FORM (DWC 1) AND NOTICE OF POTENTIAL ELIGIBILITY

Workers' Compensation Claim Form (DWC 1) & Notice of Potential Eligibility
Formulario de Reclamo de Compensación de Trabajadores (DWC 1) y Notificación de Posible Elegibilidad

If you are injured or become ill, either physically or mentally, because of your job, including injuries resulting from a workplace crime, you may be entitled to workers' compensation benefits. Use the attached form to file a workers' compensation claim with your employer. **You should read all of the information below.** Keep this sheet and all other papers for your records. You may be eligible for some or all of the benefits listed depending on the nature of your claim. If you file a claim, the claims administrator, who is responsible for handling your claim, must notify you within 14 days whether your claim is accepted or whether additional investigation is needed.

To file a claim, complete the "Employee" section of the form, keep one copy and give the rest to your employer. Do this right away to avoid problems with your claim. In some cases, benefits will not start until you inform your employer about your injury by filing a claim form. Describe your injury completely. Include every part of your body affected by the injury. If you mail the form to your employer, use first-class or certified mail. If you buy a return receipt, you will be able to prove that the claim form was mailed and when it was delivered. Within one working day after you file the claim form, your employer must complete the "Employer" section, give you a dated copy, keep one copy, and send one to the claims administrator.

Medical Care: Your claims administrator will pay for all reasonable and necessary medical care for your work injury or illness. Medical benefits are subject to approval and may include treatment by a doctor, hospital services, physical therapy, lab tests, x-rays, medicines, equipment and travel costs. Your claims administrator will pay the costs of approved medical services directly so you should never see a bill. There are limits on chiropractic, physical therapy, and other occupational therapy visits.

The Primary Treating Physician (PTP) is the doctor with the overall responsibility for treatment of your injury or illness.

- If you previously designated your personal physician or a medical group, you may see your personal physician or the medical group after you are injured.
- If your employer is using a medical provider network (MPN) or Health Care Organization (HCO), in most cases, you will be treated in the MPN or HCO unless you predesignated your personal physician or a medical group. An MPN is a group of health care providers who provide treatment to workers injured on the job. You should receive information from your employer if you are covered by an HCO or a MPN. Contact your employer for more information.
- If your employer is not using an MPN or HCO, in most cases, the claims administrator can choose the doctor who first treats you unless you predesignated your personal physician or a medical group.
- If your employer has not put up a poster describing your rights to workers' compensation, you may be able to be treated by your personal physician right after you are injured.

Within one working day after you file a claim form, your employer or the claims administrator must authorize up to $10,000 in treatment for your injury, consistent with the applicable treating guidelines until the claim is accepted or rejected. If the employer or claims administrator does not authorize treatment right away, talk to your supervisor, someone else in management, or the claims administrator. Ask for treatment to be authorized right now, while waiting for a decision on your claim. If the employer or claims administrator will not authorize treatment, use your own health insurance to get medical care. Your health insurer will seek reimbursement from the claims administrator. If you do not have health insurance, there are doctors, clinics or hospitals that will treat you without immediate payment. They will seek reimbursement from the claims administrator.

Switching to a Different Doctor as Your PTP:

- If you are being treated in a Medical Provider Network (MPN), you may switch to other doctors within the MPN after the first visit.
- If you are being treated in a Health Care Organization (HCO), you may switch at least one time to another doctor within the HCO. You may switch to a doctor outside the HCO 90 or 180 days after your injury is reported to your employer (depending on whether you are covered by employer-provided health insurance).
- If you are not being treated in an MPN or HCO and did not predesignate, you may switch to a new doctor one time during the first 30 days after your injury is reported to your employer. Contact the claims administrator to switch doctors. After 30 days, you may switch to a doctor of your choice if

Si Ud. se lesiona o se enferma, ya sea físicamente o mentalmente, debido a su trabajo, incluyendo lesiones que resulten de un crimen en el lugar de trabajo, es posible que Ud. tenga derecho a beneficios de compensación de trabajadores. Utilice el formulario adjunto para presentar un reclamo de compensación de trabajadores con su empleador. **Ud. debe leer toda la información a continuación.** Guarde esta hoja y todos los demás documentos para sus archivos. Es posible que usted reúna los requisitos para todos los beneficios, o parte de éstos, que se enumeran dependiendo de la índole de su reclamo. Si usted presenta un reclamo, l administrador de reclamos, quien es responsable por el manejo de su reclamo, debe notificarle dentro de 14 días si se acepta su reclamo o si se necesita investigación adicional.

Para presentar un reclamo, llene la sección del formulario designada para el "Empleado," guarde una copia, y déle el resto a su empleador. Haga esto de inmediato para evitar problemas con su reclamo. En algunos casos, los beneficios no se iniciarán hasta que usted le informe a su empleador acerca de su lesión mediante la presentación de un formulario de reclamo. Describa su lesión por completo. Incluya cada parte de su cuerpo afectada por la lesión. Si usted le envía por correo el formulario a su empleador, utilice primera clase o correo certificado. Si usted compra un acuse de recibo, usted podrá demostrar que el formulario de reclamo fue enviado por correo y cuando fue entregado. Dentro de un día laboral después de presentar el formulario de reclamo, su empleador debe completar la sección designada para el "Empleador," le dará a Ud. una copia fechada, guardará una copia, y enviará una al administrador de reclamos.

Atención Médica: Su administrador de reclamos pagará por toda la atención médica razonable y necesaria para su lesión o enfermedad relacionada con el trabajo. Los beneficios médicos están sujetos a la aprobación y pueden incluir tratamiento por parte de un médico, los servicios de hospital, la terapia física, los análisis de laboratorio, las medicinas, equipos y gastos de viaje. Su administrador de reclamos pagará directamente los costos de los servicios médicos aprobados de manera que usted nunca verá una factura. Hay límites en terapia quiropráctica, física y otras visitas de terapia ocupacional.

El Médico Primario que le Atiende *(Primary Treating Physician- PTP)* es el médico con la responsabilidad total para tratar su lesión o enfermedad.

- Si usted designó previamente a su médico personal o a un grupo médico, usted podrá ver a su médico personal o grupo médico después de lesionarse.
- Si su empleador está utilizando una red de proveedores médicos (*Medical Provider Network- MPN)* o una Organización de Cuidado Médico *(Health Care Organization- HCO)*, en la mayoría de los casos, usted será tratado en la *MPN* o *HCO* a menos que usted hizo una designación previa de su médico personal o grupo médico. Una *MPN* es un grupo de proveedores de asistencia médica quien da tratamiento a los trabajadores lesionados en el trabajo. Usted debe recibir información de su empleador si su tratamiento es cubierto por una *HCO* o una *MPN.* Hable con su empleador para más información.
- Si su empleador no está utilizando una *MPN* o *HCO*, en la mayoría de los casos, el administrador de reclamos puede elegir el médico que lo atiende primero a menos de que usted hizo una designación previa de su médico personal o grupo médico.
- Si su empleador no ha colocado un cartel describiendo sus derechos para la compensación de trabajadores, Ud. puede ser tratado por su médico personal inmediatamente después de lesionarse.

Dentro de un día laboral después de que Ud. Presente un formulario de reclamo, su empleador o el administrador de reclamos debe autorizar hasta $10000 en tratamiento para su lesión, de acuerdo con las pautas de tratamiento aplicables, hasta que el reclamo sea aceptado o rechazado. Si el empleador o administrador de reclamos no autoriza el tratamiento de inmediato, hable con su supervisor, alguien más en la gerencia, o con el administrador de reclamos. Pida que el tratamiento sea autorizado ya mismo, mientras espera una decisión sobre su reclamo. Si el empleador o administrador de reclamos no autoriza el tratamiento, utilice su propio seguro médico para recibir atención médica. Su compañía de seguro médico buscará reembolso del administrador de reclamos. Si usted no tiene seguro médico, hay médicos, clínicas u hospitales que lo tratarán sin pago inmediato. Ellos buscarán reembolso del administrador de reclamos.

Cambiando a otro Médico Primario o *PTP*:

- Si usted está recibiendo tratamiento en una Red de Proveedores Médicos your employer or the claims administrator has not created or selected an MPN.

Disclosure of Medical Records: After you make a claim for workers' compensation benefits, your medical records will not have the same level of privacy that you usually expect. If you don't agree to voluntarily release medical records, a workers' compensation judge may decide what records will be released. If you request privacy, the judge may "seal" (keep private) certain medical records.

Problems with Medical Care and Medical Reports: At some point during your claim, you might disagree with your PTP about what treatment is necessary. If this happens, you can switch to other doctors as described above. If you cannot reach agreement with another doctor, the steps to take depend on whether you are receiving care in an MPN, HCO, or neither. For more information, see "Learn More About Workers' Compensation," below.

If the claims administrator denies treatment recommended by your PTP, you may request independent medical review (IMR) using the request form included with the claims administrator's written decision to deny treatment. The IMR process is similar to the group health IMR process, and takes approximately 40 (or fewer) days to arrive at a determination so that appropriate treatment can be given. Your attorney or your physician may assist you in the IMR process. IMR is not available to resolve disputes over matters other than the medical necessity of a particular treatment requested by your physician.

If you disagree with your PTP on matters other than treatment, such as the cause of your injury or how severe the injury is, you can switch to other doctors as described above. If you cannot reach agreement with another doctor, notify the claims administrator in writing as soon as possible. In some cases, you risk losing the right to challenge your PTP's opinion unless you do this promptly. If you do not have an attorney, the claims administrator must send you instructions on how to be seen by a doctor called a qualified medical evaluator (QME) to help resolve the dispute. If you have an attorney, the claims administrator may try to reach agreement with your attorney on a doctor called an agreed medical evaluator (AME). If the claims administrator disagrees with your PTP on matters other than treatment, the claims administrator can require you to be seen by a QME or AME.

Payment for Temporary Disability (Lost Wages): If you can't work while you are recovering from a job injury or illness, you may receive temporary disability payments for a limited period. These payments may change or stop when your doctor says you are able to return to work. These benefits are tax-free. Temporary disability payments are two-thirds of your average weekly pay, within minimums and maximums set by state law. Payments are not made for the first three days you are off the job unless you are hospitalized overnight or cannot work for more than 14 days.

Stay at Work or Return to Work: Being injured does not mean you must stop working. If you can continue working, you should. If not, it is important to go back to work with your current employer as soon as you are medically able. Studies show that the longer you are off work, the harder it is to get back to your original job and wages. While you are recovering, your PTP, your employer (supervisors or others in management), the claims administrator, and your attorney (if you have one) will work with you to decide how you will stay at work or return to work and what work you will do. Actively communicate with your PTP, your employer, and the claims administrator about the work you did before you were injured, your medical condition and the kinds of work you can do now, and the kinds of work that your employer could make available to you.

Payment for Permanent Disability: If a doctor says you have not recovered completely from your injury and you will always be limited in the work you can do, you may receive additional payments. The amount will depend on the type of injury, extent of impairment, your age, occupation, date of injury, and your wages before you were injured.

Supplemental Job Displacement Benefit (SJDB): If you were injured on or after 1/1/04, and your injury results in a permanent disability and your employer does not offer regular, modified, or alternative work, you may qualify for a nontransferable voucher payable for retraining and/or skill enhancement. If you qualify, the claims administrator will pay the costs up to the maximum set by state law.

Death Benefits: If the injury or illness causes death, payments may be made to a

(Medical Provider Network- MPN), usted puede cambiar a otros médicos dentro de la MPN después de la primera visita.

- Si usted está recibiendo tratamiento en un Organización de Cuidado Médico (Healthcare Organization- HCO), es posible cambiar al menos una vez a otro médico dentro de la HCO. Usted puede cambiar a un médico fuera de la HCO 90 o 180 días después de que su lesión es reportada a su empleador (dependiendo de si usted está cubierto por un seguro médico proporcionado por su empleador).
- Si usted no está recibiendo tratamiento en una MPN o HCO y no hizo una designación previa, usted puede cambiar a un nuevo médico una vez durante los primeros 30 días después de que su lesión es reportada a su empleador. Póngase en contacto con el administrador de reclamos para cambiar de médico. Después de 30 días, puede cambiar a un médico de su elección si su empleador o el administrador de reclamos no ha creado o seleccionado una MPN.

Divulgación de Expedientes Médicos: Después de que Ud. presente un reclamo para beneficios de compensación de trabajadores, sus expedientes médicos no tendrán el mismo nivel de privacidad que usted normalmente espera. Si Ud. no está de acuerdo en divulgar voluntariamente los expedientes médicos, un juez de compensación de trabajadores posiblemente decida qué expedientes serán revelados. Si usted solicita privacidad, es posible que el juez "selle" (mantenga privados) ciertos expedientes médicos.

Problemas con la Atención Médica y los Informes Médicos: En algún momento durante su reclamo, podría estar en desacuerdo con su *PTP* sobre qué tratamiento es necesario. Si esto sucede, usted puede cambiar a otros médicos como se describe anteriormente. Si no puede llegar a un acuerdo con otro médico, los pasos a seguir dependen de si usted está recibiendo atención en una *MPN*, *HCO* o ninguna de las dos. Para más información, consulte la sección "Aprenda Más Sobre la Compensación de Trabajadores," a continuación.

Si el administrador de reclamos niega el tratamiento recomendado por su *PTP*, puede solicitar una revisión médica independiente *(Independent Medical Review-IMR)*, utilizando el formulario de solicitud que se incluye con la decisión por escrito del administrador de reclamos negando el tratamiento. El proceso de la *IMR* es parecido al proceso de la *IMR* de un seguro médico colectivo, y tarda aproximadamente 40 (o menos) días para llegar a una determinación de manera que se pueda dar un tratamiento apropiado. Su abogado o su médico le pueden ayudar en el proceso de la *IMR*. La *IMR* no está disponible para resolver disputas sobre cuestiones aparte de la necesidad médica de un tratamiento particular solicitado por su médico.

Si no está de acuerdo con su *PTP* en cuestiones aparte del tratamiento, como la causa de su lesión o la gravedad de la lesión, usted puede cambiar a otros médicos como se describe anteriormente. Si no puede llegar a un acuerdo con otro médico, notifique al administrador de reclamos por escrito tan pronto como sea posible. En algunos casos, usted arriesg perder el derecho a objetar a la opinión de su *PTP* a menos que hace esto de inmediato. Si usted no tiene un abogado, el administrador de reclamos debe enviarle instrucciones para ser evaluado por un médico llamado un evaluador médico calificado *(Qualified Medical Evaluator-QME)* para ayudar a resolver la disputa. Si usted tiene un abogado, el administrador de reclamos puede tratar de llegar a un acuerdo con su abogado sobre un médico llamado un evaluador médico acordado *(Agreed Medical Evaluator- AME)*. Si el administrador de reclamos no está de acuerdo con su *PTP* sobre asuntos aparte del tratamiento, el administrador de reclamos puede exigirle que sea atendido por un *QME* o *AME*.

Pago por Incapacidad Temporal (Sueldos Perdidos): Si Ud. no puede trabajar, mientras se está recuperando de una lesión o enfermedad relacionada con el trabajo, Ud. puede recibir pagos por incapacidad temporal por un periodo limitado. Estos pagos pueden cambiar o parar cuando su médico diga que Ud. está en condiciones de regresar a trabajar. Estos beneficios son libres de impuestos. Los pagos por incapacidad temporal son dos tercios de su pago semanal promedio, con cantidades mínimas y máximas establecidas por las leyes estales. Los pagos no se hacen durante los primeros tres días en que Ud. no trabaje, a menos que Ud. sea hospitalizado una noche o no puede trabajar durante más de 14 días.

Permanezca en el Trabajo o Regreso al Trabajo: Estar lesionado no significa que usted debe dejar de trabajar. Si usted puede seguir trabajando, usted debe hacerlo. Si no es así, es importante regresar a trabajar con su empleador actual tan spouse and other relatives or household members who were financially dependent on the deceased worker.

It is illegal for your employer to punish or fire you for having a job injury or illness, for filing a claim, or testifying in another person's workers' compensation case (Labor Code 132a). If proven, you may receive lost wages, job reinstatement, increased benefits, and costs and expenses up to limits set by the state.

Resolving Problems or Disputes: You have the right to disagree with decisions affecting your claim. If you have a disagreement, contact your employer or claims administrator first to see if you can resolve it. If you are not receiving benefits, you may be able to get State Disability Insurance (SDI) or unemployment insurance (UI) benefits. Call the state Employment Development Department at (800) 480-3287 or (866) 333-4606, or go to their website at www.edd.ca.gov.

You Can Contact an Information & Assistance (I&A) Officer: State I&A officers answer questions, help injured workers, provide forms, and help resolve problems. Some I&A officers hold workshops for injured workers. To obtain important information about the workers' compensation claims process and your rights and obligations, go to www.dwc.ca.gov or contact an I&A officer of the state Division of Workers' Compensation. You can also hear recorded information and a list of local I&A offices by calling (800) 736-7401.

You can consult with an attorney. Most attorneys offer one free consultation. If you decide to hire an attorney, his or her fee will be taken out of some of your benefits. For names of workers' compensation attorneys, call the State Bar of California at (415) 538-2120 or go to their website at **www. californiaspecialist.org**.

Learn More About Workers' Compensation: For more information about the workers' compensation claims process, go to www.dwc.ca.gov. At the website, you can access a useful booklet, "Workers' Compensation in California: A Guidebook for Injured Workers." You can also contact an Information & Assistance Officer (above), or hear recorded information by calling 1-800-736-7401.

pronto como usted pueda medicamente hacerlo. Los estudios demuestran que entre más tiempo esté fuera del trabajo, más difícil es regresar a su trabajo original y a sus salarios. Mientras se está recuperando, su *PTP*, su empleador (supervisores u otras personas en la gerencia), el administrador de reclamos, y su abogado (si tiene uno) trabajarán con usted para decidir cómo va a permanecer en el trabajo o regresar al trabajo y qué trabajo hará. Comuníquese de manera activa con su *PTP*, su empleador y el administrador de reclamos sobre el trabajo que hizo antes de lesionarse, su condición médica y los tipos de trabajo que usted puede hacer ahora y los tipos de trabajo que su empleador podría poner a su disposición.

Pago por Incapacidad Permanente: Si un médico dice que no se ha recuperado completamente de su lesión y siempre será limitado en el trabajo que puede hacer, es posible que Ud. reciba pagos adicionales. La cantidad dependerá de la clase de lesión, grado de deterioro, su edad, ocupación, fecha de la lesión y sus salarios antes de lesionarse.

Beneficio Suplementario por Desplazamiento de Trabajo *(Supplemental Job Displacement Benefit- SJDB)*: Si Ud. se lesionó en o después del 1/1/04, y su lesión resulta en una incapacidad permanente y su empleador no ofrece un trabajo regular, modificado, o alternativo, usted podría cumplir los requisitos para recibir un vale no-transferible pagadero a una escuela para recibir un nuevo un curso de reentrenamiento y/o mejorar su habilidad. Si Ud. cumple los requisios, el administrador de reclamos pagará los gastos hasta un máximo establecido por las leyes estatales.

Beneficios por Muerte: Si la lesión o enfermedad causa la muerte, es posible que los pagos se hagan a un cónyuge y otros parientes o a las personas que viven en el hogar que dependían económicamente del trabajador difunto.

Es ilegal que su empleador le castigue o despida por sufrir una lesión o enfermedad laboral, por presentar un reclamo o por testificar en el caso de compensación de trabajadores de otra persona. (Código Laboral, sección 132a.) De ser probado, usted puede recibir pagos por pérdida de sueldos, reposición del trabajo, aumento de beneficios y gastos hasta los límites establecidos por el estado.

Resolviendo problemas o disputas: Ud. tiene derecho a no estar de acuerdo con las decisiones que afecten su reclamo. Si Ud. tiene un desacuerdo, primero comuníquese con su empleador o administrador de reclamos para ver si usted puede resolverlo. Si usted no está recibiendo beneficios, es posible que Ud. pueda obtener beneficios del Seguro Estatalde Incapacidad *(State Disability Insurance-SDI)* o beneficios del desempleo *(Unemployment Insurance- UI)*. Llame al Departamento del Desarrollo del Empleo estatal al (800) 480-3287 o (866) 333-4606, o visite su página Web en www.edd.ca.gov.

Puede Contactar a un Oficial de Información y Asistencia *(Information & Assistance- I&A)*: Los Oficiales de Información y Asistencia *(I&A)* estatal contestan preguntas, ayudan a los trabajadores lesionados, proporcionan formularios y ayudan a resolver problemas. Algunos oficiales de *I&A* tienen talleres para trabajadores lesionados. Para obtener información importante sobre el proceso de la compensación de trabajadores y sus derechos y obligaciones, vaya a www.dwc.ca.gov o comuníquese con un oficial de información y asistencia de la División Estatal de Compensación de Trabajadores. También puede escuchar información grabada y una lista de las oficinas de *I&A* locales llamando al (800) 736-7401.

Ud. puede consultar con un abogado. La mayoría de los abogados ofrecen una consulta gratis. Si Ud. decide contratar a un abogado, los honorarios serán tomados de algunos de sus beneficios. Para obtener nombres de abogados de compensación de trabajadores, llame a la Asociación Estatal de Abogados de California *(State Bar)* al (415) 538-2120, o consulte su página Web en www.californiaspecialist.org.

Aprenda Más Sobre la Compensación de Trabajadores: Para obtener más información sobre el proceso de reclamos del programa de compensación de trabajadores, vaya a www.dwc.ca.gov. En la página Web, podrá acceder a un folleto útil, "Compensación del Trabajador de California: Una Guía para Trabajadores Lesionados." También puede contactar a un oficial de Información y Asistencia (arriba), o escuchar información grabada llamando al 1-800-736-7401.

State of California
Department of Industrial Relations
DIVISION OF WORKERS' COMPENSATION

Estado de California
Departamento de Relaciones Industriales
DIVISION DE COMPENSACIÓN AL TRABAJADOR

WORKERS' COMPENSATION CLAIM FORM (DWC 1)

PETITION DEL EMPLEADO PARA DE COMPENSACIÓN DEL TRABAJADOR (DWC 1)

Employee: Complete the **"Employee"** section and give the form to your employer. Keep a copy and mark it "**Employee's Temporary Receipt"** until you receive the signed and dated copy from your employer. You may call the Division of Workers' Compensation and hear recorded information at **(800) 736-7401.** An explanation of workers' compensation benefits is included in the Notice of Potential Eligibility, which is the cover sheet of this form. Detach and save this notice for future reference.

You should also have received a pamphlet from your employer describing workers' compensation benefits and the procedures to obtain them. You may receive written notices from your employer or its claims administrator about your claim. If your claims administrator offers to send you notices electronically, and you agree to receive these notices only by email, please provide your email address below and check the appropriate box. If you later decide you want to receive the notices by mail, you must inform your employer in writing.

Any person who makes or causes to be made any knowingly false or fraudulent material statement or material representation for the purpose of obtaining or denying workers' compensation benefits or payments is guilty of a felony.

Empleado: *Complete la sección **"Empleado"** y entregue la forma a su empleador. Quédese con la copia designada **"Recibo Temporal del Empleado"** hasta que Ud. reciba la copia firmada y fechada de su empleador. Ud. puede llamar a la Division de Compensación al Trabajador al **(800) 736-7401** para oir información gravada. Una explicación de los beneficios de compensación de trabajadores está incluido en la Notificación de Posible Elegibilidad, que es la hoja de portada de esta forma. Separe y guarde esta notificación como referencia para el futuro.*

Ud. también debería haber recibido de su empleador un folleto describiendo los benficios de compensación al trabajador lesionado y los procedimientos para obtenerlos. Es posible que reciba notificaciones escritas de su empleador o de su administrador de reclamos sobre su reclamo. Si su administrador de reclamos ofrece enviarle notificaciones electrónicamente, y usted acepta recibir estas notificaciones solo por correo electrónico, por favor proporcione su dirección de correo electrónico abajo y marque la caja apropiada. Si usted decide después que quiere recibir las notificaciones por correo, usted debe de informar a su empleador por escrito.

Toda aquella persona que a propósito haga o cause que se produzca cualquier declaración o representación material falsa o fraudulenta con el fin de obtener o negar beneficios o pagos de compensación a trabajadores lesionados es culpable de un crimen mayor "felonia".

Employee—complete this section and see note above ***Empleado—complete esta sección y note la notación arriba.***

1. Name. *Nombre.* ______________________ Today's Date. *Fecha de Hoy.* ______________________
2. Home Address. *Dirección Residencial.* ______________________
3. City. *Ciudad.* ______________ State. *Estado.* ______________ Zip. *Código Postal.* ______________
4. Date of Injury. *Fecha de la lesión (accidente).* ______________ Time of Injury. *Hora en que ocurrió.* ________a.m. ________p.m.
5. Address and description of where injury happened. *Dirección/lugar dónde occurió el accidente.* ______________________
6. Describe injury and part of body affected. *Describa la lesión y parte del cuerpo afectada.* ______________________
7. Social Security Number. *Número de Seguro Social del Empleado.* ______________ *Employee #:* ______________
8. ☐ Check if you agree to receive notices about your claim by email only. ☐ *Marque si usted acepta recibir notificaciones sobre su reclamo solo por correo electrónico.* Employee's e-mail. ______________ *Correo electrónico del empleado*. ______________.

You will receive benefit notices by regular mail if you do not choose, or your claims administrator does not offer, an electronic service option. *Usted recibirá notificaciones de beneficios por correo ordinario si usted no escoge, o su administrador de reclamos no le ofrece, una opción de servicio electrónico.*

9. Signature of employee. *Firma del empleado.* ______________________

Employer—complete this section and see note below. ***Empleador—complete esta sección y note la notación abajo.***

10. Name of employer. *Nombre del empleador.* **Los Angeles Department of Water and Power**
11. Address. *Dirección.* **P.O. Box 51111, Room #553, Los Angeles, CA 90051-5700**
12. Date employer first knew of injury. *Fecha en que el empleador supo por primera vez de la lesión o accidente.* ______________
13. Date claim form was provided to employee. *Fecha en que se le entregó al empleado la petición.* ______________
14. Date employer received claim form. *Fecha en que el empleado devolvió la petición al empleador.* ______________
15. Name and address of insurance carrier or adjusting agency. *Nombre y dirección de la compañía de seguros o agencia adminstradora de seguros.* ______________
Los Angeles Department of Water and Power : P.O. Box 51111, Room #553, Los Angeles, CA 90051-5700
16. Insurance Policy Number. *El número de la póliza de Seguro*. ______________
17. Signature of employer representative. *Firma del representante del empleador.* ______________
18. Title. *Título.* ______________ 19. Telephone. *Teléfono.* **(213) 367-1942**

Employer: You are required to date this form and provide copies to your insurer or claims administrator and to the employee, dependent or representative who filed the claim within **one working day** of receipt of the form from the employee.

SIGNING THIS FORM IS NOT AN ADMISSION OF LIABILITY

Empleador: *Se requiere que Ud. feche esta forma y que provéa copias a su compañía de seguros, administrador de reclamos, o dependiente/representante de reclamos y al empleado que hayan presentado esta petición dentro del plazo de **un día hábil** desde el momento de haber sido recibida la forma del empleado.*

EL FIRMAR ESTA FORMA NO SIGNIFICA ADMISION DE RESPONSABILIDAD

☐ Employer copy/*Copia del Empleador* ☐ Employee copy/*Copia del Empleado* ☐ Workers' Compensation Office, Room 553/*Administrador de Reclamos*

☐ Temporary Receipt/*Recibo del Empleado* Supervisor's Name: ______________ Supervisor's Phone Number: ______________ Room No.: ______

ATTACHMENT U

WORKERS' COMPENSATION PROGRAM
PRE-DESIGNATED PHYSICIAN OR
HEALTH CARE PROVIDER FORM

PREDESIGNATION OF PERSONAL PHYSICIAN

In the event you sustain an injury or illness related to your employment, you may be treated for such injury or illness by your personal medical doctor (M.D.), doctor of osteopathic medicine (D.O.) or medical group if:

- on the date of your work injury you have health care coverage for injuries or illnesses that are not work related;
- the doctor is your regular physician, who shall be either a physician who has limited his or her practice of medicine to general practice or who is a board-certified or board-eligible internist, pediatrician, obstetrician-gynecologist, or family practitioner, and has previously directed your medical treatment, and retains your medical records;
- your "personal physician" may be a medical group if it is a single corporation or partnership composed of licensed doctors of medicine or osteopathy, which operates an integrated multispecialty medical group providing comprehensive medical services predominantly for nonoccupational illnesses and injuries;
- prior to the injury your doctor agrees to treat you for work injuries or illnesses;
- prior to the injury you provided your employer the following in writing: (1) notice that you want your personal doctor to treat you for a work-related injury or illness, and (2) your personal doctor's name and business address.

You may use this form to notify your employer if you wish to have your personal medical doctor or a doctor of osteopathic medicine treat you for a work- related injury or illness and the above requirements are met.

NOTICE OF PREDESIGNATION OF PERSONAL PHYSICIAN

Employee: Complete this section.

To: _____________________________ (name of employer) If I have a work-related injury or illness, I choose to be treated by:

____

(name of doctor)(M.D., D.O., or medical group)

____(street address, city, state, ZIP)

____(telephone number)

Employee Name (please print):

____

Employee's Address:

____

Employee's Signature____Date:_____________

Physician: I agree to this Predesignation:

Signature:____Date:__________

(Physician or Designated Employee of the Physician or Medical Group)

The physician is not required to sign this form, however, if the physician or designated employee of the physician or medical group does not sign, other documentation of the physician's agreement to be predesignated will be required pursuant to Title 8, California Code of Regulations, section 9780.1(a)(3).

Title 8, California Code of Regulations, section 9783.

ATTACHMENT V

STATEMENT OF ACCIDENT – MOBILE EQUIPMENT FORM

Confidential, Attorney-Client Privilege, Attorney Work Product

CODE 8702364 Rev. 02/10
DEPT. OF WATER & POWER
OF THE CITY OF LOS ANGELES

STATEMENT OF ACCIDENT

MOBILE EQUIPMENT

Date of report ______

NAME OF DRIVER ______ Employee No. ______ Payroll ______
Occupation ______ Business Unit ______ Group ______ Dept. Tel. ______
Immediate Supervisor ______ Working Address ______
Date of Accident ______ Hour ______ Location ______
Driver's/Operator's License No. ______ Expiration Date ______ Hours of employment ______
Dept. vehicle going TO ______ Coming FROM ______

DEPT. EQUIPT.

Equipt. No. ______ License plate no. ______ Year, make & type ______
Speed of vehicle ______ Direction of vehicle ______
Street ______ Speed limit ______
Condition of brakes ______ If faulty, was it reported? ______ To whom? ______
Describe damage ______

Passengers in DEPARTMENT equipment

Name ______ Employee No. ______ Phone ______
Name ______ Employee No. ______ Phone ______
Name ______ Employee No. ______ Phone ______

OUTSIDE EQUIPT. OR OTHER DEPT. VEHICLE

License plate no. ______ State ______ Year & make ______ Driver's license no. ______
Name of driver ______ Street ______
City ______ State ______ Zip ______ Phone ______
Name of owner ______ Street ______
City ______ State ______ Zip ______ Phone ______
Direction ______ Street ______ Speed ______
Describe damage ______

Passengers in OUTSIDE equipment

Name ______ Street ______
City ______ State ______ Zip ______ Phone ______
Name ______ Street ______
City ______ State ______ Zip ______ Phone ______
Name ______ Street ______
City ______ State ______ Zip ______ Phone ______

PROPERTY OTHER THAN MOBILE EQUIPT.

Owner & address ______
______ Phone ______
Location of property damaged ______
Describe Damage ______

INJURED: PEDESTRIAN OR VEHICLE OCCUPANT

Name; describe injury; show address and phone if not stated elsewhere on this report ______

Did you signal? ______ How? ______ Did other driver signal? ______ How? ______
Police Officer ______ Badge no. ______ Traffic signals ______
Width of street ______ No. of lanes and markings ______
Length of skid marks by which car ______
Weather condition ______ Street condition ______
Type of area: Business ______ School ______ Residential ______ Open ______ Other: ______
Did you turn in Police report? ______ Form SRI? ______ Had any of the parties involved been drinking? ______ Who? ______

Witness OTHER THAN passengers

Name ______ Street ______
City ______ State ______ Zip ______ Phone ______
Name ______ Street ______
City ______ State ______ Zip ______ Phone ______
Name ______ Street ______
City ______ State ______ Zip ______ Phone ______

DISTRIBUTION:
Orig.: Office of City Attorney
Claims Investigation Group JFB, Rm 340
Copy: Business Unit
Copy: Driving Rules Committee, Corporate Health & Safety Office, 1350 S. Wall St. Rm. 238
Copy: Fleet Maintenance Office, 433 E Temple St. Bldg. 6, 3rd Floor

EXPLAIN FULLY on reverse side how accident occurred, including conversation with outside parties and witnesses. Use additional paper if necessary.

I HAVE READ THIS REPORT, both sides.
IT CORRECTLY STATES THE FACTS.

Signed ______ Phone ______

Statement received/signed by:

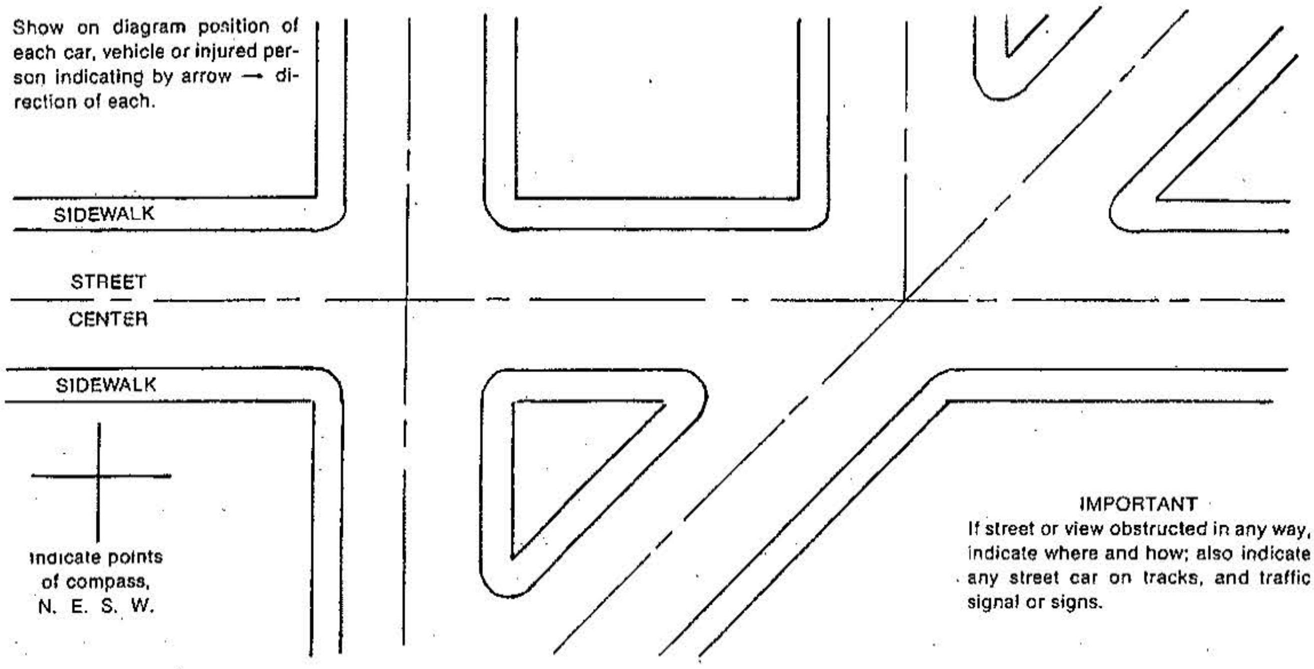
______
Supervisor

Home Address ______

BE SURE TO MAKE SKETCH ON REVERSE SIDE

DIRECTIONS: This form is to be completed and distributed with the Supervisor's Analysis of Mobile Equipment Accident Form

COMPLETE ALL DETAILS



USE THIS SPACE FOR EXPLANATION

ATTACHMENT W

SUPERVISOR’S ANALYSIS OF MOBILE EQUIPMENT ACCIDENT FORM

Code 8702374 (Rev. 07/07)
Analysis.dot (Rev. 9/15/98)

SUPERVISOR'S ANALYSIS OF MOBILE EQUIPMENT ACCIDENT

Name of Driver: ____________________ Driver's Employee Number: __________

Business Unit: ____________________ Group: __________

Payroll: ____________________ Civil Service Class: __________

Date of Accident: ____________________ Time: __________

Vehicle Number: ____________________ Vehicle Type: __________

Location of Accident: ____________________

☐ **Check here if report is required to obtain vehicle repairs only (no further information required)**

Accidents cannot be prevented unless the causes are known. When making this analysis, try to disclose the basic cause(s).

HOW DID THE ACCIDENT OCCUR? (Describe fully)

UNSAFE ACT (If appropriate - what did the driver do or fail to do that led to the accident?)
(The final determination of preventability will be made by the Driving Rules Committee.)

WAS THIS ACCIDENT PREVENTABLE IN YOUR OPINION? ☐ Yes ☐ No
IF YES, WHAT CORRECTIVE ACTION WAS TAKEN?

UNSAFE VEHICLE CONDITION (Describe any contributing mechanical defect)

WAS EMPLOYEE WEARING SEATBELT? ☐ YES ☐ NO

PLEASE PRINT SUPERVISOR: ____________________ SIGNATURE: ____________________

DATE: ____________________

DIRECTIONS:	This form is to be completed by the immediate supervisor and a copy attached to and distributed with the Statement of Accident - Mobile Equipment.

ATTACHMENT X

SAFETY FOOTWEAR PROGRAM
BULLETIN 2016-05

LOS ANGELES DEPARTMENT OF WATER AND POWER

CORPORATE HEALTH AND SAFETY bulletin

2016-05 February 2, 2016

Safety Footwear Program 2016

In an effort to improve the Los Angeles Department of Water and Power (LADWP) Safety Footwear Program, beginning on January 19, 2016, the LADWP is now providing a $150.00 annual shoe allowance for the purchase of safety footwear. This allowance is for employees that have been determined by their management to be full-time safety footwear users. This new safety program replaces the prior practice of issuing safety shoes through Corporate Safety. This provides employees with the flexibility of purchasing safety shoes that best fit the employee as long as the shoes meet the following LADWP safety shoes standards.

LADWP Safety Shoe Standards

1. All safety footwear shall have a steel or composite toe that meets the American National Standard Institute (ANSI) for protective footwear, ASTM F2413-05, or the latest standard, and shall be labeled as such from the manufacturer.

2. All safety footwear shall be puncture resistant and shall have that designation from the manufacturer.

3. The safety footwear shall be designated by the manufacturer as slip resistant.

4. All safety footwear shall have a minimum of a 6-inch leather upper.

Supervisor's Responsibility for Safety Footwear

Supervisors will be responsible for verifying that employees under their supervision are wearing safety footwear that meet the LADWP safety shoe standards. Employees are required to wear appropriate footwear when division management has determined that there are foot hazards associated with assigned tasks. This includes, but is not limited to, foot injuries due to falling or rolling objects, objects piercing the sole, and slipping hazards.

SOURCE	DISTRIBUTION	MANUALS REFERENCE	SERIES	DISPOSITION
BW:mm	Global	NA	4005	Post Until March 3, 2016

It is the responsibility of the employee to maintain their safety footwear per this policy. Full-time safety shoe users will continue to receive the annual $150.00 allowance for the replacement or repair of their safety footwear.

Thank you for your help and cooperation in implementing the changes to the Safety Footwear Program. If you have any questions, please contact Leland Gong at (213) 367-0117 or Bradley Walker at (213) 367-8629.

Bradley Walker
Safety Administrator

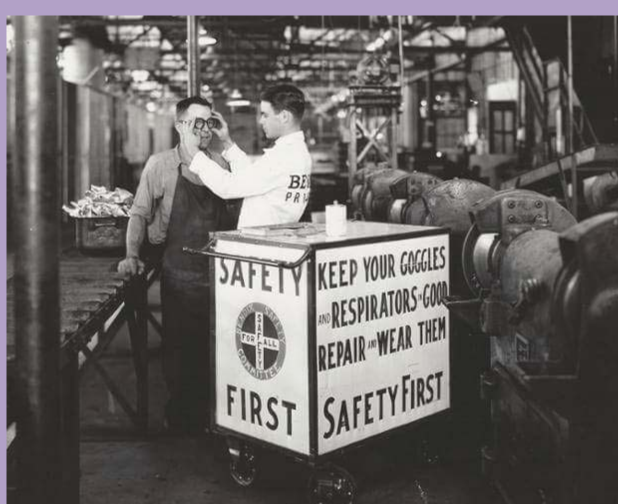
ATTACHMENT Y

PRESCRIPTION SAFETY EYEWEAR PROGRAM

INFORMATION & PROCEDURES TO OBTAIN PRESCRIPTION SAFETY EYEWEAR

Established:

2002



VSP
Vision care for life

INFORMATION REGARDING THE PRESCRIPTION SAFETY EYEWEAR PROGRAM

In order to reduce injuries, ensure consistency, and minimize compliance issues, upper management and IBEW representatives agreed to have the side shields on prescription safety eyewear permanently attached. Unfortunately, we have a small number of employees who have taken it upon themselves to remove the side shields. For obvious reasons, this practice is unacceptable and requires correction.

Please be aware that VSP has specific instructions to provide permanently attached side shields. – NO EXCEPTIONS.

As a reminder, PLEASE read your VSP information sheet carefully (see attached). Call VSP for your appointment, and remember to ask for and view the optometrist's frame selection before your eye exam to ensure your complete satisfaction with the available frames. The frame benefit has a $75.00 retail allowance. This allowance should ensure a wide selection to meet your needs without an out-of-pocket expense from you. If your optometrist does not have a wide selection, you can select another optometrist.

ELIGIBLE EMPLOYEES IDENTIFIED BASED ON THE FOLLOWING CRITERIA:

1

- Job Classification: One that requires, through its DDR, the performance of a task which exposes an employee to a risk of receiving eye injuries such as punctures, abrasions, contusions, or burns as a result of contact with flying particles, hazardous substances, projections or injurious light rays which are inherent in the work or environment - according to the California Code of Regulations (CCR), Title 8 (T8), Section 3382 - Eye and Face Protection.

2

- Employees: Those who work in a designated job classification and who require the wearing of **prescription** eyewear to perform the normal duties as described in their respective DDR.

3

- Business Organization/Division(BU) Written Policy: Employees in non-designated/qualifying job classifications may qualify as a result of their specific job duties or location if based on a written BU policy (e.g., clerical or engineering person working in a generating station/construction area/shop area having to venture into a hazardous area on a regular basis based on normal duties).

<u>HOW TO MAKE CHANGES TO THE VSP LIST (ADDITIONS OR DELETIONS)</u>

Any changes must be reported to your immediate supervisor and processed through your respective prescription safety eyewear program coordinator, as noted below:

Power System
→Mark Vanvakaris
→(818) 771-4814
→Araceli Lomeli
→(818) 771-4827

Water System
→Lorena Quintero
→(213) 367-8656

ITS
→Minh Nguyen
→(213) 367-0000

Support Services
→Irving Chou
→(213) 367-3021

Customer Services
→Lorraine Mitchell
→(213) 367-1453
→Mandi Tom
→(213) 367-3361

*** All other organizations not listed please contact - Lorena Quintero (213) 367-8656**

Please direct your questions regarding eligibility and VSP list information to:

- Your supervisor
- Your safety coordinator
- Your prescription safety eyewear program coordinator

Appendix C Bench-scale Ultraviolet Advanced Oxidation Process (UV AOP) Testing Report

TASK 301
BENCH-SCALE TESTING REPORT

North Hollywood West Treatability Testing Bench-Scale Report

Prepared for:

City of Los Angeles
Department of Water and Power
111 North Hope Street
Los Angeles, California 90012

Submitted by:

Hazen and Sawyer (Hazen) under Agreement No. 47329-6 (Owner's Agent for the SFB Remediation)

Prepared by:

Owner's Agent: Hazen, with primary input from Arcadis and University of Colorado at Boulder
800 West 6th Street, Suite 400
Los Angeles, California 90017

December 2020

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TABLES

FIGURES

1 Introduction

The City of Los Angeles Department of Water and Power (LADWP), in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and guidelines presented in the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (EPA 1988a), conducted an interim remedial investigation/feasibility study (RI/FS) to address the synthetic contaminant 1,4-dioxane dissolved in groundwater at the North Hollywood West (NHW) Well Field located within the San Fernando Groundwater Basin (San Fernando Basin [SFB]). An Interim Remedial Action including groundwater treatment was selected as the Preferred Alternative.

Treatment goals for NHW groundwater remediation wells are shown on Table 1-1. Influent design concentrations based on modelling results and use of a safety factor are also provided.

Table 1-1. Performance Treatment Goals

Contaminant	Design Influent	Design Effluent	Performance goal
Tetrachloroethylene (PCE)	25 μg/L	<0.5 μg/L	1.7-log reduction
Trichloroethylene (TCE)	50 μg/L	<0.5 μg/L	2.0-log reduction
1,4-Dioxane	20 μg/L	<0.25 μg/L	1.9-log reduction

1.1 Testing Objective

The purpose of this bench-scale testing is to support the technical evaluation of an Ultraviolet Advanced Oxidation Process (UV AOP) using UV light and hydrogen peroxide (UV/peroxide) for treating groundwater from the San Fernando Basin North Hollywood West Well Field.

The goals for bench-scale testing of UV/peroxide are listed below:

1. Generate site-specific data to evaluate the ability of UV/peroxide to treat 1,4-dioxane and volatile organic compounds (VOCs) present in the groundwater.
2. Evaluate regulated and unregulated byproduct formation of the UV/peroxide process.
3. Evaluate relative treatment efficiencies and byproduct formation with low pressure high output (LPHO) and medium pressure (MP) UV lamps.
4. Develop 1,4-dioxane UV dose response curves as a function of peroxide dose for comparison to full-scale design criteria.
5. Evaluate TTHM/HAA5 formation with blend of UV/peroxide treated groundwater with LADWP surface water through Simulated Distribution System (SDS) testing.

1.2 UV AOP Background

UV/peroxide uses UV light to photolyze hydrogen peroxide to form hydroxyl radicals. Hydroxyl radicals can oxidize 1,4-dioxane, PCE, TCE and 1,1-DCE, and UV/peroxide has been proven to be effective and reliable potable water applications in Southern California and at other locations throughout the United States (EPA 2006). UV/peroxide uses hydroxyl radicals, which are powerful oxidizers, to break down contaminants. The reliability of this process has been proven at the regulatory level, and it is a preferred technology for 1,4-dioxane treatment. The EPA has found UV irradiation combined with hydrogen peroxide to be effective at removing 1,4-dioxane with up to greater than 99% effectiveness (EPA 2011).

Key design parameters for UV/peroxide systems included in this study are:

- Background water quality, specifically:
  - UV transmittance (UVT)
  - Hydroxyl radical scavenging demand
- Lamp technology selection
- Byproduct formation and change in toxicity

1.2.1 Background Water Quality

UVT and hydroxyl radical scavenging demand are the two most important water quality parameters for sizing UV/peroxide equipment. UVT is a measure of how much UV light is transmitted through the water and how much is absorbed by background constituents in the water (e.g., natural organic matter (NOM) or nitrate). Lower UVTs result in the UV/peroxide process being less efficient as more power is required to overcome the UV light that is absorbed by constituents other than peroxide.

Hydroxyl radicals are non-selective and will react with constituents in the water other than the target compounds. For most natural waters, the hydroxyl radical scavenging demand is driven by NOM and carbonates. However, the formation of nitrite with a MP UV reactor may increase the background hydroxyl radical scavenging demand. Increases in the hydroxyl radical scavenging demand decrease the efficiency of the AOP process, and, as such, more UV light and/or hydrogen peroxide is required to achieve the required level of reduction of the target contaminant.

1.2.2 Lamp Technology

Municipal scale UV/peroxide systems utilize two common types of UV lamps: low pressure, high output (LPHO) and medium pressure (MP) UV lamps. LPHO lamps emit UV light at a wavelength of 254 nm, while MP lamps emit a broader spectrum. LPHO UV lamps are more efficient at turning electrical energy into UV light, while MP UV lamps emit UV light at lower wavelengths where peroxide has a higher absorbance. The efficiency of the MP UV lamps can be negatively impacted by nitrate, which has a high UV absorbance in the same range that peroxide absorbs UV light. The broad spectrum of UV light emitted by MP UV lamps may also impact byproduct formation as discussed in the following section.

1.2.3 Byproduct Formation

For municipal scale applications, AOPs are typically not operated to achieve complete mineralization (i.e., oxidation to carbon dioxide, chloride, and water) of the target contaminants due to the power and peroxide doses that would be necessary. Since mineralization is not achieved, byproduct formation is a potential concern. The complete identity of byproducts from UV AOP oxidation of organic contaminants are not fully known (WRI, 2011), but several byproducts with regulatory limits have been identified. Potential byproducts for UV/peroxide include the following:

- Regulated disinfection byproducts [total trihalomethanes (TTHM) and five regulated haloacetic acids (HAA5)]
- Nitrite (MP UV only)
- Assimilable organic carbon (AOC), which includes biodegradable constituents such as aldehydes, carboxylic acids, and other small organic byproducts
- Unidentified chemicals contributing to toxicity
- Chloropicrin (MP UV only)

AOP technologies have been shown to transform organics in the water, which can result in higher formation of disinfection byproducts (DBPs), including TTHMs and HAA5, after free chlorine contact time (Dotson, et al. 2010, Andrews 2009). TTHMs and HAA5 are regulated under the Stage 1 and Stage 2 Disinfectants and Disinfection Byproduct Rule (DBPR). The increase in DBP formation is likely due to hydroxylation of aromatics or transformation of less reactive hydrophobic organic matter by hydroxyl radicals into more reactive hydrophilic organic matter (Dotson, et al. 2010).

Nitrite formation is specific to MP UV/peroxide systems. Nitrate has a high UV absorbance at the lower wavelengths emitted by MP UV lamps (i.e., <240 nm), and can be transformed (i.e., photolyzed) into nitrite and radical species when it absorbs UV light. The conversion of nitrate to nitrite must be considered with MP UV systems, as nitrite has a drinking water MCL of 1 mg/L as N and is a hydroxyl radical scavenger.

AOC is a measure of the potential bacterial regrowth or the ability of a water to support bacterial growth. Increases in AOC can be problematic because there is a potential to increase biological growth in the distribution systems. Ozone/peroxide (another AOP process) is known to increase AOC concentrations, but less data are available for AOC formation with UV/peroxide. Linden et al. (2015) found AOC formation with UV/peroxide was limited, but concluded that it may be site specific.

Toxicity testing can be a useful method to evaluate the aggregate health risk of water. Several studies have evaluated the effect of MP UV irradiation on nitrate-containing waters (Martjin and Kruithof 2012, Martijn, Boersma, et al. 2014, Martijn, Kruithof, et al. 2015). The studies evaluated the toxicity of waters prior to and after MP UV exposure. Nitrate-containing waters had increased toxicity after exposure to MP UV light at relevant doses for drinking water disinfection and advanced oxidation. However, the increase in toxicity was contingent on the presence of NOM in the water. It is hypothesized that nitrate photolysis leads to nitrogen-containing intermediate molecules that can react with NOM to increase toxicity by forming nitrated aromatic compounds (Martijn et al. 2014).

Oxidation byproducts have also been evaluated for their impact on toxicity. Linden et al. (2015) evaluated the byproducts of AOP treatment of the EPA Contaminant Candidate List 3 (CCL3) compounds, which includes 1,4-dioxane. It was found that the oxidation byproducts for the majority of the CCL3 compounds, including 1,4-dioxane, did not increase toxicity.

Chloropicrin (Cl_3CNO_2) is a known, unregulated byproduct associated with MP UV irradiation. Studies have shown increasing chloropicrin formation after MP UV exposure. The increase in chloropicrin concentrations is likely due to exposure of NOM or nitrate to UV, leading to more favorable conditions for chloropicrin formation (Reckhow et al. 2010).

1,1,2-TCA is another unregulated oxidation byproduct observed through Vacuum UV (VUV) irradiation. A study published by Baum et al. concluded that 1,1,2-TCA was formed through VUV in the presence of 1,2 DCE.

2 Methods

The following sections summarize the bench-testing methods used in the UV AOP evaluation of NHW groundwater. Testing was provided by Dr. Karl Linden's laboratory at the University of Colorado at Boulder.

2.1 Source Water

Source water was collected from two sources: well water from LADWP's Well NH-37 and surface water from LADWP's North Hollywood Pump Station (NHPS). All UV AOP tests were completed on water from NH-37, which is a Remediation Well. Surface water was only used for blending in the SDS evaluations. Two samples were collected from Well NH-37 (2016 and 2017 sample). The second sample was collected to extend the log reduction of 1,4-dioxane using MP lamps.

2.2 Test Matrix

Table 2-1 presents the goal test matrix to evaluate LPHO and MP technologies under a range of hydrogen peroxide and UV doses, as well as the SDS testing using NHPS water. Tests 2 and 6 were conducted first. The range of UV doses was increased for the remaining tests based on the results of tests 2 and 6. The 2017 water had noticeable particles in the water for test conditions 9 and 10. For test condition 12, the water was filtered through a 0.45-micron filter to remove the particulates. The full-scale facility includes sand separators and cartridge filters to minimize particulates from the wells.

Table 2-1. UV/Peroxide Test Matrix

Test Number	Water	Sample Collection Date	Nitrate/Alkalinity Spiking	Lamp Technology	H_2O_2 Dose (mg/L)	Target UV Dose (mJ/cm^2)[1]
Control 1	NH-37	2016	N/A	N/A	0	0
Control 2	NH-37	2016	N/A	N/A	15	0
Control 3	NH-37 + NHPS	2016	N/A	N/A	0	0
1	NH-37	2016	N/A	LPHO	5	0, 1000, 1700, 2400, 3200
2	NH-37	2016	N/A	LPHO	8	0, 300, 600, 1000, 1500
3	NH-37	2016	N/A	LPHO	12	0, 1000, 1700, 2400, 3200
4	NH-37	2016	N/A	LPHO	15	0, 1000, 1700, 2400, 3200
5	NH-37	2016	N/A	MP	5	0, 700, 1200, 1700, 2300
6	NH-37	2016	N/A	MP	8	0, 200, 400, 700, 1100
7	NH-37	2016	N/A	MP	12	0, 700, 1200, 1700, 2300
8	NH-37	2016	N/A	MP	15	0, 700, 1200, 1700, 2300
9	NH-37 (2017)	2017	Nitrate; Alkalinity	MP	8	0, 2000, 3000, 5000, 7000
10	NH-37 (2017)	2017	Nitrate; Alkalinity	MP	15	0, 2000, 3500, 4500, 6000
11	NH-37	2016	N/A	MP	10	0, 2000, 3000, 4000, 6000
12	NH-37(2017 Filtered)	2017	Nitrate	MP	15	0, 3000, 4500, 6000, 8000

[1]The actual UV dose achieved varied from the target dose. MP UV doses are presented as peroxide weighted doses.

2.3 Target Contaminant Spiking

The 1,4-dioxane concentration in the raw water from Well NH-37 was approximately 14 µg/L. To allow better detection of 1,4-dioxane in the treated water and to test higher log reductions given the uncertainties of the full-scale design criteria at the time of testing, 1,4-dioxane was spiked to approximately 60 µg/L for the bench-scale testing.

VOCs are also present in the North Hollywood West Well Field, including trichloroethylene (TCE), tetrachloroethylene (PCE), and 1,1-dichloroethylene (1,1-DCE). This study also includes testing of 1,2-3-trichloropropane (1,2,3-TCP). While 1,2,3-TCP has never been detected in any operating production wells in the North Hollywood West Well Field (it has only been detected above the newly adopted MCL in 6 out of 84 samples and those detections occurred many years ago when the wells were not pumping), the chemical has had sporadic detections in other San Fernando Basin wellfields. Thus, the chemical was included in the testing to provide information on removal for potential projects in other well fields. VOCs were spiked in the test water to the following concentrations for testing purposes: 30 to 40 µg/L TCE, 4 to 5 µg/L 1,1-DCE, and 0.050 µg/L 1,2,3-TCP. PCE was not spiked due to it having a similar hydroxyl radical rate constant as TCE. Subsequent testing at other wellfield with spiked PCE concentration showed no negative changes to toxicity. Background PCE concentrations were approximately 0.16 µg/L. 1,4-dioxane and VOCs were purchased as neat chemicals and diluted with deionized water. 1,4-dioxane and all VOCs except 1,1-DCA were purchased from Fluka. 1,1-DCA was purchased from Ultra Scientific.

For the 2017 water sample, nitrate was spiked to match the 2016 sample nitrate concentration of approximately 6 mg/L as N. To make the results comparable with similar hydroxyl radical scavenging demands, the alkalinity was also spiked to 290-295 mg/L as $CaCO_3$ to account for the lower modeled hydroxyl radical scavenging demand due to the lower TOC concentration of the 2017 sample.

2.4 Hydrogen Peroxide Dosing

Analytical grade hydrogen peroxide was used for UV AOP testing, with target concentrations of 5, 8, 10 (MP only), 12, and 15 mg/L. A hydrogen peroxide stock of 5,000 mg/L hydrogen peroxide was used, and diluted in ultra-pure deionized water to achieve the desired hydrogen peroxide dose for each sample. All peroxide doses were determined before and after exposure, using the triiodide method by Klassen et al. (1994). Hydrogen peroxide was purchased from BDH VWR Analytical.

2.5 Collimated Beam Testing

UV/peroxide experiments were performed using both LP UV and MP UV collimated beam systems (Figure 2-1). The LP UV system was equipped with four 15-watt bulbs. The MP UV system was equipped with a single ozone free, 1 kilowatt lamp. Incident UV irradiance was measured by a calibrated radiometer (International Light Inc., Model 1700/SED 240/W). UV dose was calculated by multiplying the average irradiance (incident irradiance corrected for sample depth, absorbance at 254 nm (LP) or across the 200-300 nm range (MP), sample reflectance, divergence factor, and petri factor) by the irradiation time in seconds, as per the published standard method (Bolton and Linden, 2003). The UV dose for the MP system was further calculated using a hydrogen peroxide weighting factor that was normalized to 254 nm. The LP UV doses were not weighted to hydrogen peroxide as the LP lamps are monochromatic. Note that the use of the divergence factor, which corrects for the photons of light that exit the water column before reaching the full depth of water due to divergence, is relatively new and not included in all bench-scale studies. Its precise use for MP UV dosimetry is an area of research. The use of the DF here results in a decrease in the reported UV dose of approximately 13 percent. While the UV doses reported include the divergence factor, if it were not used the required UV doses reported would be higher. The divergence factor was also applied to the LP UV doses.

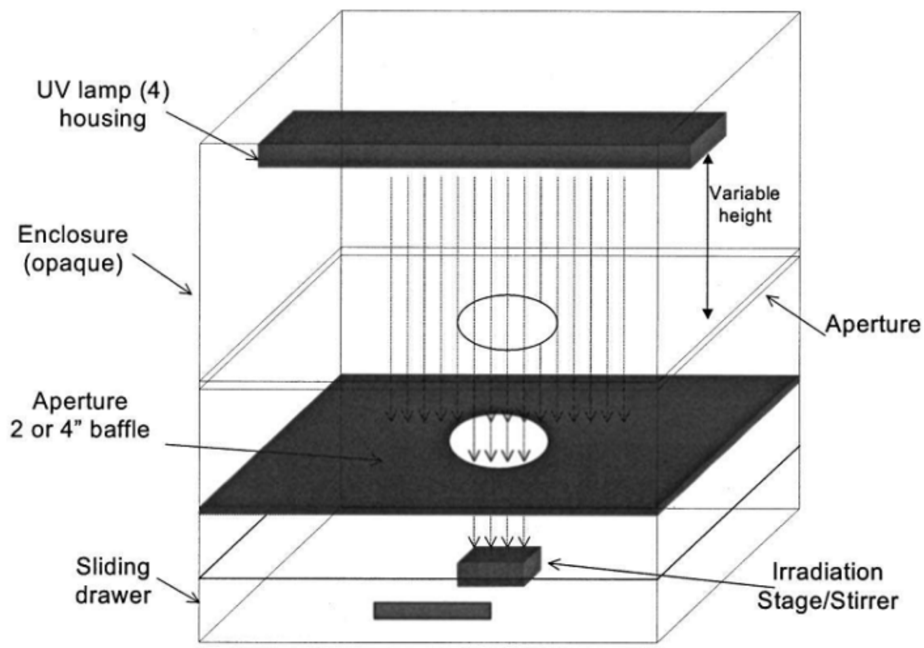

Figure 2-1. Bench-scale collimated LPHO and MP UV system (Bolton and Linden 2003).

UV exposures were performed in both open and closed vessels. The open vessels were used for DBP, nitrate/nitrite, and TOC determinations. The closed vessels were used for spiked VOC and 1,4-dioxane analysis to minimize volatilization losses. Open exposures were performed in a 600 mL glass petri dish, while the closed exposures were conducted in a custom quartz vessel with a volume of roughly 300 mL (Figure 2-2). Samples were completely stirred for the duration of the UV exposure. Due to the exposure times required for the target doses, ice packs were added to the chambers and airflow allowed to minimize temperature changes.

Figure 2-2. Quartz vessel used in the UV AOP analysis of VOCs and 1,4-Dioxane

2.6 Simulated Distribution System Testing

SDS testing was conducted to evaluate potential changes in DBP formation downstream of UV AOP treatment. SDS testing utilized chlorine quenching for removing the remaining peroxide residual prior to the SDS hold period. Full-scale DBP formation is expected to be less due to utilizing GAC for peroxide quenching, which reduces the potential for DBP formation by removing organics through adsorption and biological removal. SDS testing was conducted using the following method:

1. Filled two 250 mL amber glass bottles with target water (raw water, AOP treated water, or surface water blend). For SDS tests sampling nitrosamines, one 250 mL and one 1L amber glass bottles were filled. Filled bottles were headspace free.
2. Chlorine was added to achieve the target residual chlorine concentration (2.5 mg/L). Peroxide residual was quenched with chlorine prior to achieving a free chlorine residual.
3. Lids were closed and the bottles were shaken for 1 min.
4. The bottles were left for 20 mins to simulate free chlorine contact time.
5. The ammonia stock solution was used to dose at a target 5:1 ratio chlorine-to-ammonia mass ratio based on the measured residual chlorine concentration.
6. The bottles were shaken vigorously for 2 minutes.
7. Total chlorine residual was measured after 2 min of mixing time (time zero concentration).
8. The samples were stored in the dark at room temperature.
9. Total chlorine residual, TTHM, and HAA5 was measured after 3 days (72 hours) and 5 days (120 hours).
10. TTHM and HAA5 samples were taken in the appropriate vials containing quenching agents. TTHM bottles used sodium thiosulfate and HAA5 bottles used ammonium chloride as quenching agents. Nitrosamines were sampled after 5 days for the SDS tests.

2.7 Analytical Methods

Water quality before and after UV exposure was analyzed for numerous constituents by different laboratories. These details and the methods are presented in Table 2-2.

Table 2-2. Constituent Analysis Information

Analysis	Analysis Location	Method
AOC	Eurofins	Weinrich et al. - Assimilable Organic Carbon
THMs	Colorado University	EPA Method 552.2 (Agilent 6890 GC-µECD)
HAAs	Colorado University	EPA Method 552.2 (Agilent 6890 GC-µECD)
1,4-Dioxane	North Carolina State University	Modified EPA 522 (Sun, Lopez-Velandia and Knappe 2016)
VOCs	North Carolina State University	EPA Method 524.3
H_2O_2	Colorado University	Triiodide colorimetric method (Klassen, Marchington and McGowan 1994)
TOC	Colorado University	UV persulfate oxidation/conductivity method - Standard Methods 5310C and EPA 415.3 compliant.
Alkalinity	Colorado University	Hach digital titrator method, in compliance with EPA method 310.2
UV254	Colorado University	Cary Bio 100 spectrophotometer (Varian Inc., Palo Alto, TX)
Nitrate	Colorado University	Hach TNT 835 kit. Approved by the EPA. Reference Method: 40 CFR 141
Nitrite	Colorado University	Hach TNT 839 kit. Equivalent to EPA method. Reference Method EPA 353.2

2.8 Background Scavenging

Background radical scavenging experiments were carried out using 500 µg/L of para-Chlorobenzoic Acid (pCBA) as a probe compound to measure hydroxyl radical scavenging. pCBA reacts with hydroxyl radicals at a rate that far exceeds its reaction rate with UV light, making it an ideal probe to measure the formation and scavenging of hydroxyl radicals (HO·).

Samples were analyzed for the concentration of pCBA using an Agilent 1100 series high performance liquid chromatograph (HPLC) and UV detector (at 235 nm) equipped with a reverse phase C-18 column. The mobile phase flowrate was 1 mL/min. Eluents gradient began at 30% HPLC grade methanol and 70% formic acid solution (1% formic acid in lab grade water) increasing to 100% methanol by 6 minutes, followed by a 1 mL/min flow rate of 100% HPLC grade methanol for 2 minutes.

The concentration of HO· was then calculated using the following relationship:

$$\ln\frac{[\mathrm{pCBA}]}{[\mathrm{pCBA}]_0}=\frac{-\mathrm{k}_{\mathrm{HO,pCBA}}[\mathrm{HO}\,\bullet]}{\mathrm{E}_0}\times \mathrm{F}$$

Equation 2-1

In Equation 2-1, E_0 is the average fluence rate (mW/cm²), F is the fluence (mJ/cm²) and $k_{HO,pCBA}$ is a time-based reaction rate constant between pCBA and hydroxyl radicals ($M^{-1}s^{-1}$). In this equation, the quantity $\frac{-\mathrm{k}_{\mathrm{HO,pCBA}}[\mathrm{HO}\bullet]}{\mathrm{E}_0}$ represents the slope of the plot of $\ln\frac{[\mathrm{pCBA}]}{[\mathrm{pCBA}]_0}$ vs F, and HO· can be calculated as in Equation 2-2:

$$[\mathrm{HO}\,\bullet]=\frac{-\mathrm{slope}\cdot \mathrm{E}_0}{\mathrm{k}_{\mathrm{HO,pCBA}}}$$

Equation 2-2

The value for $k_{HO,pCBA}$ has been reported as 5×10^9 $M^{-1}s^{-1}$ (Buxton, et al. 1998). A UV/peroxide model (Glaze, Lay and Kang 1995) can then be rearranged to calculate the total HO· scavenging coming from the sample background, as shown in Equation 2-3.

$$\sum \mathrm{k}_\mathrm{s}\,[\mathrm{S}]=\frac{\mathrm{E}_0\varepsilon_{254}\Phi[\mathrm{H}_2\mathrm{O}_2]}{\mathrm{U}_{254}}\cdot\frac{1}{[\mathrm{HO}\,\bullet]}$$

Equation 2-3

In this equation, k_s is the HO· reaction rate constant for a given scavenging compound ($M^{-1}s^{-1}$), [S] is the concentration of the corresponding scavenging compound (M), ε_{254} is the molar absorption of H_2O_2 at 254 nm ($M^{-1}cm^{-1}$), Φ is the quantum yield of hydroxyl radical formation by photolysis of hydrogen peroxide at 254 nm, $[H_2O_2]$ is the concentration of hydrogen peroxide (M), and U_{254} is the wavelength energy (J/mol). Substituting Equation 2-2 into Equation 2-3 yields Equation 2-4:

$$\sum \mathrm{k}_\mathrm{s}\,[\mathrm{S}]=\frac{\mathrm{E}_0\varepsilon_{254}\Phi[\mathrm{H}_2\mathrm{O}_2]}{\mathrm{U}_{254}}\cdot\frac{\mathrm{k}_{\mathrm{HO,pCBA}}}{-\mathrm{slope}\cdot\mathrm{E}_0}=\frac{\varepsilon_{254}\Phi[\mathrm{H}_2\mathrm{O}_2]}{\mathrm{U}_{254}}\cdot\frac{\mathrm{k}_{\mathrm{HO,pCBA}}}{-\mathrm{slope}}$$

Equation 2-4

2.9 Toxicity Testing

As a way of testing the combined impact of potential byproducts in an AOP treated water, toxicity testing was applied. Well NH-37 groundwater was spiked with VOCs and 1,4-dioxane and treated by LPHO- or MP- UV/peroxide advanced oxidation in a batch treatment system (collimated beam). Various UV doses and hydrogen peroxide concentrations were tested. The toxicity of raw, spiked, and treated waters was assessed by a battery of *in vitro* toxicity assays. These tests measured the acute cellular toxicity, estrogenic activity, and mutagenic activity of samples via the bioluminescence inhibition assay (BLIA), yeast estrogen screen (YES), and Ames II mutagenicity assay (AMES), respectively. For AMES testing, samples were assayed after concentration by solid phase extraction (SPE; 50x).

2.9.1 Bioluminescence Inhibition Assay (BLIA)

Acute cytotoxicity is measured by the BLIA over a short incubation of samples by measuring the kinetic change in cellular respiration, indicated by luminescence of a naturally bioluminescent marine bacterium, *Vibrio fischeri* (Shemer and Linden 2007). Toxic samples inhibit cellular respiration and luminescence in comparison to a non-toxic control. Data are represented as percent cell inhibition of samples relative to the non-toxic control, where the maximum toxicity is 100% as verified by assaying cytotoxic copper sulfate. Error bars represent standard deviation of three technical replicates.

2.9.2 Yeast Estrogen Screen (YES)

Estrogenic activity of samples is measured by YES using recombinant *Saccharomyces cerevisiae* yeast containing the human estrogen receptor (Routledge and Sumpter 1996, Routledge and Sumpter 1997). When an estrogen molecule in the sample binds to the receptor, a reporter gene induces synthesis of an enzyme that changes the color of a chromophore in the media. After correcting for differences in turbidity, estrogen induction is expressed as the induction of response relative to the maximum response (=100%) of the positive control estrogen compound, 17β-estradiol. The estrogenic activity for each sample is reported as equivalent of 17β-estradiol (EEQ) (Linden, et al. 2015). Error bars represent standard deviation of three technical replicates. Increases in estrogenic activity would indicate the formation of potentially toxic compounds.

2.9.3 Ames II Mutagenicity Assay (AMES)

The Ames II assay is a reverse mutation fluctuation assay that utilizes *Salmonella typhimurium* to detect genomic point mutations frame shift (by TA98 strain) or base pair substitution (by TAMIX mixture of six strains) (Kamber, et al. 2009, Mortelmans and Zeiger 2000). Mutagenic samples cause these point mutations to reverse, enabling revertant cells to survive and be enumerated. Samples are assayed alone, or with S9 enzyme to determine mutagenicity of abiotic degradation products. Samples were 0.45 µm filtered and concentrated 50X by SPE using HLB columns prior to analysis. Mutagenicity is expressed as the percent reversions compared to the maximum response of mutagenic positive controls (PC) 2-aminoanthracene, 4-nitroquinoline, and 2-nitrofluorene. If the number of revertant wells counted is at least twice the number of revertant well in the blank (control), then that concentration of chemical is said to be genotoxic. If the number or revertant wells decreases after reaching a maximum, the cells are said to be cytotoxic (Linden, et al. 2015).

3 Results

The following sections summarize the bench-testing results for the AOP evaluation.

3.1 Source Water Quality

The following sections summarize the background source water quality for samples used in the bench-scale testing.

3.1.1 Well Water – NH-37

The source water for the bench-scale testing was raw water collected from Well NH-37. Water was collected and sent by 2-day air to the University of Colorado for testing. While the AOP treatment facility will treat a blend of wells within the North Hollywood West Wellfield, water was only collected from well NH-37, because modeling predicts this well will have the highest 1,4-dioxane concentration of the remediation wells. Historical concentrations for the wellfield are shown in Table 3-1. Water quality analyzed before (by LADWP) and after (by University of Colorado) shipment are shown in Table 3-2. Two water samples were collected (2016 and 2017). The second water sample was collected to expand the MP testing to achieve higher log reductions. Figure 3-1 presents the UV absorbance scans for both samples.

Table 3-1. Historical Operating Well Water Quality

Well	1,4-Dioxane (µg/L)[1]	Alkalinity (mg/L as $CaCO_3$)	Nitrate (mg/L as N)	TOC (mg/L)	pH (S.U.)
		Avg (Max) [2000 – 2016]			
NH-34	1.62	209 (214)	3.5 (7.3)	0.46 (0.63)	7.6 (7.7)
NH-37	11.8	209 (234)	3.1 (7.7)	0.41 (0.76)	7.7 (7.8)
NH-45	1.85	210 (218)	2.4 (4.2)	0.45 (0.68)	7.8 (8.3)

[1] 1,4-dioxane data from March 2016

Table 3-2. 2016 NH-37 Raw Water Quality

Constituent	Unit	LADWP Laboratory	University of Colorado Laboratory	
			2016	2017
1,4-Dioxane	µg/L	15.9	14.2	<15
TCE	µg/L	13.6	10.7	<0.03
1,1-DCA	µg/L	0.662	N/A	N/A
1,1-DCE	µg/L	1.49	0.285	<0.08
1,2,3-TCP	µg/L	< 0.5	<0.03	1.8
Alkalinity	mg/L $CaCO_3$	253	209	170
Nitrite	mg/L as N	< 0.005	0.01	<0.003
Nitrate	mg/L as N	5.95	5.95	1.37
pH	S.U.	7.34	N/A	N/A
TOC	mg/L	N/A	0.64	0.47
TTHM	µg/L	0.572	N/A	N/A
Turbidity	NTU	0.10	N/A	N/A
UVT_{254}	%	N/A	97.5	97.3

*N/A means the constituent was not tested.

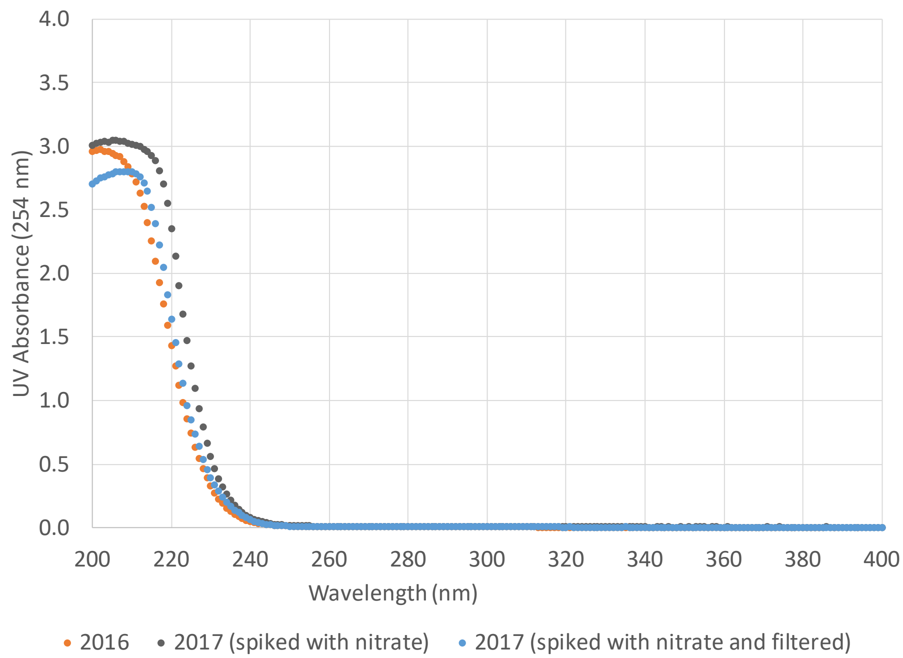

Figure 3-1. UV Absorbance Spectrum of Well NH-37

3.1.2 Surface Water – NHPS

Surface water taken from LADWP's NHPS (distribution system water) intended for SDS testing was analyzed by LADWP; relevant results are shown in Table 3-3.

Table 3-3. NHPS Water Quality

Constituent	Unit	LADWP Laboratory
TCE	µg/L	< 0.5
1,1-DCA	µg/L	< 0.5
1,1-DCE	µg/L	< 0.5
Ammonia (free)	mg/L as N	0.114
Ammonia (total)	mg/L as N	0.623
Chlorine (total)	mg/L	2.26
HAA (total)	µg/L	8.74
HAA5	µg/L	6.1
Turbidity	NTU	18.31

3.1.3 Hydroxyl Radical Scavenging Demand

The pH, absorbance (at 254 nm), alkalinity, and TOC of the 2016 water samples are shown in Table 3-4.

In most natural waters, hydroxyl radicals are scavenged mainly by two constituents: carbonates ($k_{HO,HCO3} = 8.5 \times 10^6$ M^{-1} s^{-1} and $k_{HO,CO3} = 3.9 \times 10^8$ M^{-1} s^{-1}) and TOC ($k_{HO,TOC} = 2.5 \text{ X } 10^4$ M^{-1} s^{-1}) (Buxton, et al. 1998). While hydrogen peroxide (~8 mg/L) was added to promote formation of hydroxyl radicals, it is also capable of scavenging radicals ($k_{HO,H2O2} = 2.7 \times 10^7$ M^{-1} s^{-1}). Given their established rate constants, the relative contribution of each water quality parameter to the overall scavenging demand can be calculated (Table 3-4).

Hydrogen peroxide (H_2O_2) concentration was determined prior to UV exposure ([H_2O_2] initial), shown in Table 3-4. Since H_2O_2 has a relatively low molar absorption coefficient at 254nm, only a small fraction is consumed during UV exposure. Hydrogen peroxide concentrations were measured using the molybdate-activated iodide method. This method utilizes a color change that occurs when H_2O_2 reacts with potassium iodide (KI) in a buffered solution containing ammonium molybdate, forming I_3^- which can be detected spectrophotometrically at 352 nm (Klassen, 1994).

Figure 3-2 presents the measured degradation of pCBA in the water from Well NH-37 by LPHO UV/peroxide with ~8 mg/L H_2O_2, and the theoretical decay of pCBA (term "model"). The modeled value was calculated using the measured water quality, associated scavenging rates from Table 3-4, and a steady-state hydroxyl radical model previously described by Rosenfeldt and Linden (2007). This model incorporates the water quality parameters and the spectral characteristics of the LPHO UV setup.

Table 3-4. Hydroxyl Radical Scavenging Demand Analysis (2016 Water Sample)

Constituent		**Test 1**	**Test 2**
pH		7.6	7.6
Alkalinity as $CaCO_3$		209	209
TOC (mg/L)		0.45	0.45
UV abs $_{254nm}$ (cm^{-1}) (Transmittance)		0.01874 (95.8%)	0.01874 (95.8%)
[H_2O_2] initial (mg/L)		8.10	7.58
Scavenger [S]	**$k_{OH/S}$ (M^{-1} s^{-1})**	**$k_{HO,S}$[S] (s^{-1})**	
TOC	2.50×10^4	1.13×10^4	1.13×10^4
HCO_3^-	8.50×10^6	1.77×10^4	1.77×10^4
CO_3^{2-}	3.90×10^8	1.62×10^3	1.62×10^3
H_2O_2	2.70×10^7	6.43×10^3	6.02×10^3
pCBA	5.00×10^9	1.65×10^4	1.67×10^4
	$\Sigma k_{OH,S}$[S] (s^{-1})	5.35×10^4	5.32×10^4
	$\Sigma k_{OH,S}$[S-pCBA] (s^{-1})	3.70×10^4	3.66×10^4

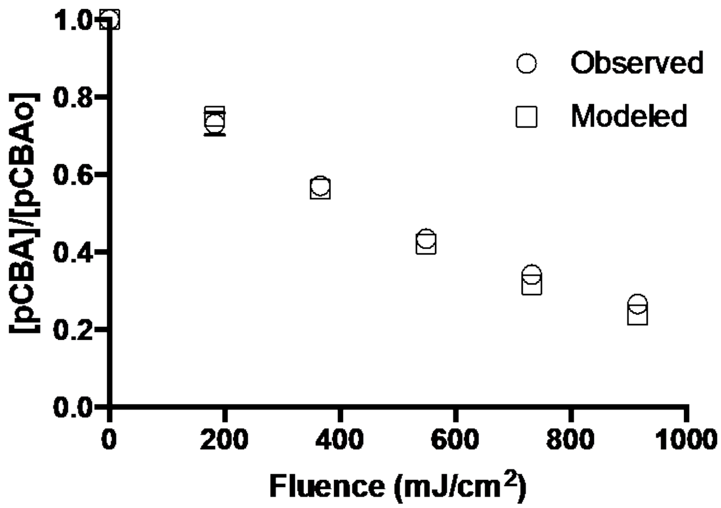

Figure 3-2. Modelled degradation of pCBA in Well NH-37 for Test 1 and 2, with 8 mg/L H2O2. Error bars represent one standard deviation.

Table 3-5 summarizes the experimental and theoretical HO• concentration and scavenging rates of the water samples. Refer to Appendix B of this document for more details on the scavenging methods and results.

Table 3-5. Comparison of Modelled and Experimentally Determined Hydroxyl Radical Concentrations and Scavenging Rates

Constituent	**Test 1**	**Test 2**
$[H_2O_2]$ mg/L	8.10	7.58
Scavenging Rate	**$k_{OH}[S]$ (s^{-1})**	
$k_{OH}[S]$, TOT-Model	3.70×10^4	3.66×10^4
$k_{OH}[S]$, TOT-Exp.	3.78×10^4	3.79×10^4
Steady State HO• Concentration	**$[OH]_{ss}$(M)**	
$[OH]_{ss\ –\ Model}$	2.52×10^{-13}	2.38×10^{-13}
$[OH]_{ss\ –\ Exp.}$	2.21×10^{-13}	2.18×10^{-13}

3.2 Treatment Performance

Figure 3-3 through Figure 3-15 show the results for 1,4-dioxane, TCE, and 1,1-DCE log reduction for LPHO and MP UV/peroxide treatment. LPHO was shown to be effective for 1,4-dioxane reduction and achieved the project goal of a 1.9-log reduction for 1,4-dioxane. TCE and 1,1-DCE concentrations were also simultaneously reduced at rates higher than 1,4-dioxane. 1,1-DCA was inadvertently spiked in place of 1,1-DCE for the 8 mg/L hydrogen peroxide tests. 1,1-DCA showed minimal removal, as would be expected based on its lower hydroxyl radical rate constant (Figure 3-14 and Table 3-6). 1,2,3-TCP was also monitored but showed no reduction with either LPHO or MP UV/peroxide (Figure 3-14).

MP was less effective for 1,4-dioxane and VOC removal (Figure 3-6 and Figure 3-7). Once the MP UV doses are weighted to hydrogen peroxide, the required doses should be identical to the LPHO UV doses, if no other water quality changes occur. However, even after adjusting to a hydrogen peroxide weighted UV dose, the MP UV/peroxide results showed lower removals than the LPHO results. This indicates a change in hydroxyl radical scavenging demand with the MP UV/peroxide tests as the hydroxyl radical formation would be similar at a given LPHO or peroxide weighted MP UV dose. The MP UV lamps emit wavelengths below 240 nm, which is where hydrogen peroxide has a high absorbance. The peroxide absorbance and MP emission spectrum allows for the potential for more efficient hydroxyl radical formation. In water containing nitrate, the water can have a high UV absorbance below 240 nm, which reduces the overall efficiency. NH-37 has high UV absorbance in the wavelengths absorbed by hydrogen peroxide, due to background nitrate concentration (Figure 3-16). The absorbance difference is accounted for in the peroxide weighted dose calculation. The low wavelengths emitted by MP UV lamps will also photolyze nitrate into nitrite (Section 3.3.2) and potentially other nitrogen radicals. Nitrite is a strong hydroxyl radical scavenger (Table 3-6). The formation of additional nitrogen radicals may off-set the increased hydroxyl radical scavenging demand from nitrite. However, the MP UV/peroxide results indicate that additional hydroxyl radical scavenging was occurring in excess of any additional nitrogen radical formation and reaction, which decreased the overall efficiency of the process. Nitrate photolysis was negligible with LPHO UV lamps.

Additional testing and modeling were completed to evaluate the impact of nitrate on MP UV AOP (Appendix A). The testing examined the impact of hydroxyl radical production on the following parameters:

- nitrate concentration
- water depth
- hydrogen peroxide concentration
- background water matrix (lab water vs groundwater)

With no peroxide present, higher nitrate concentrations resulted in higher formation of radicals (hydroxyl or nitrogen radicals). In the present of hydrogen peroxide, the experimental and model results indicated that nitrite detrimentally affects MP UV AOP performance. This effect can be ascribed to the nitrite formed during nitrate photolysis. Elevated nitrate will likely be detrimental to MP UV AOP, despite the additional hydroxyl radicals that are produced. The data indicates that LPHO UV AOP should not suffer this effect nearly as much. The results showed a net neutral effect of nitrate addition with LPHO UV AOP.

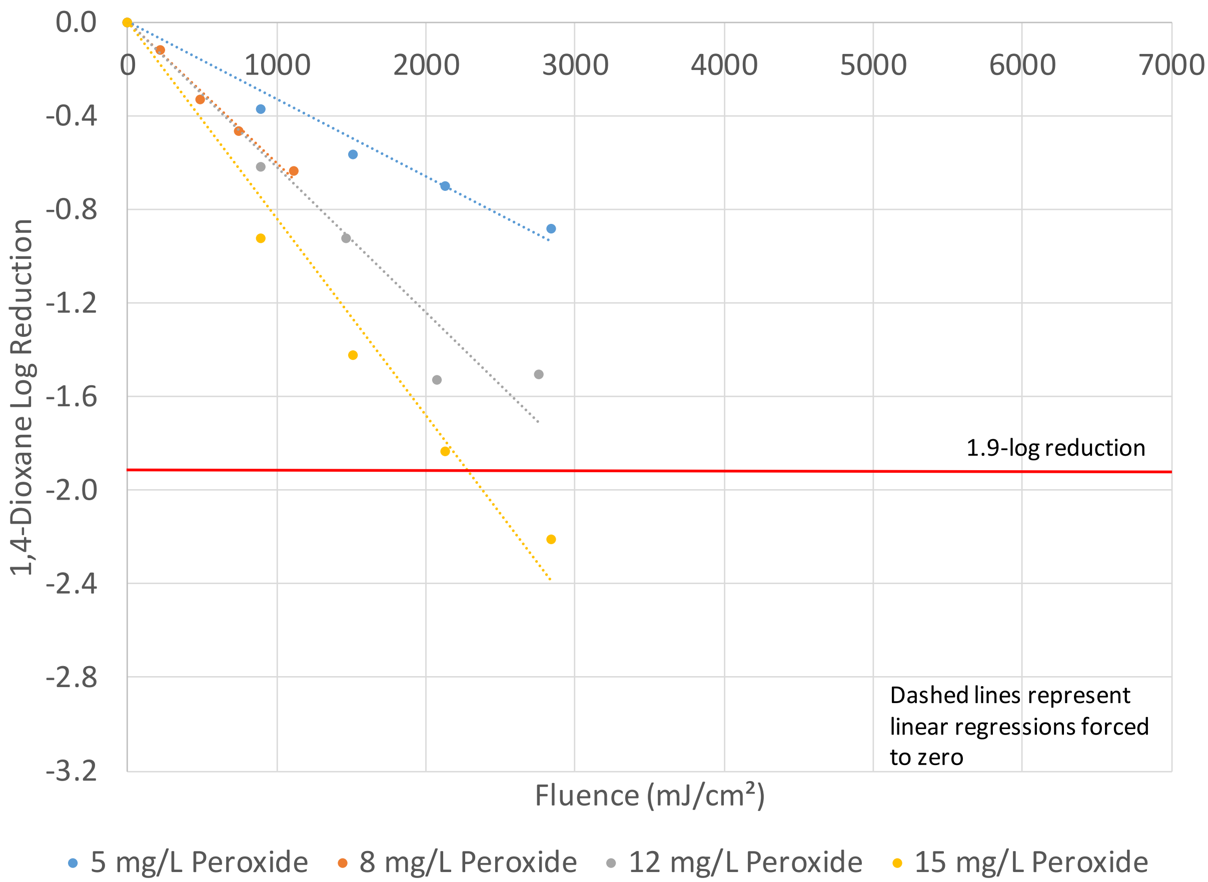

Figure 3-3. 1,4-Dioxane Log Reduction by LPHO UV/Peroxide Treatment

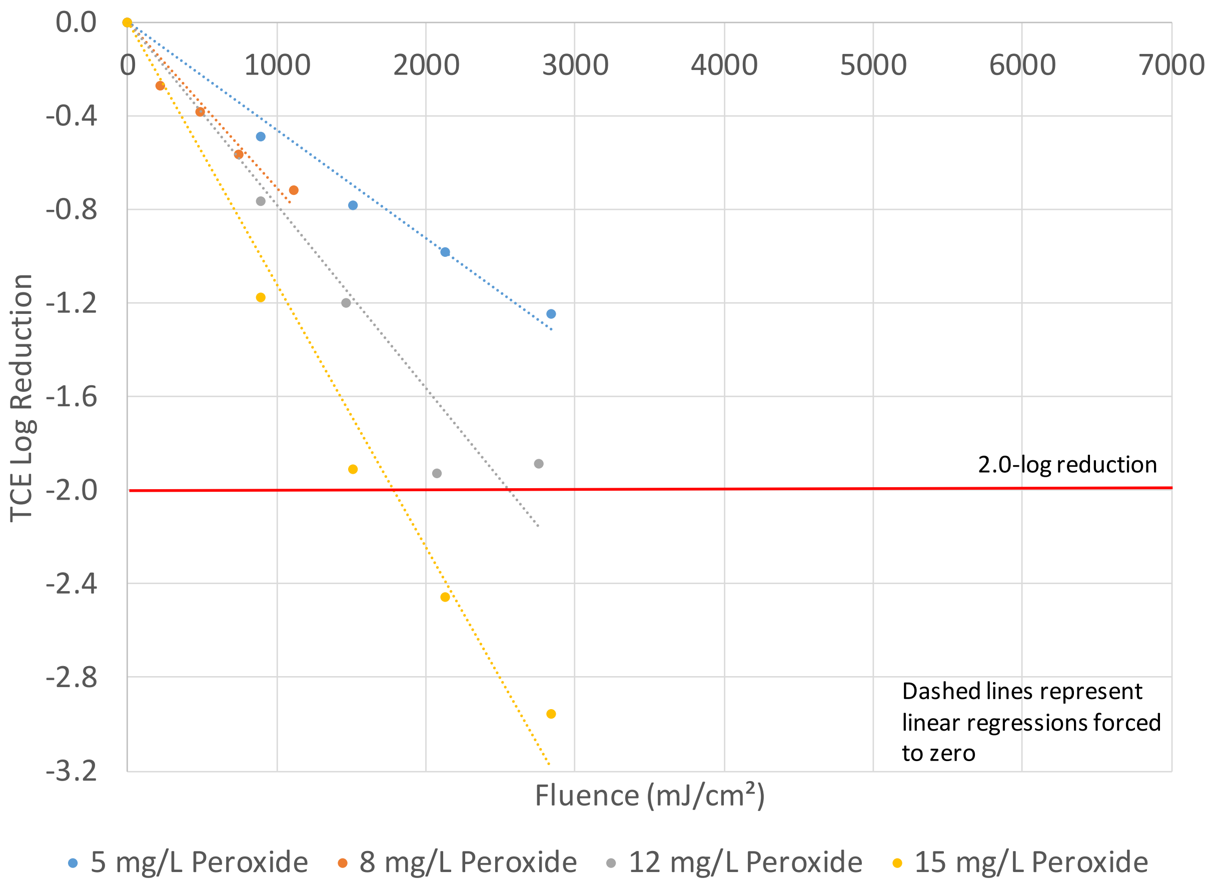

Figure 3-4. TCE Log Reduction by LPHO UV/Peroxide Treatment

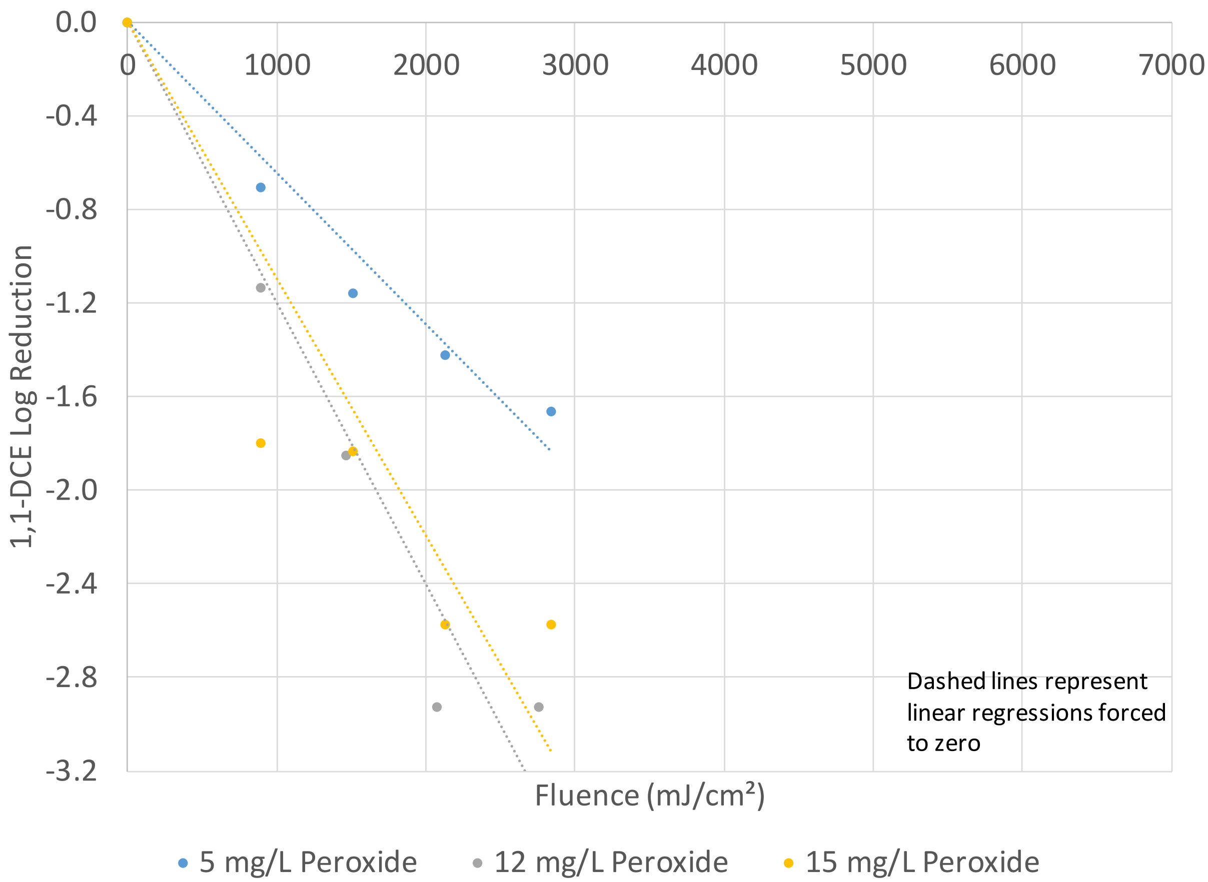

Figure 3-5. 1,1-DCE Log Reduction by LPHO UV/Peroxide Treatment

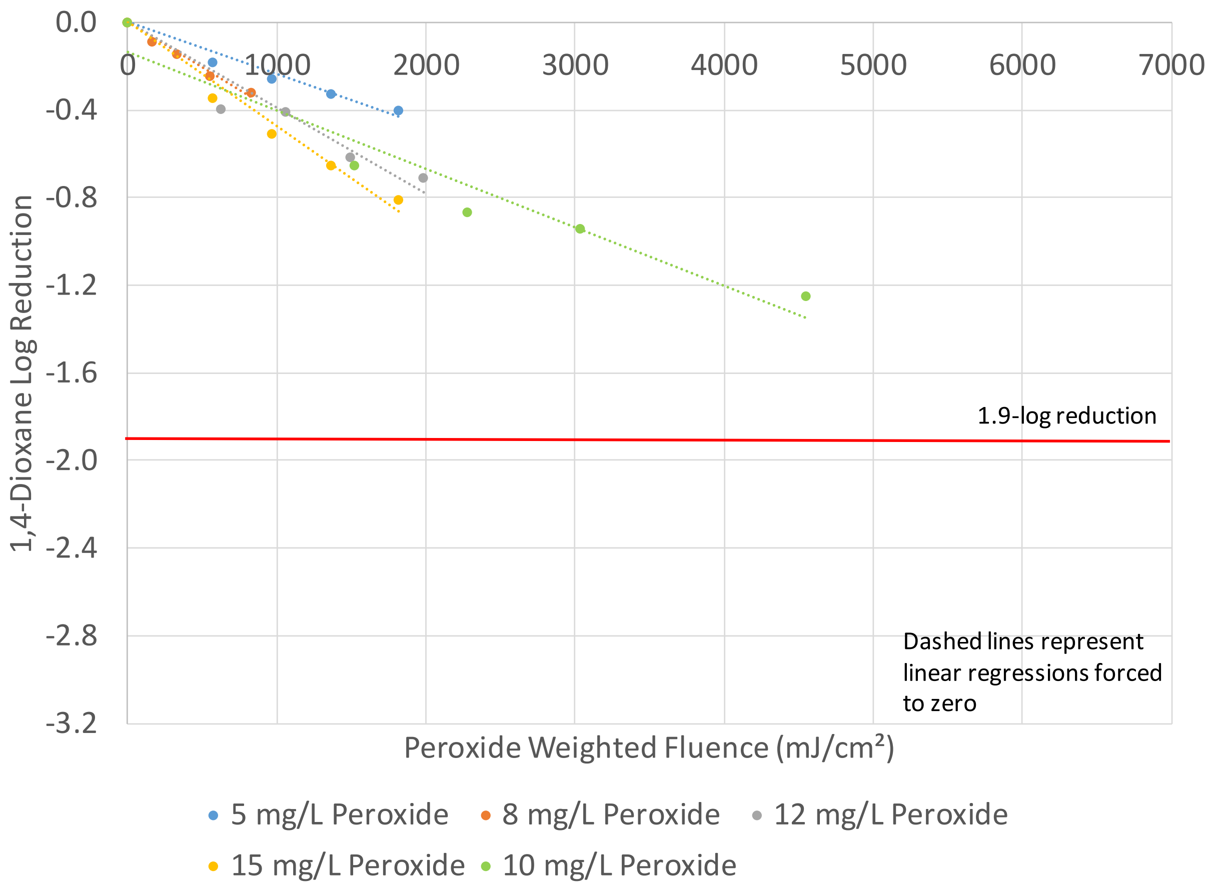

Figure 3-6. 2016 1,4-Dioxane Log Reduction by MP UV/Peroxide Treatment

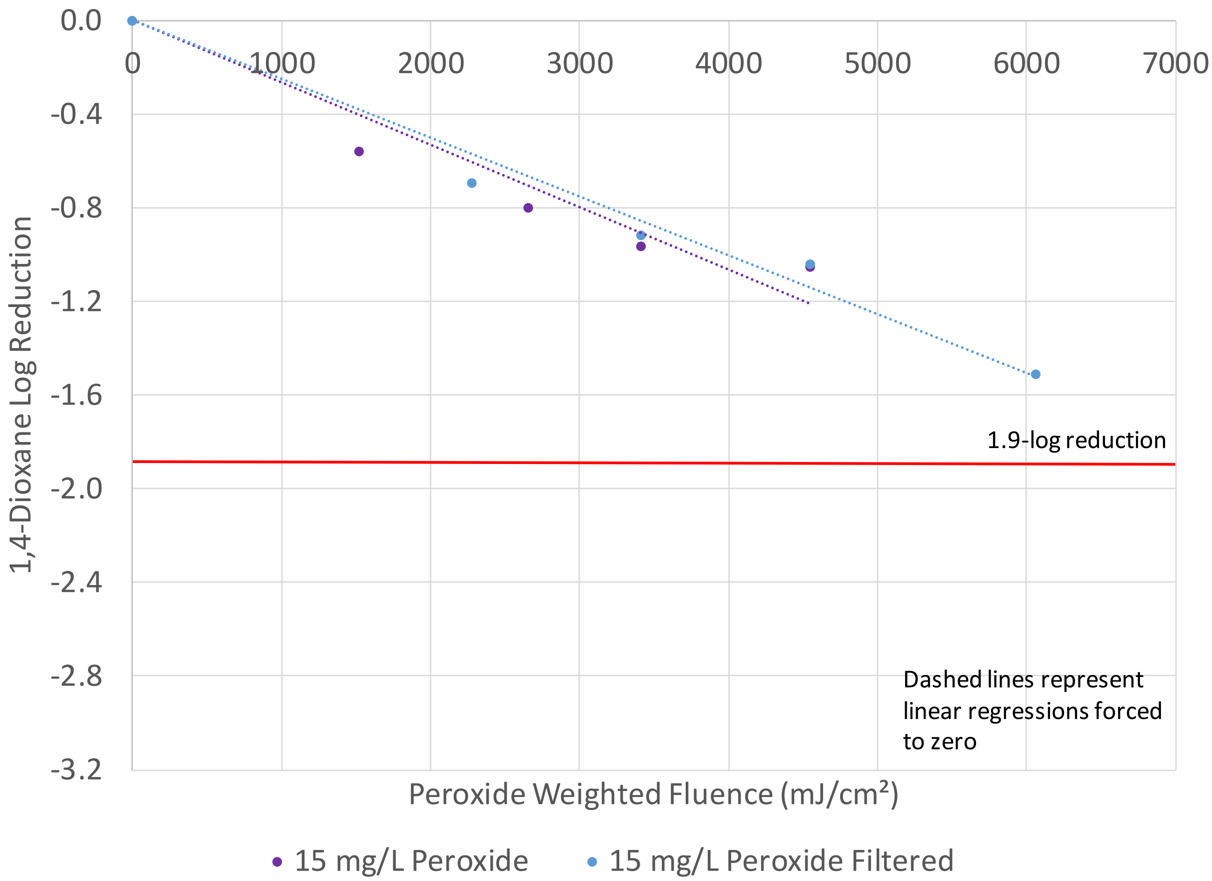

Figure 3-7. 2017 1,4-Dioxane Log Reduction by MP UV/Peroxide Treatment

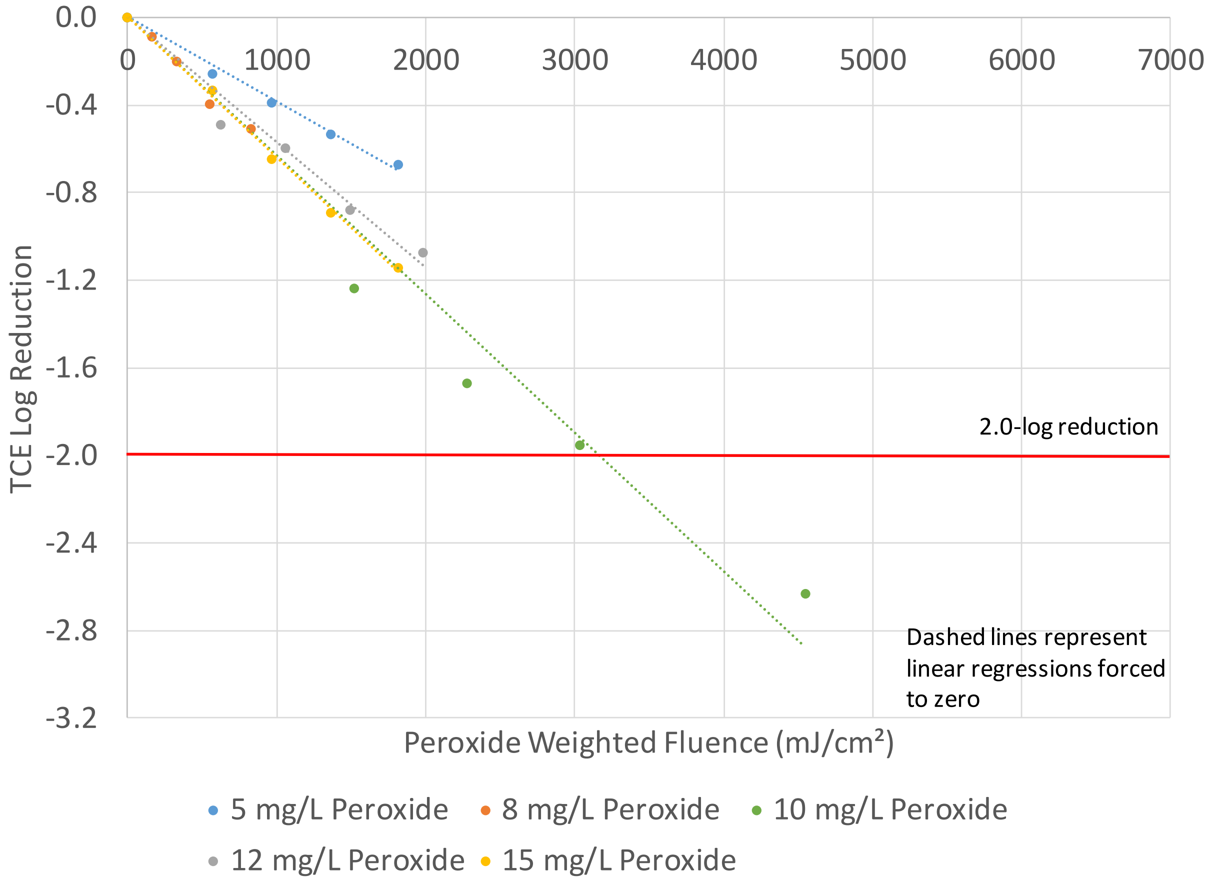

Figure 3-8. 2016 TCE Log Reduction by MP UV/Peroxide Treatment

In general, at a given UV dose, the target contaminant log reduction increases with increasing hydrogen peroxide doses. However, the increase is not linear due to the added hydroxyl radical scavenging demand of the hydrogen peroxide.

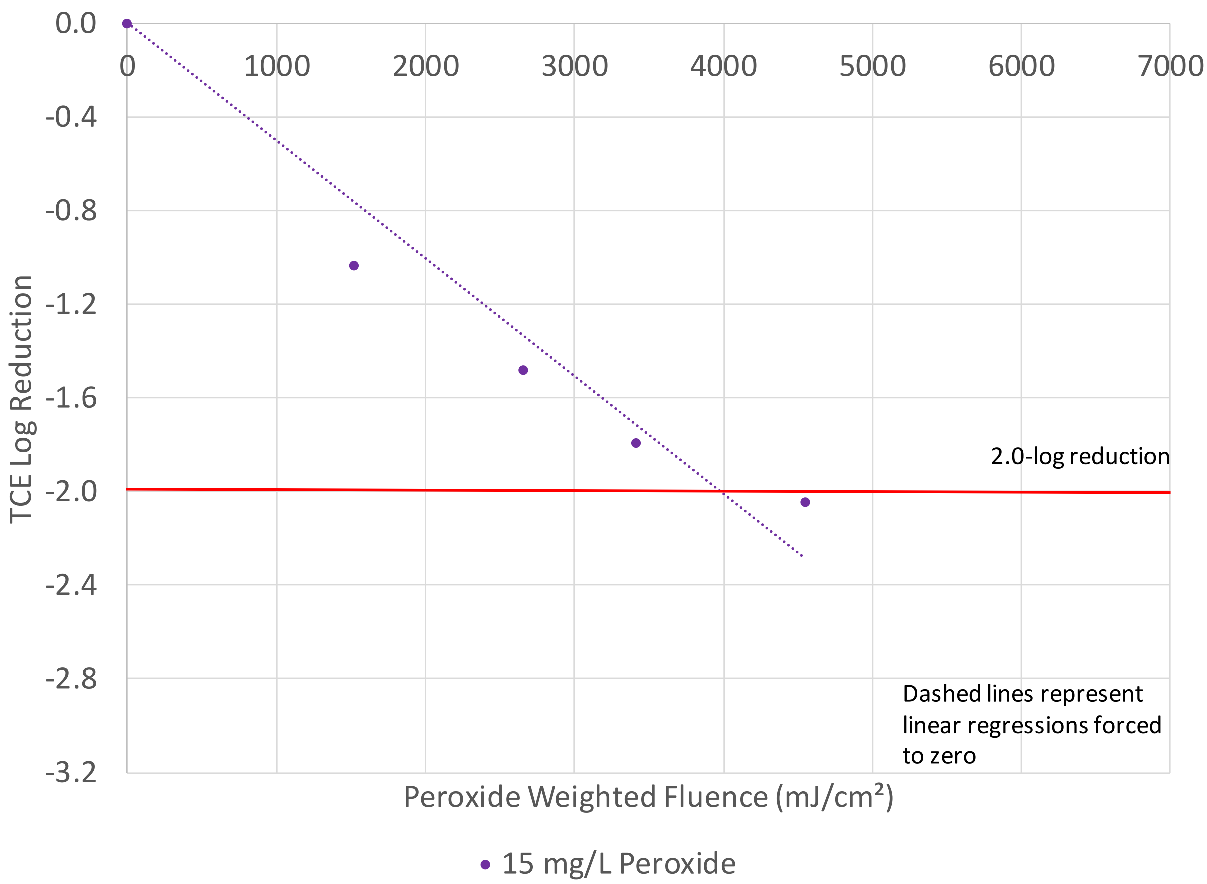

Figure 3-9. 2017 TCE Reduction by MP UV/Peroxide Treatment

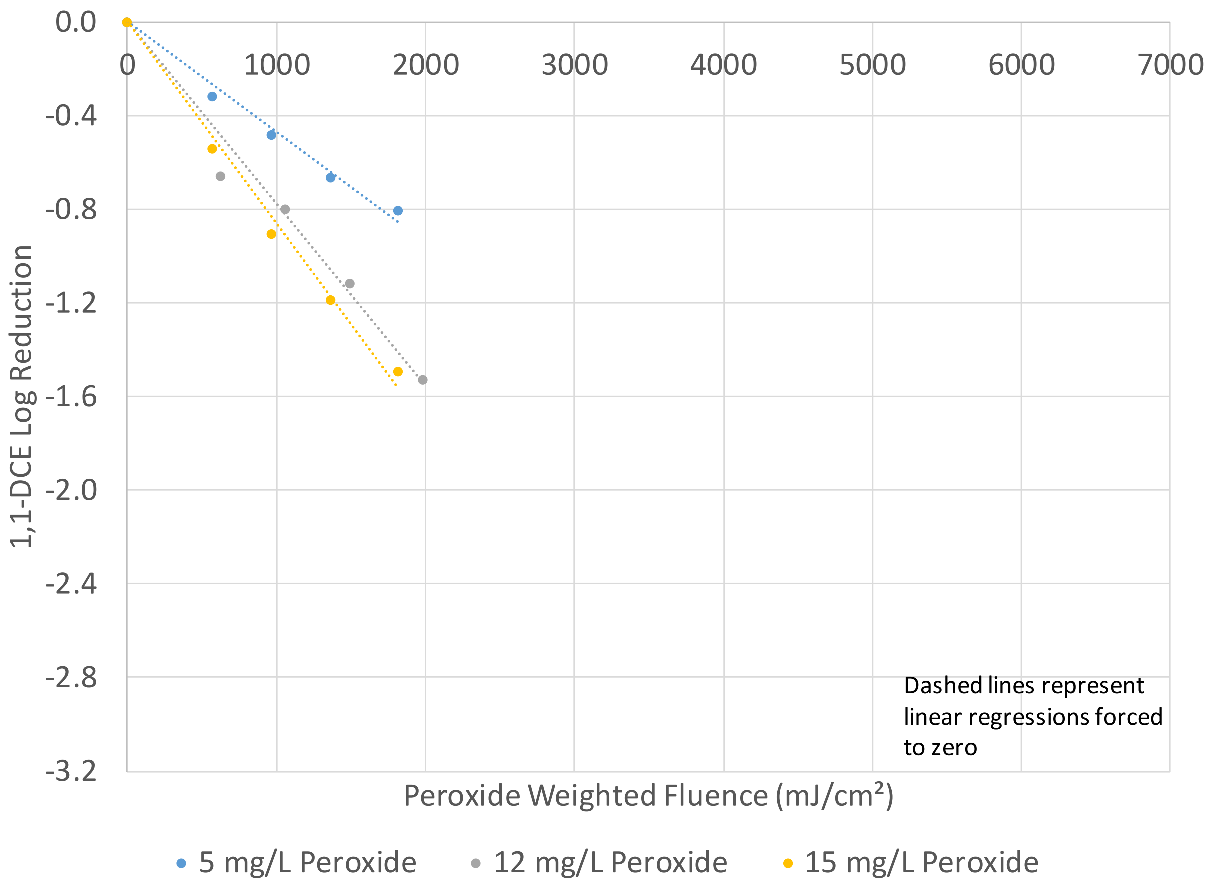

Figure 3-10. 2016 1,1-DCE Log Removals by MP UV/Peroxide Treatment

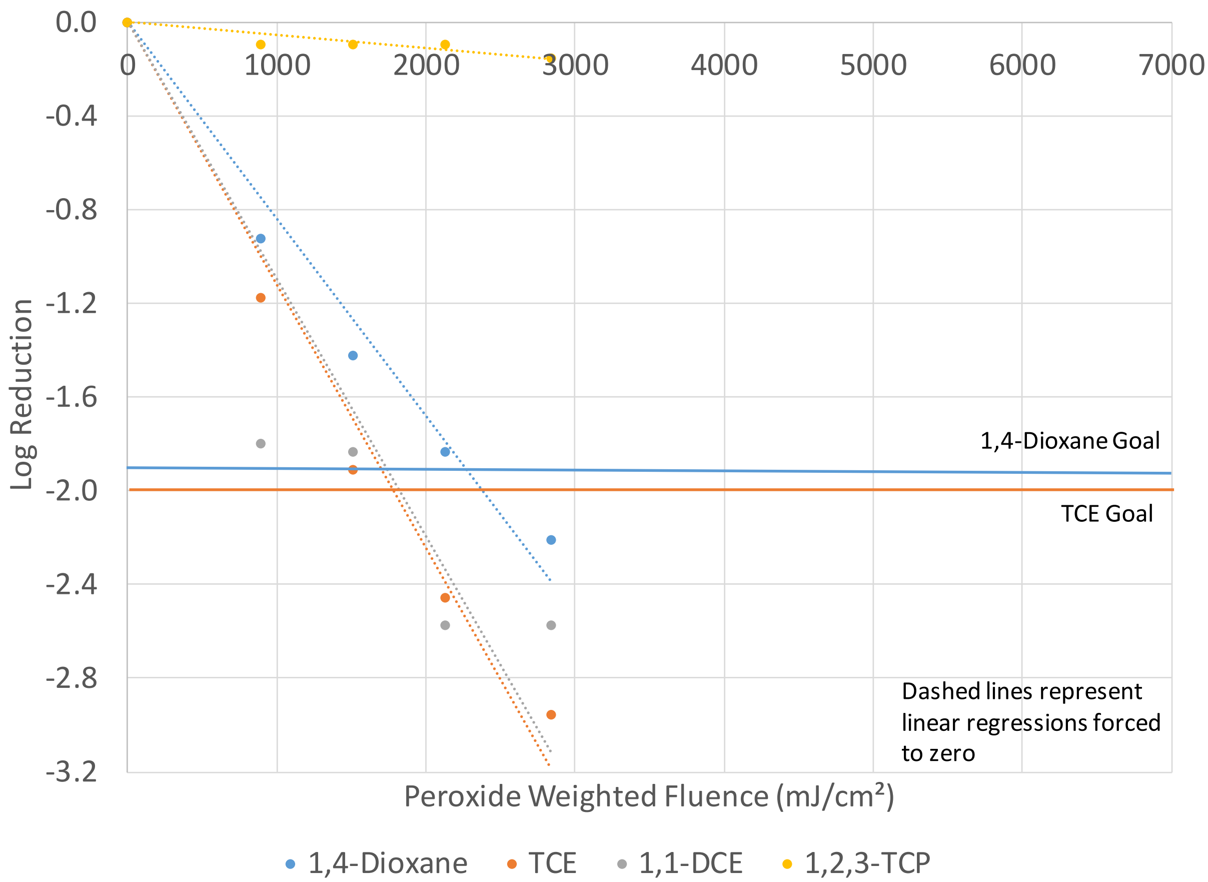

Figure 3-11. Comparison of Contaminant Removal by LPHO UV/Peroxide Treatment at 15 mg/L Hydrogen Peroxide (2016)

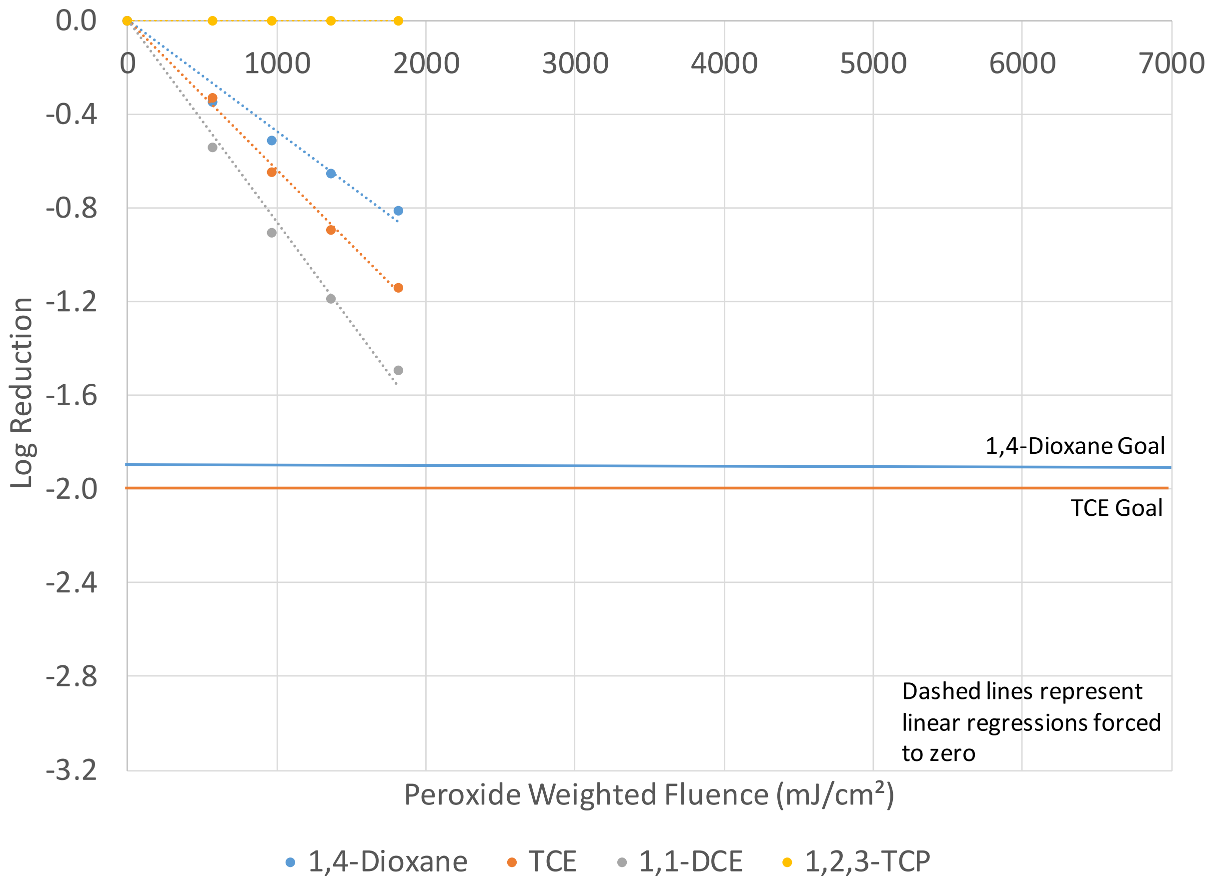

Figure 3-12. Comparison of Contaminant Removal by MP UV/Peroxide Treatment at 15 mg/L Hydrogen Peroxide (2016)

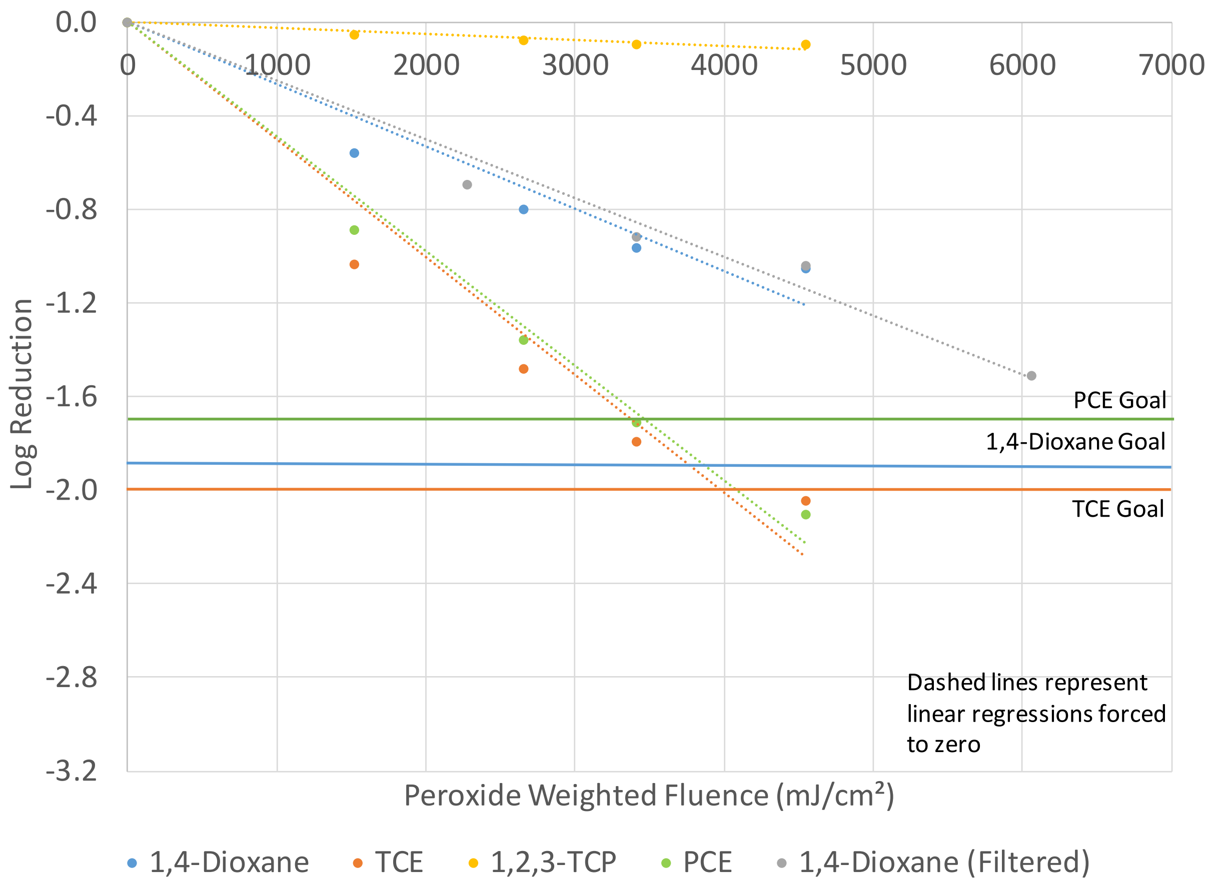

Figure 3-13. Comparison of Contaminant Removal by MP UV/Peroxide Treatment at 15 mg/L Hydrogen Peroxide (2017)

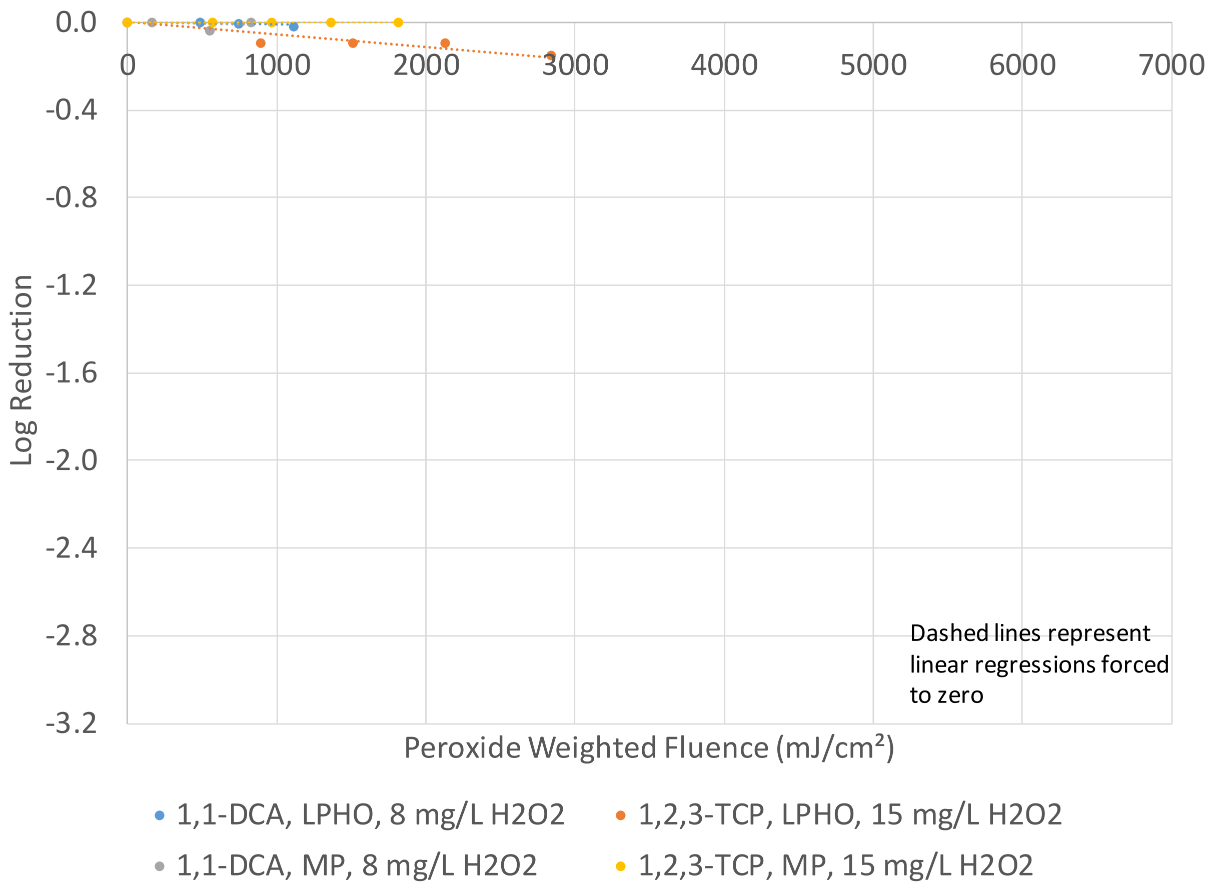

Figure 3-14. 1,1-DCA and 1,2,3-TCP Log Removals by LPHO and MP UV/Peroxide Treatment

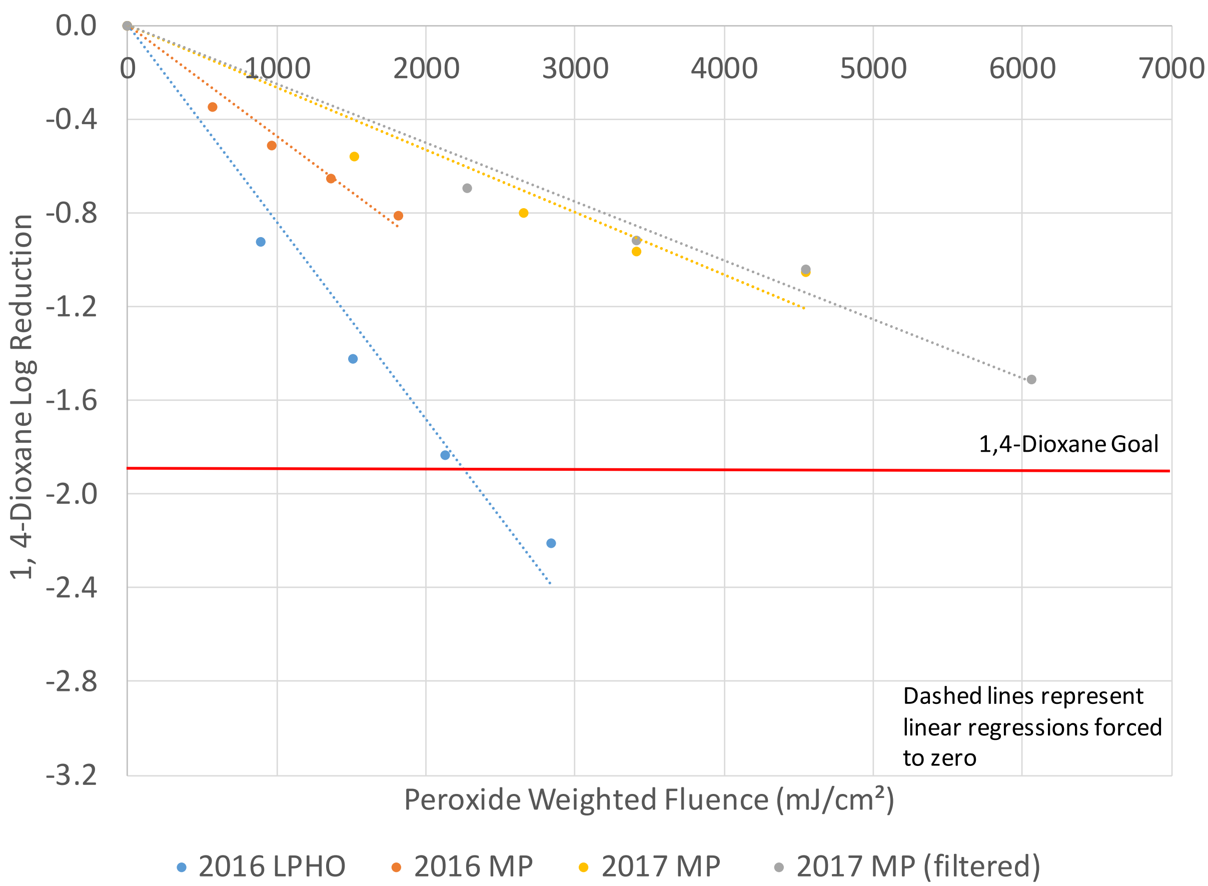

Figure 3-15. LPHO and MP UV/Peroxide 1,4-Dioxane Log Reduction at 15 mg/L Hydrogen Peroxide

Table 3-6. Hydroxyl Radical Rate Constants

Compound	Hydroxyl Radical Rate Constant ($L\ mol^{-1}\ s^{-1}$)
Hydrogen Peroxide	2.7×10^7
1,4-Dioxane	$2.3 - 3.1 \times 10^9$
TCE	$2.9 – 4.3 \times 10^9$
PCE	$2.0 – 2.8 \times 10^9$
1,1-DCE	6.8×10^9
Cis-1,2-DCE	3.8×10^9
1,1-DCA	1.3×10^8
Nitrite	1.1×10^{10}

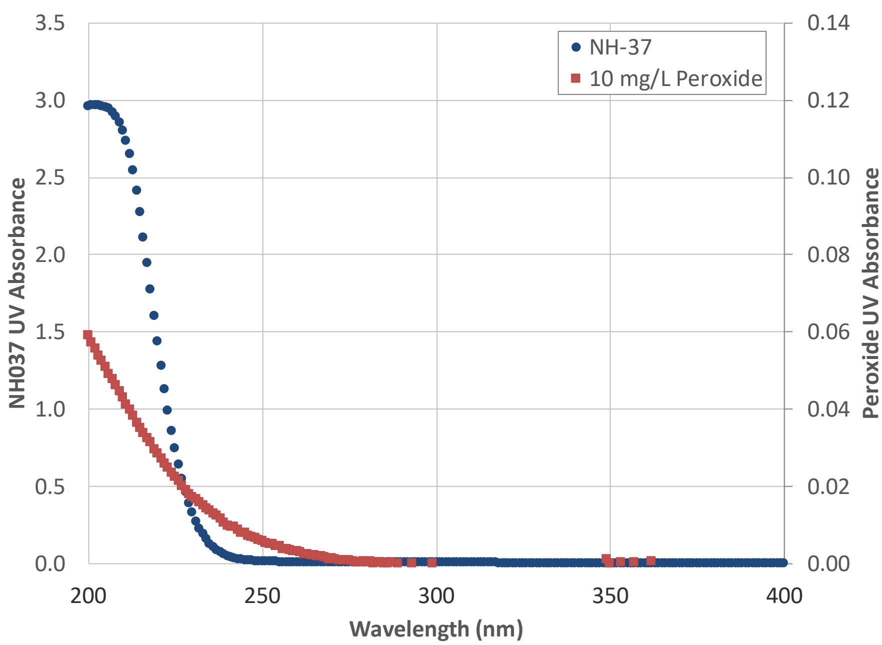

Figure 3-16. NH-37 and Hydrogen Peroxide UV Absorbance

3.3 Treatment Byproducts

The following sections summarize the AOP byproducts that were evaluated as part of the bench-scale testing.

3.3.1 Regulated DBPs

AOPs are known to increase the formation potential for regulated DBPs (i.e., TTHMs and HAA5) after the addition of chlorine. SDS testing was completed to evaluate changes in DBP formation potential after UV AOP treatment.

Figure 3-17 through Figure 3-22 show the results of the SDS testing for NH-37 1,4-dioxane and VOC spiked well water. The raw water was used as the control and the UV AOP treated water was tested with a variety of LPHO and MP dose and hydrogen peroxide doses. Figure 3-21 and Figure 3-22 show SDS results for NH-37 well water blended with NHPS surface water. The results show an increase in TTHM and HAA5 formation after UV AOP treatment for both the NH-37 well water and the blended water. However, TTHM and HAA5 formation was well below the regulatory limit for both waters. TTHM concentrations ranged from 17 to 26 μg/L for the AOP treated water compared to 6 to 8 μg/L for the raw water (Figure 3-17 and Figure 3-18). HAA5 increases were lower, with concentrations ranging from 4 to 19 μg/L for the AOP treated water compared to 3 to 4 μg/L for the raw water (Figure 3-19 and Figure 3-20). As expected, the blended raw water control had higher DBP concentrations than the raw well water. However, TTHMs were similar in the AOP treated well water and blended waters (Figure 3-21). HAA5 concentrations were slightly higher in the blended water but this is likely due to the DBP precursors in the raw water (Figure 3-22).

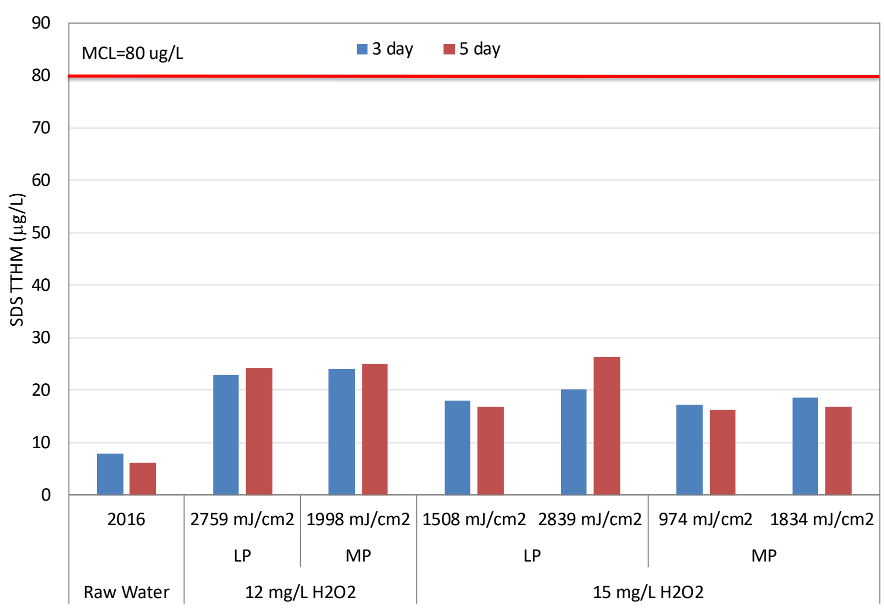

Figure 3-17. 2016 NH-37 TTHM SDS Results

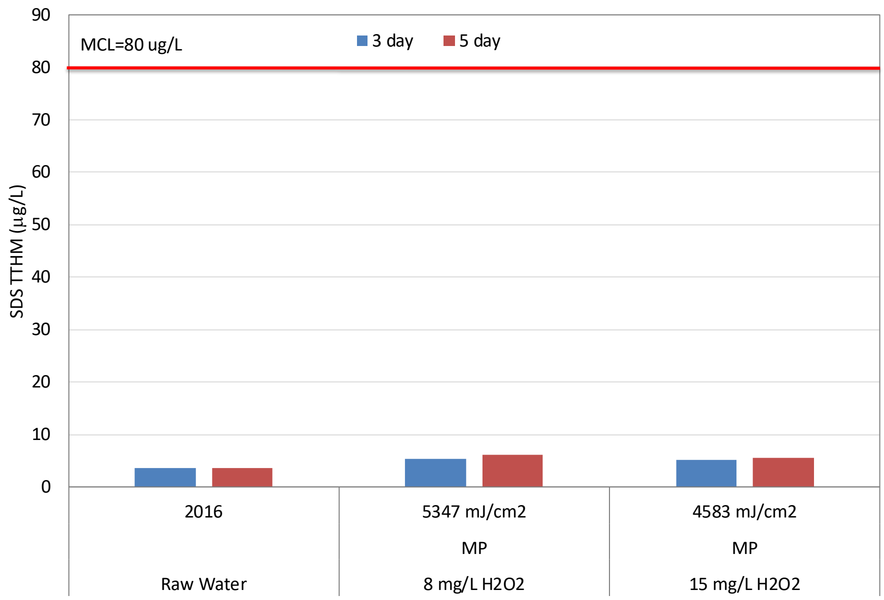

Figure 3-18. 2017 NH-37 TTHM SDS Results

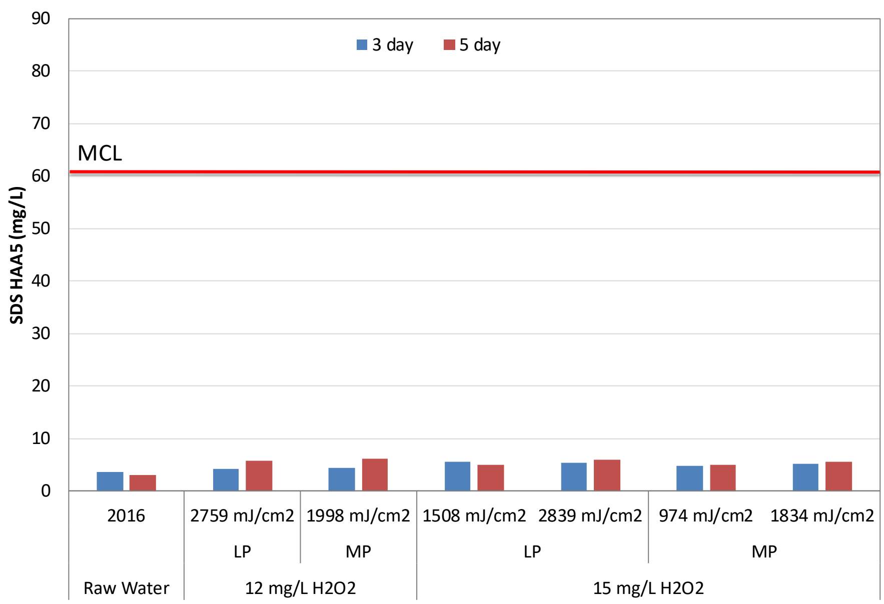

Figure 3-19. 2016 NH-37 HAA5 SDS Results

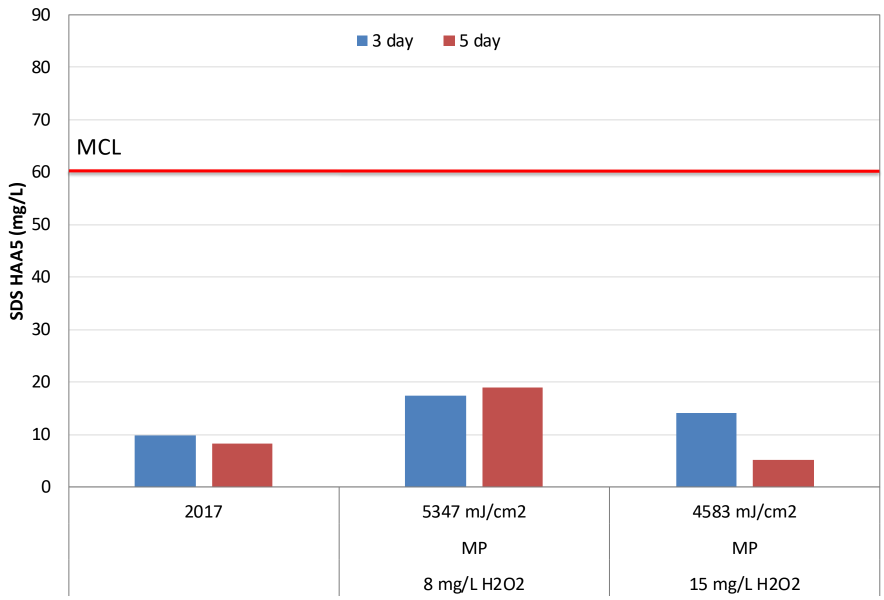

Figure 3-20. 2017 NH-37 HAA5 SDS Results

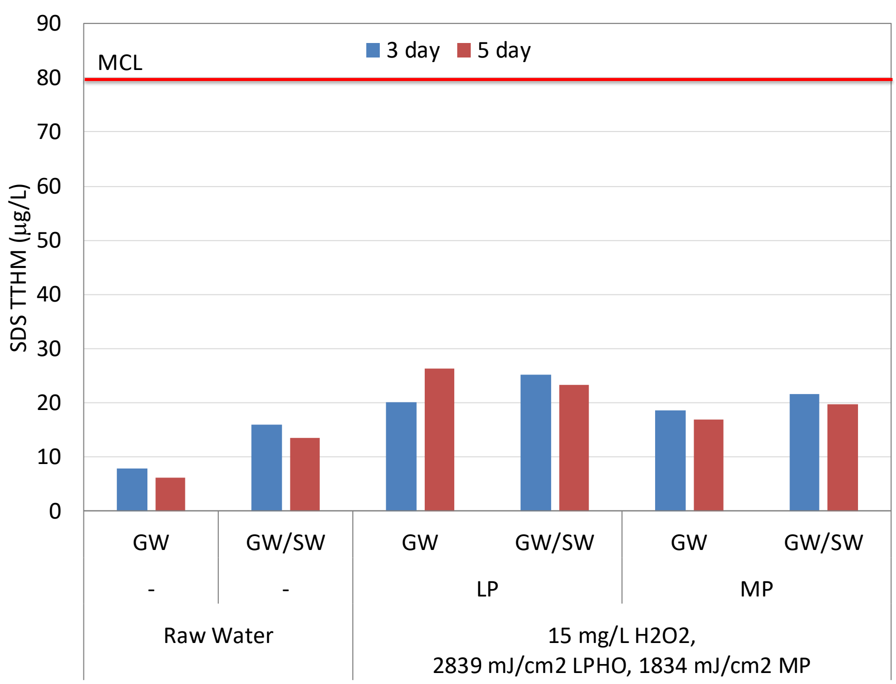

Figure 3-21. 2016 NH-37 (GW) and NHPS Surface Water (SW) Blended TTHM SDS Results

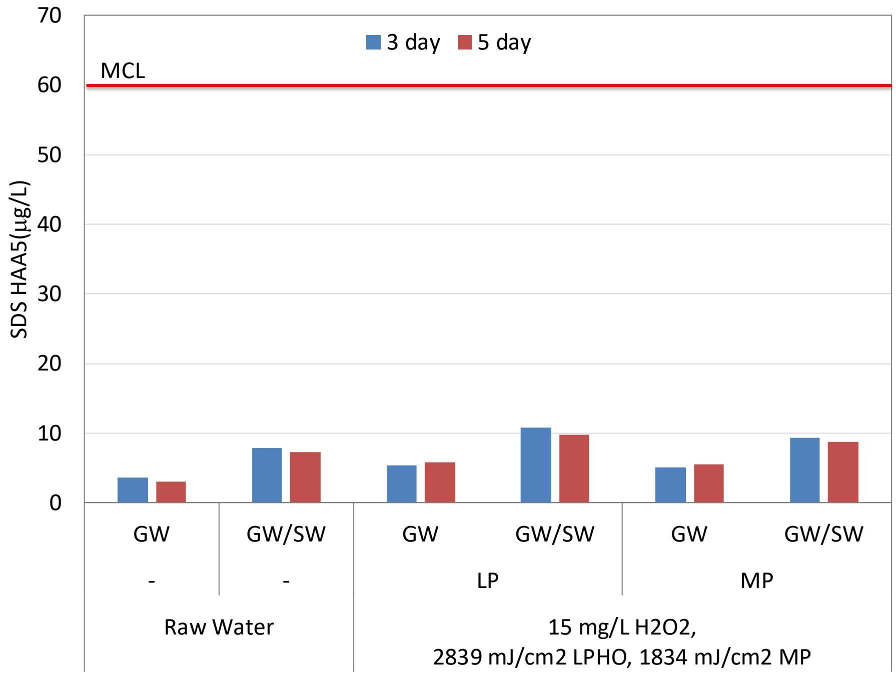

Figure 3-22. 2016 NH-37 (GW) and NHPS Surface Water (SW) Blended HAA5 SDS Results

The LPHO and MP samples were both exposed to the same unweighted UV dose (i.e., 1,700 or 3,200 mJ/cm^2). When the unweighted MP UV dose was converted to a peroxide weighted dose, the resulting MP peroxide weighted dose was lower than for the LPHO UV dose (e.g., 2839 vs 1834 mJ/cm^2). In addition, due to MP being less effective than LPHO (Figure 3-3 to Figure 3-10), the treatment level and corresponding potential for transformation of background organics would have been lower for the MP tests, which limits the ability to directly compare the LPHO and MP DBP results. However, despite the measured increases in DBP concentrations, TTHM and HAA5 concentrations were well below the regulatory limits for both lamp technologies.

3.3.2 Nitrite

Nitrite is a known by-product of the photolysis of nitrate with MP UV lamps. Nitrite formation is a function of UV dose and was measured up to 0.5 mg/L as N in NH-37 well water after MP UV AOP treatment (Figure 3-23). The actual nitrite formation during full-scale operation may vary compared to the bench-scale evaluations. Nitrate photolysis is a function of the presence of UV wavelengths below 240 nm, which is a function of the low wavelength output of the UV lamps, applied UV dose, UV absorbance of the lamp sleeve and water, nitrate concentration, and lamp spacing.

Nitrite formation was measured in all LPHO tests. The LPHO tests had negligible formation with concentrations less than 0.04 mg/L as N.

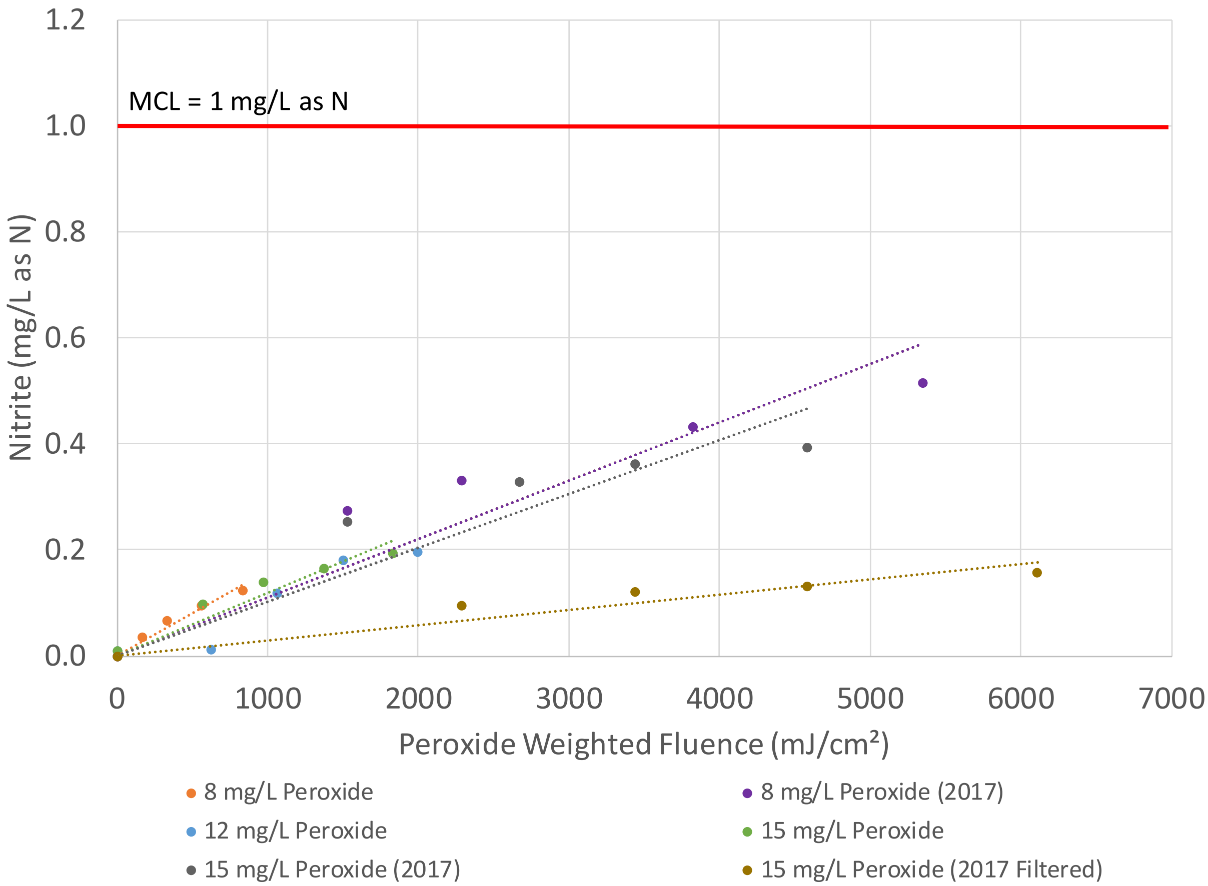

Figure 3-23. Nitrite Formation with MP UV/peroxide

3.3.3 AOC

No increases in AOC were measured after LPHO or MP UV AOP (Table 3-7). All AOC samples after treatment were below the method detection limit of 10 µg/L. UV AOP is not expected to reduce AOC. Linden et al (2015) showed no significant changes to AOC after LPHP UV AOP treatment and a slight increase with MP UV AOP. AOC formation is site-specific and depends on the organic material present. It is unknown why AOC was less than the detection limit after UV AOP treatment of the NH-037 water.

Table 3-7. AOC Formation

	Peroxide Dose	UV Dose[1]	AOC
Raw	0 mg/L	0 mJ/cm^2	73.5 µg/L
LPHO	12 mg/L	1700 mJ/cm^2	<10 µg/L
		3200 mJ/cm^2	<10 µg/L
	15 mg/L	1700 mJ/cm^2	<10 µg/L
		3200 mJ/cm^2	<10 µg/L
MP	12 mg/L	1200 mJ/cm^2	<10 µg/L
		2300 mJ/cm^2	<10 µg/L
	15 mg/L	1200 mJ/cm^2	<10 µg/L
		2300 mJ/cm^2	<10 µg/L

[1] MP UV doses are weighted to hydrogen peroxide

3.3.4 Toxicity

Three bioassays were utilized to evaluate any potential changes in toxicity after AOP treatment. Testing was completed on a range of UV doses and hydrogen peroxide concentrations for both LPHO and MP UV AOP (Table 3-8 and

Table 3-9). These tests measured acute cellular toxicity, estrogenic activity, and mutagenic activity of samples via the bioluminescence inhibition assay (BLIA), yeast estrogen screen (YES), and Ames II mutagenicity assay (AMES), respectively. For AMES testing, samples were assayed after concentration by solid phase extraction (SPE).

Table 3-8. 2016 NH37 Toxicity Sample Description

Test Number	Description/ UV Lamp	1,4-dioxane and VOCs[2]	Peroxide (mg/L)	UV Dose[1] (mJ/cm^2)
NC	Negative Control (DI water)	-	0	0
1	Raw NH-037 Groundwater	-	0	0
2	Spiked NH-037 Groundwater	+	0	0
3	Spiked NH-037 Groundwater	+	15	0
4	LPHO UV	+	5	2843
5	LPHO UV	+	8	486
6	LPHO UV	+	8	1111
7	LPHO UV	+	12	1468
8	LPHO UV	+	12	2759
9	LPHO UV	+	15	2839
10	MP UV	+	5	1833
11	MP UV	+	8	335
12	MP UV	+	8	838
13	MP UV	+	12	1063
14	MP UV	+	12	1998
15	MP UV	+	15	1834
B	SPE Blank (50X SPE of DI Water)	-	0	0
PC	Positive Control (toxic)	-	0	0

[1] MP UV doses are weighted to hydrogen peroxide

[2] + indicates 1,4-dioxane and VOCs added/ - indicates no 1,4-dioxane and VOCs spiked

Table 3-9. 2017 Toxicity Sample Descriptions

Test Number	Description/ UV Lamp	VOCs	H_2O_2 (mg/L)	UV (mJ/cm^2)[1]
NC	Negative Control (DI water)	-	0	0
1	Raw Groundwater	-	0	0
2	Spiked Groundwater	+	15	0
3	MP UV	+	15	2673
4	MP UV	+	15	4583
5	MP UV	+	8	2292
6	MP UV	+	8	5347

[1] MP UV doses are weighted to hydrogen peroxide

[2] + indicates VOCs added/ - indicates no VOCs present

3.3.4.1 Bioluminescence Inhibition Assay (BLIA)

Figure -3-24Figure -3-24 represents the data from the BLIA. All samples induced acute cytotoxicity by about 20%, but UV AOP treatment of the samples did not significantly impact this response. As shown in Figure -3-24, consolidated data from all samples indicated an initial induced luminescence that was greater than the negative control (NC), but luminescence for samples decreased more rapidly than for the NC. This greater initial luminescence of samples indicates that sample constituents increased respiration and luminescence greater than the NC (Figure 3-25). The assay compares the initial luminescence to luminescence at 15 and 30 min, so this steep decrease in luminescence resulted in the ~20% cytotoxic response that is observed. The waters likely contained a constituent that caused the cells to initially produce more light, which would indicate a nutrient source in the native water. However, as this nutrient source was consumed, the kinetic response indicates the presence of something inhibitory of respiration (cytotoxic), which could be the result of the nutrient source being consumed rather than the presence of a toxic substance. Furthermore, none of the treatments induced or decreased the assays response, indicating that no new inhibitory compounds were formed by treatment.

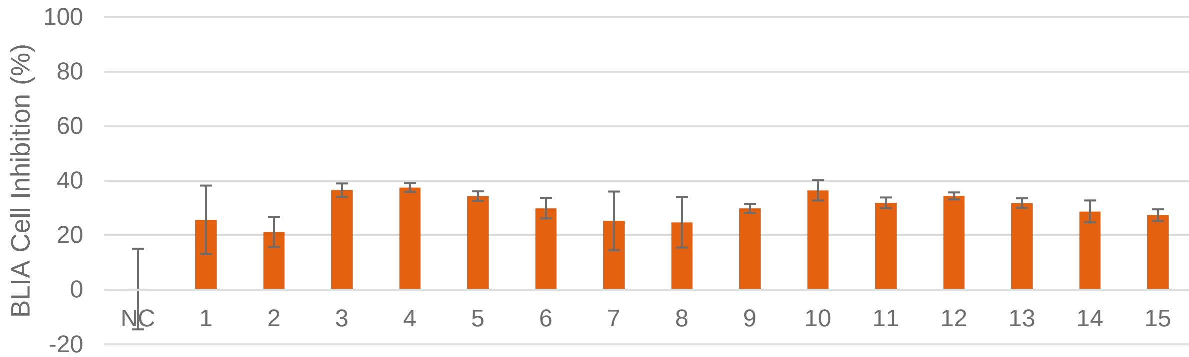

Figure -3-24. 2016 BLIA Percent Cell Inhibition

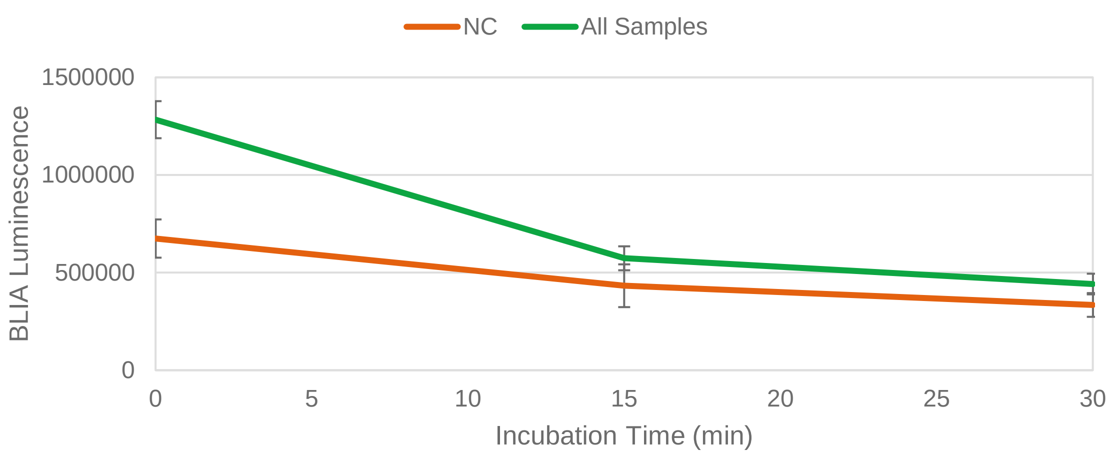

Figure 3-25. 2016 BLIA Raw Luminescence Measurement Averaged for all Negative Controls (NC) and Samples. Error Bars Represent Standard Deviation of 12 Replicates for NC and 3 Replicates of 15 Samples (45 Total) for All Samples

The results for the 2017 MP lamp data are shown on Figure 3-26. The control samples (raw water) induced a small acute cytotoxicity of around 10%, with the addition of H_2O_2 alone showing a slightly reduced level of about 5%. The samples treated with both peroxide and UV showed an insignificant assay response of less than 3%. For this assay, luminescence in sample wells was greater than that for NC, indicating presence of respiration-stimulating components in the sample. However, the luminescence in samples decreased more quickly for sample wells than for NC, indicating inhibitory components to have a greater effect than the stimulating components, resulting in consistent low-level inhibition. Overall, since treatment did not increase the inhibition, it appears that UV-AOP of these treated waters did not result in “new” inhibitory products for BLIA that formed during treatment.

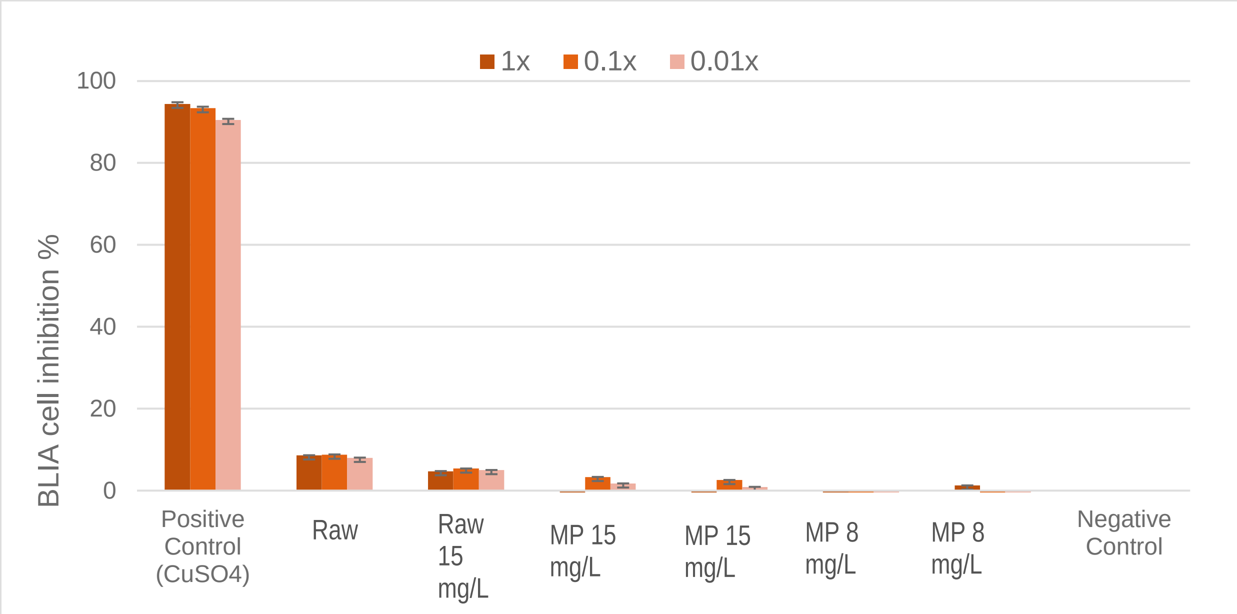

Figure 3-26. 2017 BLIA Percent Cell Inhibition

3.3.4.2 Yeast Estrogen Screen (YES)

Figure 3-27 shows the results of the YES. No samples induced significant estrogenicity. All samples induced similar cellular inhibition to that of BLIA, which resulted in low level cellular inhibition of about 20% ± 10%, but no treatment condition significantly impacted this response except for test 13, which lowered the cellular inhibition (lowest dose MP UV treatment with intermediate H_2O_2 concentration). Even though YES uses a eukaryotic microorganism and measures long term cell inhibition, and BLIA uses a bacterium to measure short term cell inhibition, the level of cell inhibition observed was similar for all samples in both YES and BLIA. Data for the 2017 tests performed on MP lamp are shown on Figure 3-28. The raw NH-37 water showed an estrogenicity of 15% while the treated samples showed an average estrogenicity of 20%, both of which do not fall into significant induction range. Most of the samples showed negative yeast inhibition (slight yeast growth) and no treatment condition significantly impacted this response.

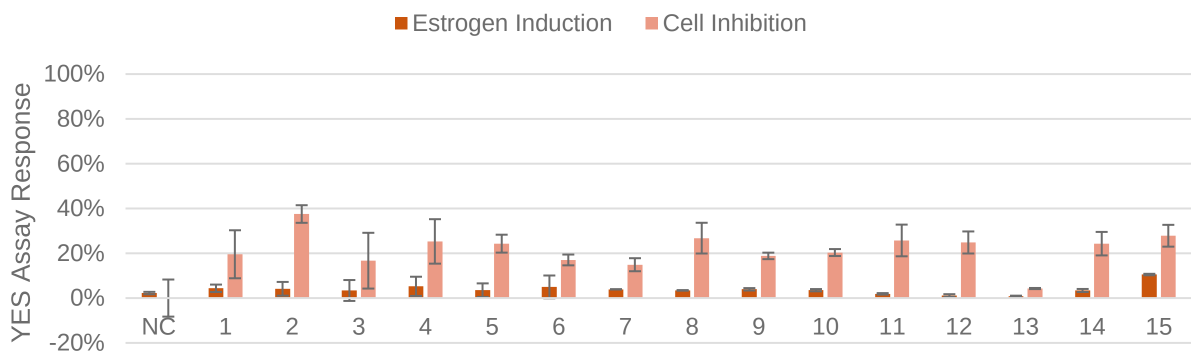

Figure 3-27. 2016 YES Percent Cell Inhibition and Percent Estrogen Induction

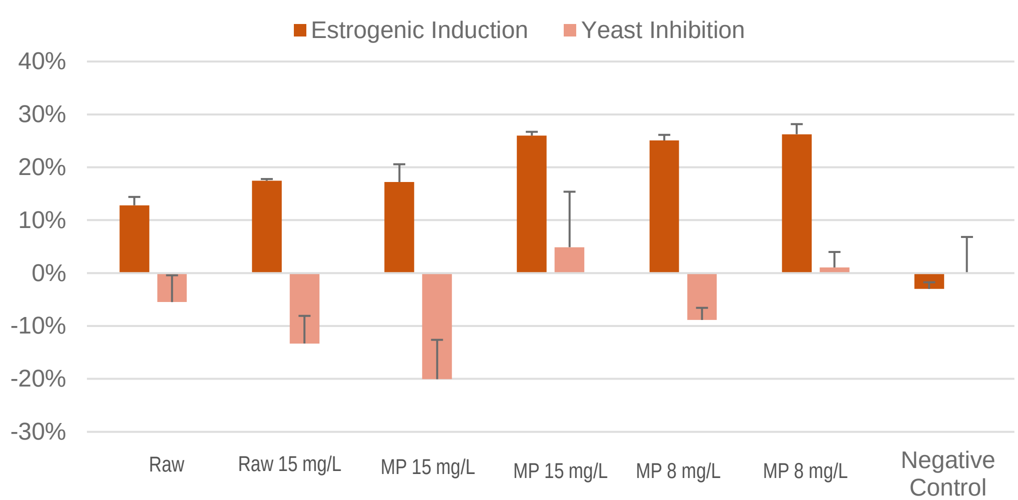

Figure 3-28. 2017 YES Percent Cell Inhibition and Percent Estrogen Induction

3.3.4.3 Ames II Mutagenicity Assay (AMES)

Figure 3-29 and Figure 3-30 presents the data from the AMES. Error bars for samples 14, 15, and B for the TA MIX-S9 are not included due to contamination of the replicate plate. No samples induced mutagenicity, even after the 25X or 50X concentration through SPE. AMES testing on select samples (not shown) indicated that non-SPE concentrated samples also did not induce mutagenicity.

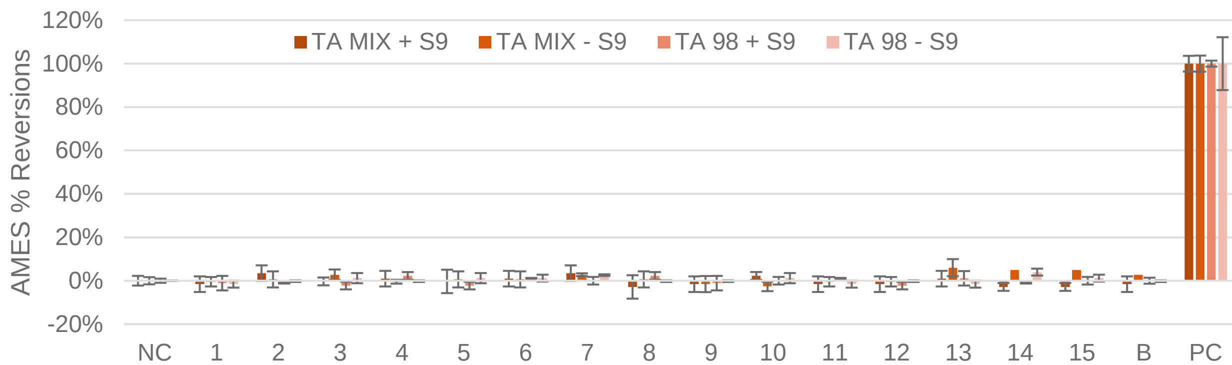

Figure 3-29. 2016 AMES Percent Reversions (50x Concentration)

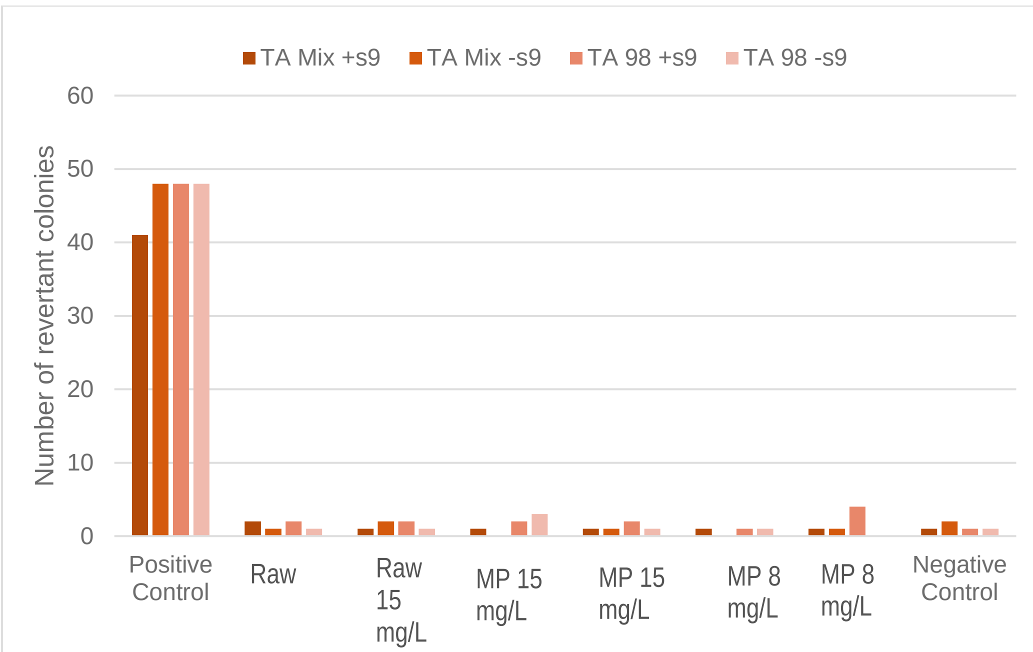

Figure 3-30. 2017 AMES Percent Reversions (25x Concentration)

3.3.5 Chloropicrin

Chloropicrin is a known byproduct with MP UV when nitrate is present, as is the case with NHW. Chloropicrin is not a regulated contaminant, but California has an archived advisory level of 50 µg/L for chloropicrin that was established in 1986. Due to a laboratory error, chloropicrin results were limited to the SDS results. In addition to UV light, chloropicrin can also be formed as a byproduct of chlorination (Merlet, Thibaud and Dore 1985), which may have impacted the results. Chloropicrin in the NH-37 raw water control was approximately 1 µg/L. After LPHO and MP UV/peroxide treatment, the chloropicrin concentrations ranged from 0.6 and 2.1 µg/L (Figure 3-31). The blend of surface water and groundwater showed higher chloropicrin results with concentrations ranging from 6 to 11 µg/L.

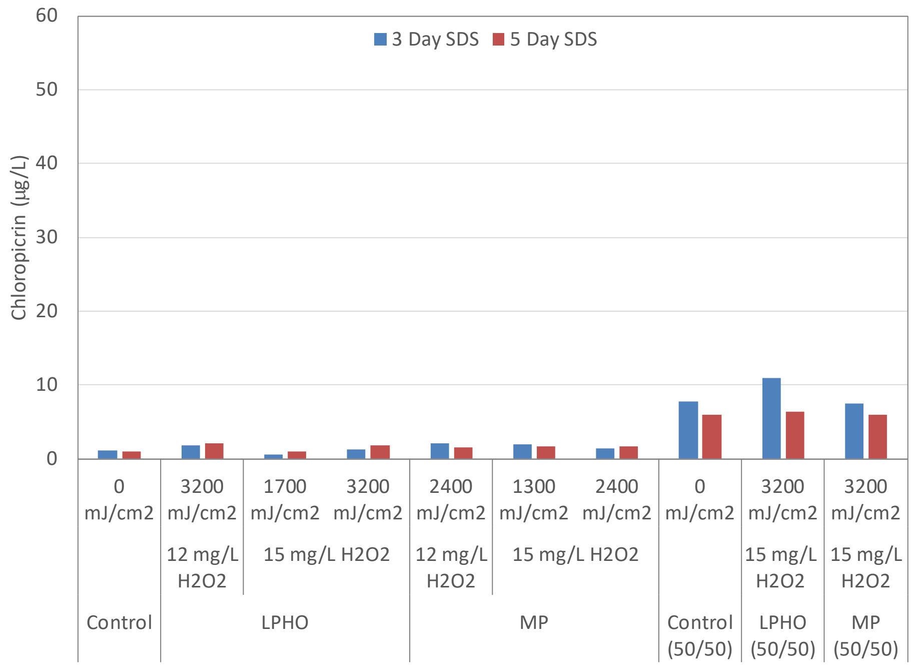

Figure 3-31. Chloropicrin Results from SDS Tests

4 CONCLUSIONS

Bench-scale testing was completed to assist with evaluating UV advanced oxidation for 1,4-dioxane treatment of North Hollywood West groundwater. The testing evaluated the relative efficiency of LPHO and MP UV/peroxide based on the site-specific water quality and the potential for oxidation byproducts.

LPHO UV/peroxide was able to achieve the target 1.9-log reduction of 1,4-dioxane while simultaneously reducing TCE and 1,1-DCE concentrations. As seen on Figure 3-15, MP UV/peroxide was not able to achieve the target log reduction at the evaluated UV doses compared to the LPHO lamps. Due to time limitations, higher doses were not able to be evaluated under the first phase of testing.

The MP UV/peroxide was shown to be less efficient than LPHO UV/peroxide after the MP UV doses were converted to peroxide weighted UV doses, which would account for the additional absorbance of hydrogen peroxide at the lower wavelengths and the site-specific water UV absorbance. The efficiency of the MP UV/peroxide appears to be limited due to the nitrate concentrations present in the NHW groundwater. Nitrate is photolyzed by MP UV to nitrite, which is a hydroxyl radical scavenger. Nitrate specific testing showed that the added hydroxyl radical scavenging demand from nitrate photolysis negatively impacts MP UV AOP efficiency. Table 4-1 presents the relative differences between the doses required for MP and LPHO UV/peroxide for 1,4-dioxane and VOC removal. UV doses were extrapolated when targets were not achieved.

Table 4-1. Comparison on LPHO and MP UV/Peroxide Efficiency for 1,4-Dioxane, TCE, and 1,1-DCE Reduction

Lamp Technology	Log Reduction	Required UV Dose (mJ/cm^2) at 15 mg/L Hydrogen Peroxide		
		1,4- Dioxane	TCE	1,1-DCE
LPHO	0.5-log	594	456	445
	1-log	1188	912	891
	2-log	2377	1823	1782
2016 MP[1]	0.5-log	1051	781	581
	1-log	2102	1562	1162
	2-log	4204	3123	2324
2017 MP[1]	0.5-log	1882	994	-
	1-log	3765	1988	-
	2-log	7530	3977	-

[1] MP UV doses are weighted to hydrogen peroxide

Testing evaluated the potential formation of a range of oxidation byproducts. A summary of findings from the byproduct evaluation is provided below:

- Nitrite was formed with MP UV/peroxide at concentration up to 0.5 mg/L as N. Nitrite is a regulated contaminant with a USEPA MCL of 1 mg/L as N. Nitrite formation is a function of the delivered UV dose. Actual nitrite formation may vary in the full-scale reactor depending on the UV dose and lamp spacing. Nitrite formation was negligible with LPHO UV/peroxide.

- Both LPHO and MP UV/peroxide resulted in increased formation potential for TTHMs and HAA5. However, TTHM and HAA5 concentrations were well below the regulatory limits.
- Blended surface and groundwater TTHM testing showed similar results compared to the 2016 TTHM levels. The HAA5 concentrations were slightly higher results than the 2016 groundwater HAA5 levels. The blended water was well below regulatory limits.
- No increases in AOC concentrations were measured after AOP treatment.
- The background matrix exhibited a slight cytotoxic response for the two assays that tested for cytotoxicity, but the response was low and could be the result of other factors.
- AOP treatment with both LPHO and MP UV did not result in a significant increase in toxicity based on the three tests completed.

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Appendix A Nitrate Report

Testing Report

UV Advanced Oxidation Collimated Beam Testing and Subsequent Modeling to Predict Impact of Nitrate on Hydroxyl Radical Generation Efficiency in Well Water from LADWP

By Sydney Ulliman, Charles Sharpless, PhD and Karl Linden, PhD.
August 31, 2017, Revised November 20, 2017 and May 30, 2018

University of Colorado Boulder

Introduction

UV advanced oxidation process (AOP) experiments were performed at the University of Colorado Boulder for the Los Angeles Department of Water and Power (LADWP). The goal of this study was to better understand the effect of nitrate on hydroxyl radical (•OH) scavenging in medium pressure UV/H_2O_2 (MPUV) and low-pressure UV/H_2O_2 (LPUV) systems. The evaluation examined the impact on •OH production by the following parameters:

- nitrate concentration
- water depth
- hydrogen peroxide (H_2O_2) concentration
- background water matrix

Nitrate was studied due to its role as both a promoter and scavenger of OH radicals, based on its UV absorbance of some wavelengths emitted by MPUV. Water depth was evaluated to compared shallow and longer pathlengths for UV light to travel and the impacts on the OH radical generation due to UV absorbance over different pathlengths. Hydrogen peroxide was examined at a level relevant to practice, to determine how the presence of H_2O_2 with nitrate affects the OH radical generation efficiency. The background water matrix was evaluated to determine the effect of scavenging from different water matrix constituents. Following the experimental work, the data were analyzed, and a model developed to evaluate various scenarios of UV fluence and nitrate concentration on the production of hydroxyl radical under MP UV irradiation.

Part 1: Bench Scale Testing - Experimental Results

I. Analytical Methods

Water quality

Lab-grade DI water (i.e. ultrapure water, resistance = 18 MΩ cm) and well water from the North Hollywood West wellfield (labeled as NH037 in Table 1), collected and shipped by LADWP to the University of Colorado, served as test water matrices for exposures. Pertinent water quality parameters were measured (Table 1) and compared to previously used well waters (TJ and NHC) using methods presented in Table 2. Water quality parameters were measured prior to and after UV exposure (1000 mJ/cm^2) for NH037. These values are presented in Tables A1-6 in Attachment A. The absorbance spectrum of the native well water is illustrated in Figure 1 (right).

Table 1. Water Quality for well waters.

Parameter	Units	NH037	TJ	NHC
Total organic carbon	ppm as C	0.42	0.75	0.31
Alkalinity	ppm as $CaCO_3$	209	152	155
Nitrate	ppm NO_3-N	1.24	7.07	2.33
Nitrite*	ppm NO_2-N	ND	ND	ND
UVA 254 nm (UVT)	m^{-1} (%)	6.70 (98.5%)	2.07 (95.3%)	0.010 (99.7%)
LPUV •OH scavenging rate	$\times 10^4$ s^{-1}	3.79	2.34	2.21
LPUV •OH steady-state concentration	$\times 10^{-13}$ M	2.20	3.71	3.95

*Method reporting limit of 0.10 ppm NO_2-N

Table 2. Analytical Methods.

Analysis	**Method**
Hydrogen peroxide	Triiodide colorimetric method (Klassen 1994)[1]
TOC	UV persulfate oxidation/conductivity method - Standard Methods 5310C and EPA 415.3 compliant
Alkalinity	Hach digital titrator method, in compliance with EPA method 310.2
pH	Orion Star A211 meter
UV_{254}	Cary Bio 100 spectrophotometer (Varian Inc., Palo Alto, TX)
Nitrate	Hach TNT 835 kit. Approved by the EPA. Reference Method: 40 CFR 141
Nitrite	Hach TNT 839 kit. Equivalent to EPA method. Reference Method EPA 353.2

Solutions were spiked with para-chlorobenzoic acid (pCBA), NO_3^-, and H_2O_2 to achieve concentrations of 1 ppm, 10 ppm NO_3-N and 10 ppm, respectively. Water depths of 3 and 9 cm were tested to assess the impact of pathlength but were not selected to represent the average pathlength in a specific UV reactor. All experiments were carried out in duplicate. pCBA was selected as a chemical probe to measure the steady state •OH production in the

UV/H_2O_2 system because it reacts with •OH at a rate that far exceeds its reaction rate with UV light. The absorption spectra of pCBA and NO_3^- can be viewed in Figure 1 (left) and H_2O_2 absorbance in Figure 2a.

Because pCBA was rapidly consumed by •OH, experiments to measure •OH were performed at UV doses up to 1000 mJ/cm^2, including 0, 250, 500, 750 and 1000 mJ/cm^2. All doses were calculated as peroxide weighted, relative to 254 nm. To determine the formation of nitrite (NO_2^-) and degradation of H_2O_2 in the MPUV system, separate experiments were performed at doses up to 4000 mJ/cm^2 and at a 9 cm sample depth. Previous bench scale testing indicated MPUV doses in excess of 5000 mJ/cm^2 would be required to achieve the full-scale treatment goals. Experimental results were also modeled (See Part II) to predict performance at high fluence levels and varying depths.

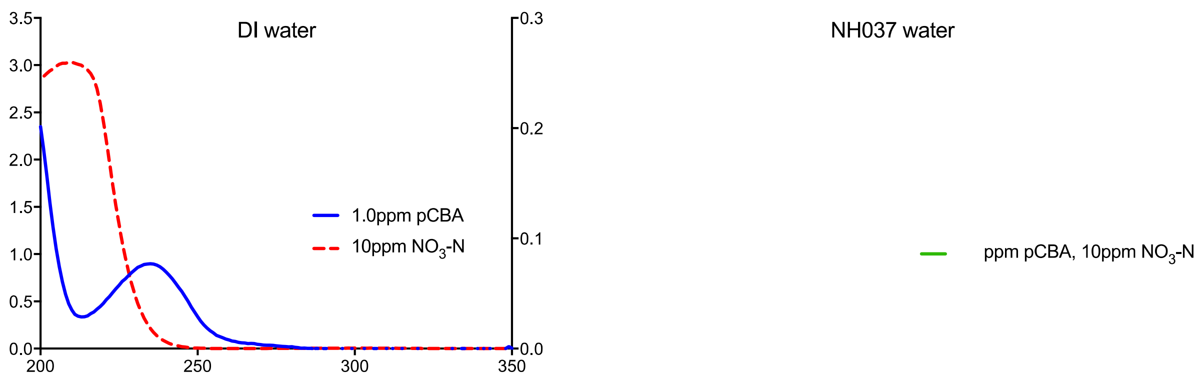

Figure 1. Absorbance spectra of NO_3-N (primary y-axis) and pCBA (secondary y-axis) in DI water (left graph) and well water with added pCBA and NO_3-N (right graph) and. Absorbance values reflect concentrations used for experimental testing.

Low pressure and medium pressure UV/H_2O_2 experiments were conducted in benchtop quasi-collimated system setups (Figure 2b) with the details of individual experiments presented in Tables A1-6 in Attachment A. For the LPUV system, four LPUV lamps (15 watt, #G15T8) were housed above two 4-inch apertures equipped with a manual shutter. For the MPUV system, a Calgon Carbon UV Technologies LLC (Pittsburg, PA) benchtop instrument was used in conjunction with a single 1 kW MP lamp (ozone-free, Calgon Carbon). The MP and LPUV lamp emission spectra are presented in Figure 2a.

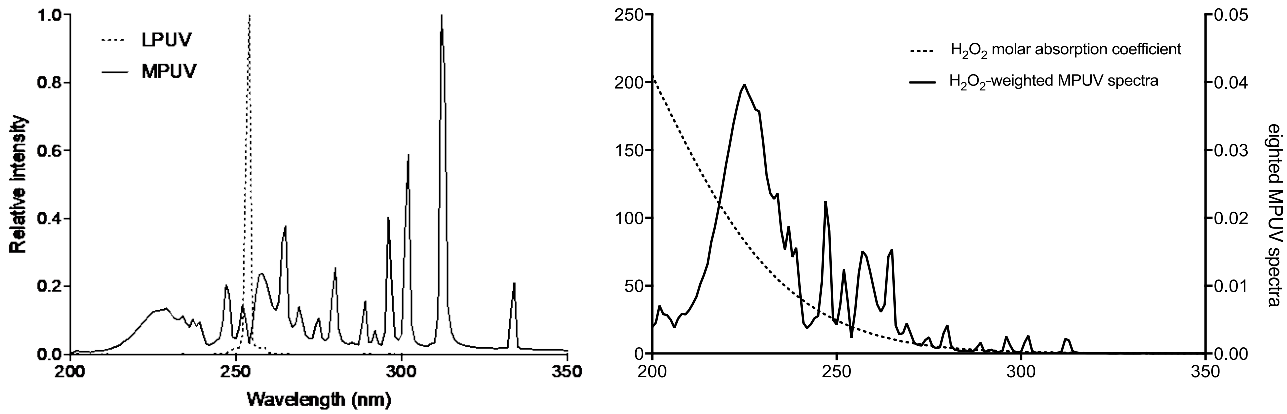

Figure 2a. Normalized MP and LPUV lamp emission spectrum (left graph) and H_2O_2 molar absorption coefficients (primary y-axis) and H_2O_2-weighted MPUV spectra (secondary axis) (right graph).

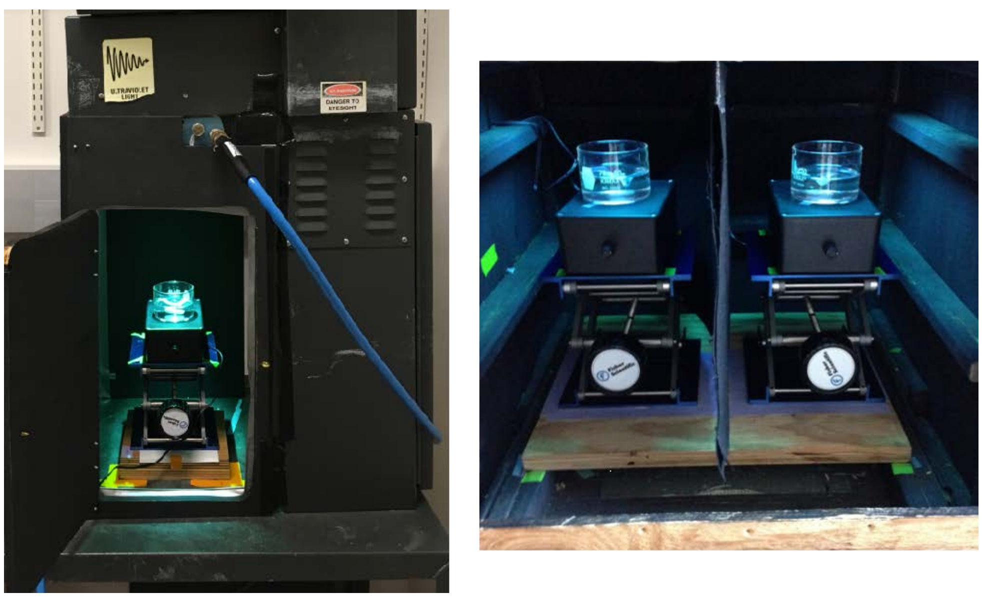

Figure 2b. MPUV (left) and LPUV (right) quasi-collimated bench-scale setups.

Incident UV irradiance was measured by a calibrated radiometer (International Light Inc., Model 1700/SED 240/W). UV dose was calculated by multiplying the average irradiance by the exposure time in seconds. The UV average irradiance was determined by correcting the incident irradiance (radiometer reading) for sample depth, absorbance, sample reflectance, and the petri factor according to Bolton and Linden, 2003.[2] Two additional corrections were required for the MPUV average irradiance calculation: sensor factor and a H_2O_2-weighting factor. The latter weights each wavelength by the H_2O_2 molar absorption coefficient relative to its value at 254 nm (H_2O_2 molar absorption shown in Figure 2a).

Hydroxyl radical determination

Samples were analyzed for the concentration of the radical probe, pCBA, using an Agilent 1100 series high performance liquid chromatograph (HPLC) and UV detector (at 235 nm for pCBA detection) equipped with a reverse phase C-18 column (HPLC method found in (Ulliman et al., 2017)).[3]

The concentration of •OH was then calculated using the following relationship:

$$\ln\frac{[pCBA]}{[pCBA]_o} = \frac{-k_{\cdot OH,pCBA}[\cdot OH]_{ss}}{E_o} \times F \qquad (1)$$

where E_0 is the average fluence rate (mW/cm^2), F is the fluence (0 to ~1000 mJ/cm^2) (i.e., UV dose) and $k_{\cdot OH,pCBA}$ is a time-based reaction rate constant between pCBA and hydroxyl radicals ($M^{-1}s^{-1}$).

In this equation, the quantity $\frac{-k_{\cdot OH,pCBA}[\cdot OH]_{ss}}{E_o}$ is the slope of the plot of ln([pCBA]/[pCBA]$_0$) *vs F*, and $[\cdot OH]_{ss}$ can be calculated as:

$$[\cdot OH]_{ss} = \frac{-slope \times E_o}{k_{\cdot OH,pCBA}} \qquad (2)$$

The value for $k_{\cdot OH,pCBA}$ has been reported as 5×10^9 $M^{-1}s^{-1}$ by Buxton *et al.*, 1988.[4]

II. Results and Discussion

The influence of NO_3^- concentration, H_2O_2 concentration, water depth, and water matrix on •OH steady state concentration was assessed using pCBA as a probe compound.

A comparison between MP and LPUV

Illustrated in Figure 3 is the measured steady-state •OH concentrations of samples with and without 10 ppm H_2O_2 and irradiated by MP and LPUV. Addition of nitrate was shown to produce radicals in the MPUV irradiated samples without H_2O_2 addition whereas negligible radical production was observed in nitrate-rich LPUV treated waters.

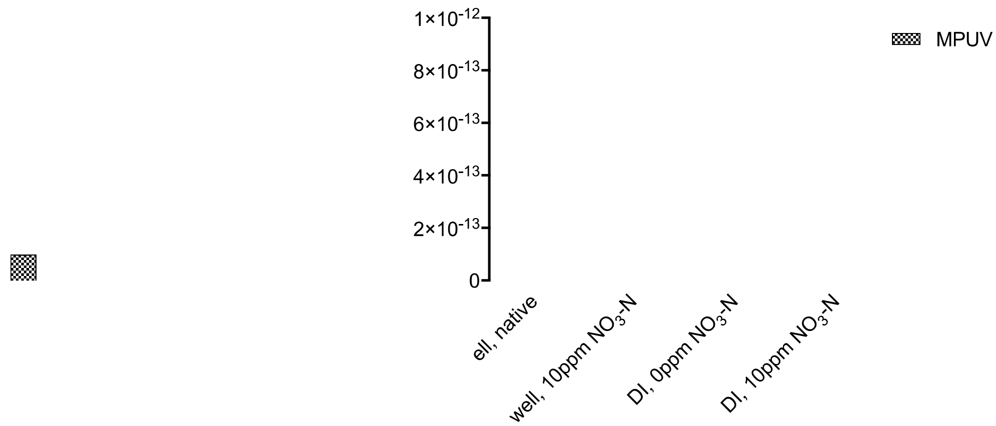

Figure 3. A comparison of MP and LPUV steady-state hydroxyl radical production determined in well and DI water at a 3 cm water depth with 0 ppm H_2O_2 (A) and 10 ppm H_2O_2 (B) with and without NO_3^- addition (displayed on x-axis). Error bars represent the standard deviations between duplicate experiments. Well water contained a native NO_3-N concentration of 1.24 ppm.

Nitrate strongly absorbs light emitted below 250 nm (Figure 1). During MPUV exposure, the resulting photochemical reactions include the reduction of nitrate to nitrite (NO_2^-) and production of •OH (Rxns 1 and 2). A more comprehensive list of major reactions involving nitrate can be viewed in Sharpless *et al.*, 2003.[5] As shown in Rxn 3, nitrite produced in Rxn 1 is also an •OH scavenger with a high second order reaction rate with •OH (k_{OH} = 10^{10} $M^{-1}s^{-1}$). These results are used in development of a model to predict the impact of nitrate on •OH radical production.

$$NO_3^- + h\nu \rightarrow NO_2^- + O \qquad \text{(R1)}$$

$$NO_3^- + h\nu + H^+ \rightarrow NO_2 + \bullet OH \qquad \text{(R2)}$$

$$NO_2^- + \bullet OH \rightarrow \bullet NO_2 + OH^- \qquad \text{(R3)}$$

With 10 ppm H_2O_2 addition (Figure 3 B), •OH radical production under MP and LPUV irradiation for scenarios with and without nitrate addition was comparable (2 to 15%, reported as the coefficient of variation). The experiential results agree with expected results. In comparing Figures 3 A and 3 B, the addition of H_2O_2 increased radical production by several orders of magnitude in LPUV/NO_3^- scenarios while a relatively minimal increase in radical production (97% well water and 70% DI water) was observed for MPUV/NO_3^- scenarios with NO_3^- addition. Keen *et al.*[6] found similarly that in the presence of nitrate, the addition of H_2O_2 (up to 10 ppm) had a positive but dampened effect on •OH radical production. A likely explanation is that the H_2O_2 added to MPUV/NO_3^- led to a higher •OH scavenging potential since H_2O_2 has been shown to accelerate the production of NO_2^-.[5] Increased NO_2-N concentration was observed in scenarios with added H_2O_2. For example, in well water scenarios with 10ppm NO_3-N addition and at a MPUV dose of ~800 mJ/cm^2, approximately 0.31 ppm of NO_2-N was formed with added H_2O_2 whereas 0.21 ppm NO_2-N was formed without added H_2O_2.

Water matrix and sample depth

Despite higher NO_2^- concentrations in scenarios with H_2O_2, added H_2O_2 increased radical production in all scenarios containing 10 ppm NO_3-N by 83% on average in 3 cm water depths and 177% in 9 cm water depths (Figure 4 A). Experiments performed in DI water, at both 3 cm and 9 cm water depths, were observed to have two to four times higher radical production when compared to experiments performed in well water. This may be because the well water contained higher concentrations of •OH scavengers, mainly carbonate species and dissolved organic matter (see Table 1) or be due to the production of nitrite as a scavenger, from the low levels of nitrate present.

When H_2O_2 concentration is held constant and NO_3^- is varied (Figure 4 B), added NO_3^- inhibited radical production by 30% in well water and 21 to 55% in DI water, respectively. A possible explanation is the scavenging of •OH by NO_2^- generated from NO_3^- photolysis.

Figure 4. Hydroxyl radical steady state concentration produced by MPUV exposure of well and DI water containing 10 ppm NO_3^- at varied water depths and H_2O_2 concentrations (A) and containing 10 ppm H_2O_2 at varied water depths and NO_3^- concentrations (B). Well water contained a native NO_3-N concentration of 1.24 ppm.

For scenarios with NO_3^- (added or native), NO_2^- is produced at a constant rate during MPUV exposure and accumulates in the system. As a result, NO_2^- scavenges •OH at an increasing rate (reaction 2) with increasing time or UV dose.[5] Nitrite production as a function of UV doses can be viewed in Figure 5. The linear increase of NO_2^- concentrations (Figure 5) suggests that radical scavenging may also increase with increased MPUV dose. This may result in decreased MPUV efficiency for higher UV doses applied in the presence of nitrate and H_2O_2. These points are further presented in Part II when the results are modeled.

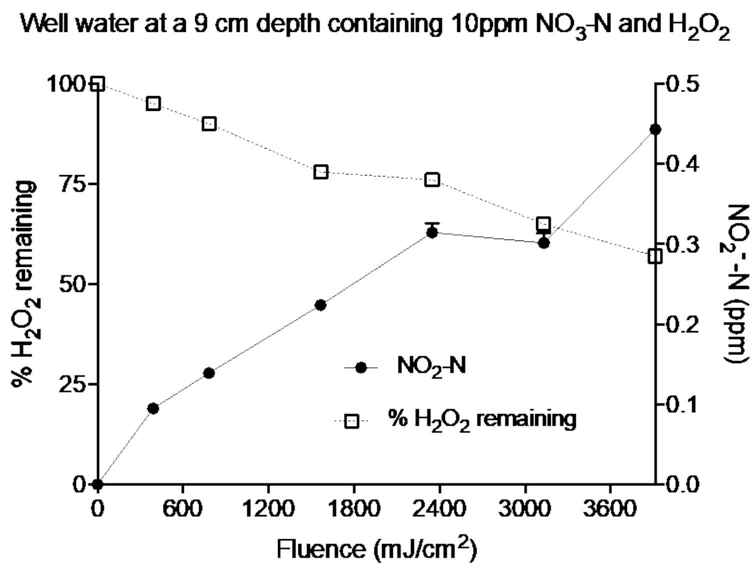

Figure 5. NO_2^- generation and H_2O_2 degradation as a function of MPUV dose. Experiments were performed in well water containing 10 ppm NO_3-N and H_2O_2 concentrations at a 9 cm depth.

Part II: Modelling Production of Hydroxyl Radical and Nitrite During Medium Pressure Irradiation of Solutions Containing Hydrogen Peroxide and Nitrate

Overview and Summary of Modeling

As noted in Part I, bench scale medium pressure (MP) UV/H_2O_2 experiments indicated that elevated nitrate (NO_3^-) could decrease •OH concentrations and that this effect was associated with the photochemical production of nitrite (NO_2^-) by NO_3^- photolysis, thus offsetting any potential gain in •OH from NO_3^- photolysis. At the highest

NO_2^- levels reached in experiments using 1000 mJ cm^{-2} fluence (H_2O_2 weighted), NO_2^- contributions to •OH scavenging are calculated to be approximately three-fold higher than the background rate in this water (details provided in Section II). To further explore the extent of this effect a kinetic model was developed to predict NO_2^- and •OH production rates and concentrations as a function of H_2O_2 and NO_3^- concentrations as well as water depth. Two key model variables, the background water •OH scavenging rate constant and an empirical efficiency of NO_2^- destruction by •OH, were parameterized by fitting NO_2^- and •OH kinetics from experimental scenario 16 in Part I. These parameters were then fixed for use in two different model applications described below. In one application, the effect of NO_3^-, H_2O_2, and water depth on NO_2^- and •OH levels was modelled for comparison to bench scale test results 9 through 16, which involved single point measurements at 1000 mJ cm^{-2} nominal H_2O_2-weighted fluence. Model results compare very favorably with experiments for •OH and generally NO_2^- as well, but a tendency was noted for the model to overpredict NO_2^- levels with added NO_3^- in the absence of H_2O_2 and to underpredict NO_2^- levels with added H_2O_2 in the absence of additional NO_3^- (see Table IV and Fig 9 in Section IV, Model Results). In the second model application, full NO_2^- and •OH kinetic profiles were modelled for varying levels of NO_3^- with fixed H_2O_2 concentration (10 mg/L) and water depth (9 cm). These results suggest that any level of NO_3^- will always detrimentally impact MPUV/H_2O_2 performance due to OH scavenging by photochemically produced NO_2^-.

I. Review of Bench Scale Testing Results

This work examined whether photochemical modeling could reproduce results from experimental scenarios 9 through 16 in the Part I Bench Scale Testing (See Tables A3 and A4 in Attachment A) and further explore the extent to which NO_2^- production interferes with MP-UV/H_2O_2 performance. Scenarios 9 to 16 tested LADWP well water, and the conditions and results are summarized in Table 3 and Figures 6 and 7. In the Table, F stands for fluence, which is H_2O_2-weighted throughout this report, with the weighting determined as per the dose calculation spreadsheets used in the bench scale tests.

Table 3. Experimental conditions and NO_2^- and •OH results for bench scale tests 9 through 16.

	Total&NO$_3$ *	Added&H$_2$O$_2$	Depth	H$_2$O$_2$ &weighted&F	NO$_2$ *&	[•OH]$_{ss}$
Exp.&ID	*mg-N/L*	*mg/L*	*cm*	*mJ cm^{-2}*	*(mg-N/L)*	*(M)*
9	1.24	0	3	1000	0.09	8.0E*14
10	11.24	0	3	1000	0.21	1.3E*13
11	1.24	10	3	1000	0.14	3.5E*13
12	11.24	10	3	1000	0.30	2.5E*13
13	1.24	0	9	1000	0.06	3.7E*14
14	11.24	0	9	720	0.09	5.8E*14
15	1.24	10	9	1000	0.10	2.3E*13
16	11.24	10	9	1000	0.19	1.6E*13

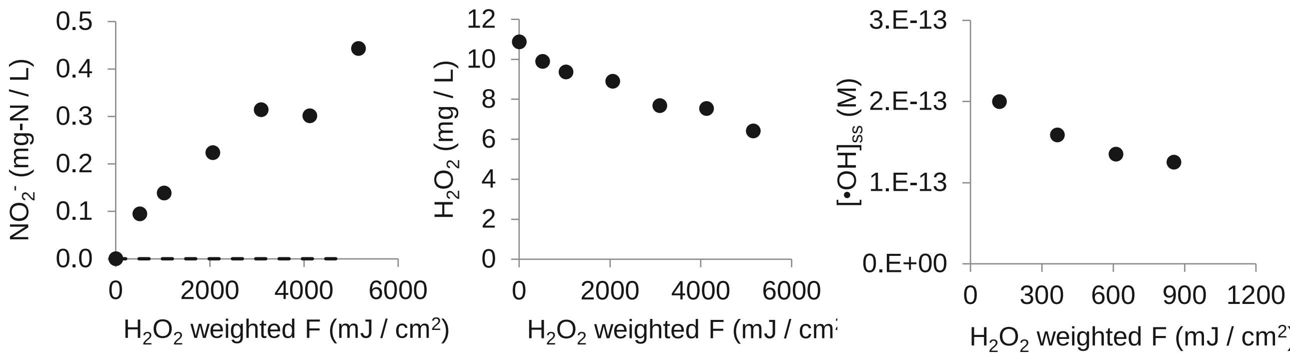

Figure 6. Experiment 16 results for NO_2^-, H_2O_2, and •OH. The fluence dependence of [•OH]$_{ss}$ was calculated from the results shown in Figure 6 as described in the text.

The second panel in Fig 6 displays the fluence dependence of steady state •OH concentrations, [•OH]$_{ss}$, which was not reported in Part I (Tables A1-A6), which instead gave average [•OH]$_{ss}$ values over the irradiation period (summarized in Table 3) determined from linear best-fits to 1st order plots of p-chlorobenzoic acid (pCBA) loss. However, when NO_3^- levels are high, the 1st order pCBA loss is not linear and slows with time as shown in Figure 7, which displays results for scenario 16. The curvature indicates a decrease in [•OH]$_{ss}$ with irradiation, which can be ascribed to scavenging by NO_2^-. To determine the fluence dependence of [•OH]$_{ss}$ shown in Fig 7, the slope between individual pairs of data in Fig 7 was used along with Eqns 1 and 2 in Part I. The fluence associated with each [•OH]$_{ss}$ value in the figure was taken as the average between the two points used in the calculation.

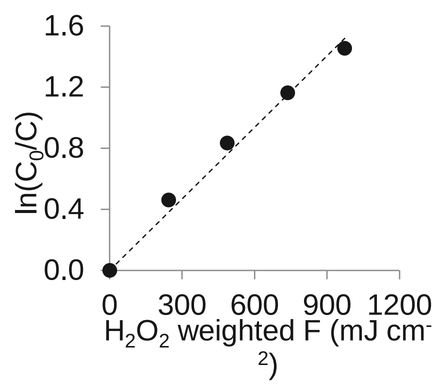

Figure 7. 1st order plot of pCBA loss during experiment 16 demonstrating non-linearity of results. Pairs of data points were used to determine the fluence dependence of [•OH]$_{ss}$ as described in the text.

II. Conclusions Concerning NO_2^- Impact From Bench Scale Results

The results in Table 3 can be used to show that NO_2^- levels reached at 1000 mJ cm^{-2} should negatively impact $[\bullet OH]_{ss}$. A key parameter controlling $[\bullet OH]_{ss}$ in any aquatic advanced oxidation process (AOP) is the rate of •OH scavenging by the water. Several water constituents can contribute to scavenging as shown in Rxns 4 to 8.

$$NOM + \bullet OH \rightarrow \text{products} \qquad k_{OH,OM} = 2.5\text{x}10^4 \text{ L mg-C}^{-1} \text{ s}^{-1} \text{ (ref 7)} \quad \text{(R4)}$$

$$HCO_3^- + \bullet OH \rightarrow \bullet CO_3^- + H_2O \qquad k_{OH,HCO3-} = 1\text{x}10^7 \text{ M}^{-1} \text{ s}^{-1} \text{ (ref 8)} \quad \text{(R5)}$$

$$CO_3^{2-} + \bullet OH \rightarrow \bullet CO_3^- + OH^- \qquad k_{OH,CO32-} = 4\text{x}10^8 \text{ M}^{-1} \text{ s}^{-1} \text{(ref 8)} \quad \text{(R6)}$$

$$H_2O_2 + \bullet OH \rightarrow HOO\bullet + H_2O \qquad k_{OH,H2O2} = 2.7\text{x}10^8 \text{ M}^{-1} \text{ s}^{-1} \text{ (ref 8)} \quad \text{(R7)}$$

$$NO_2^- + \bullet OH \rightarrow \bullet NO_2 + H_2O \qquad k_{OH,NO2-} = 1\text{x}10^{10} \text{ M}^{-1} \text{ s}^{-1} \text{(ref 8)} \quad \text{(R8)}$$

Additionally, pCBA, the •OH probe used in bench scale tests, scavenges •OH with $k_s = 5.0\text{x}10^9$ M^{-1} s^{-1}.[4] From these equations and the known water composition, total k_s values for the unirradiated and irradiated water can be calculated via Eqn 3.

$$k_{s,tot} = k_{OH,OM}C_{OM} + k_{OH,HCO3-}[HCO_3^-] + k_{OH,CO32-}[CO_3^{2-}] + k_{OH,H2O2}[H_2O_2] + k_{OH,NO2}[NO_2^-] \quad (3)$$

Here, HCO_3^- and CO_3^{2-} concentrations were determined from the known alkalinity and pH of the LADWP water, 168 ppm and 7.4, respectively. Predicted $k_{s,tot}$ values in the LADPW water before irradiation (no NO_2^-) are $7.8\text{x}10^4$ s^{-1} without H_2O_2 and $8.6\text{x}10^4$ s^{-1} with 10 mg/L H_2O_2. For comparison, the contribution to k_s from NO_2^- at the lowest and highest values reached with 1000 mJ cm^{-2} (Table 3), 0.1 and 0.3 mg-N/L, is $7.1\text{x}10^4$ s^{-1} and $2.1\text{x}10^5$ s^{-1}, respectively, the latter being almost 3-fold larger than the background scavenging. These results indicate that NO_2^- production negatively impacts $[\bullet OH]_{ss}$ and combined with experimental observations (Table 3) suggest that •OH scavenging by photochemically produced NO_2^- is substantial enough to more than cancel out any positive contribution to •OH made by NO_3^- photolysis with MP-UV under the water quality conditions of the LADWP test water.

III. Model Background

To further explore the potential interplay between NO_3^- production of •OH and NO_2^- and their effect on $[\bullet OH]_{ss}$, a photochemical kinetic model was developed as none currently exist. The calculations were carried out in Excel, and the mathematical equations involved are provided as an Attachment (B) to this document. The model involves three photochemical reactions (Rxns 9-11) and three thermal equations (reactions 12-14).

$$H_2O_2 + h\nu \rightarrow 2\bullet OH \qquad \Phi_{H2O2} = 1.11 \qquad \text{(R9)}$$

$$NO_3^- + h\nu + H_2O \rightarrow \bullet NO_2 + \bullet OH + OH^- \qquad \Phi^{N}_{OH,\lambda} \qquad (R10)$$

$$NO_3^- + h\nu \rightarrow NO_2^- + O \qquad \Phi_{NO2-,\lambda} \qquad (R11)$$

$$\bullet OH + H_2O_2 \rightarrow H_2O + H^+ + O_2^- \qquad k_{OH,H2O2} \qquad (R12)$$

$$\bullet OH + NO_2^- \rightarrow \bullet NO_2 + OH^- \qquad k_{OH,NO2-} \qquad (R13)$$

$$\bullet OH + \text{LA water} \rightarrow \text{products} \qquad k_{s,w} \qquad (R14)$$

The quantum yield, Φ_{H2O2}, represents the wavelength independent efficiency of H_2O_2 loss and •OH production, and the value is taken from Goldstein *et al.*, 2007.[9] The quantum yield, $\Phi^{N}_{OH,\lambda}$, represents the wavelength dependent efficiency of •OH production by NO_3^-. Values from 200 to 300 nm were reported by Goldstein and Rabani[10] at roughly 5 nm intervals, and to obtain 1 nm resolution for use in calculations their data were fit to an exponential decay (see model spreadsheet, “Inputs and results.xlsx” worksheet “nitrate QYs”). Similarly, the quantum yield, $\Phi_{NO2-,\lambda}$, represents the wavelength dependent efficiency of NO_2^- production by NO_3^-. Values from 200 to 300 nm were reported by Goldstein and Rabani[10] at roughly 5 nm intervals, and to obtain 1 nm resolution for use in calculations their data were fit to a Gaussian curve (see model spreadsheet, “Inputs and results.xlsx” worksheet “nitrate QYs”). Rate constants for Rxns 12 and 13 are given above (Rxns 7 and 8). For modelling, the value of $k_{s,w}$ (Rxn 14) was used as a fitting parameter to match $[\bullet OH]_{ss}$ concentrations from scenario 16 (Fig 6). The fitted $k_{s,w}$, 8.35×10^4 s^{-1}, agrees well with the value predicted from the water quality, 7.8×10^4 s^{-1} (see above).

The model only considers one loss pathway for NO_2^-, reaction with •OH (Rxn 13) . It ignores NO_2^- photolysis, and preliminary model runs show that the quantum yield for NO_2^- photolysis would need to be greater than 20% to have even a small influence on the NO_2^- kinetics (data not shown). In contrast, calculated rates of NO_2^- loss via Rxn 13 are too large to be compatible with production rates in bench scale testing. This is likely due to the fact that a sequence of reactions involving $\bullet NO_2$, •NO (from nitrite photolysis), and water regenerates NO_2^-, which decreases its apparent rate of loss.[9,10] Rather than trying to account for all of the radical intermediate chemistry, the model applies a correction factor (γ) to the efficiency of Rxn 13. The correction factor was used to fit the model to the NO_2^- results from bench scale scenario 16. The correction factor (γ) calculated to be 0.56. Preliminary sensitivity analysis indicates that the model is much more dependent on γ than on inclusion of NO_2^- photolysis. For this purpose, a less fine-grained model (lower time resolution) was run to simulate scenario 16 that included terms for the rate of light absorption by nitrite and a user-controlled photolysis quantum yield. The photolysis quantum yield and γ were varied to examine the effect of each on the model fit to the nitrite data, as indicated by the residual sum of squares. The photolysis of nitrite exclusively produces •OH, and literature reports indicate that the quantum yield for this process at circumneutral pH is somewhere in the range of 2 to 15%.[11] Fixing γ at 0.56 and increasing the photolysis quantum yield from 0 to 15% increased the sum of squares (decreased the goodness of fit) from 1.3×10^{-10} to 2.2×10^{-10}. In contrast, the same magnitude of impact on the fits could be obtained by fixing the photolysis quantum yield at 0% and changing γ from 0.56 to either 0.53 or 0.61 (only a small percent change in thermal NO_2^- loss). These results indicate that the primary mechanism for NO_2^- loss is reaction with •OH and that photolysis is essentially negligible in the experimental waters.

IV. Model Results

Figure 8 shows the model results for NO_2^-, •OH, and H_2O_2 in comparison to the experimental values from bench scale scenario 16. The first step was to fit the •OH concentration versus fluence (or time) using equations B10 to B12 in Attachment B along with experimental NO_2^- and H_2O_2 concentrations in order to find a value of $k_{s,w}$ that minimized the sum of squared residuals between the model and the experimental data. As noted above, the best fit was obtained with $k_{s,w} = 8.35 \times 10^4\ s^{-1}$, and this value was used in all subsequent modelling. Next, the full model was run (see Attachment B) to fit the NO_2^- data leaving γ as a fitting parameter; the best fit value of γ was 0.56 (i.e., thermal reactions of radical intermediates appear to regenerate 44% of NO_2^- destroyed by •OH). Note that both $k_{s,w}$ and γ will be water quality dependent. While the dependence for $k_{s,w}$ is well understood, that is not the case for γ, where unknown reactions of $•NO_2$ and •NO with DOC may be important.

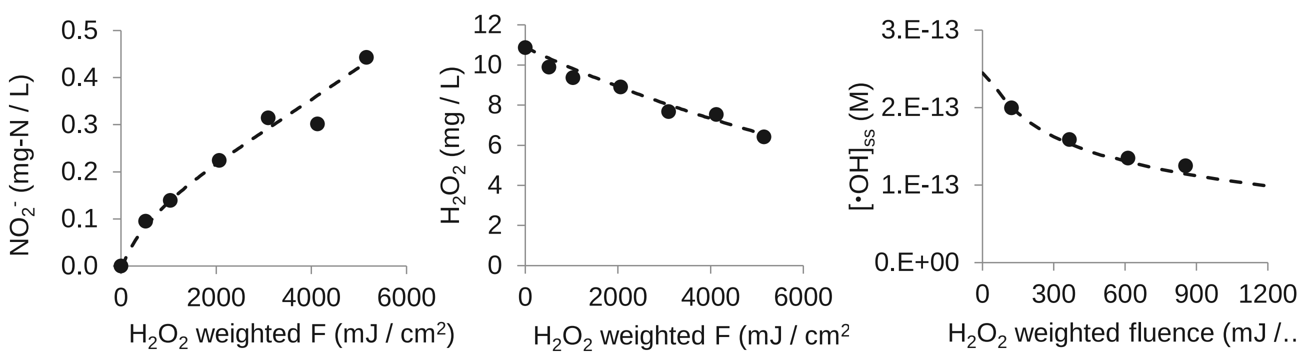

Figure 8. Experiment 16 and model results for NO_2^-, H_2O_2, and •OH. Experimental data are the symbols, model results are the dashed lines.

Using the values for $k_{s,w}$ and γ derived by fitting the data from scenario 16, the model was applied to simulate single point (1000 mJ cm^{-2}) results from bench scale experiments 9 to 16 (Table 3). In these calculations, approximately 20 time intervals were used in the model to achieve the final desired fluence, and model $[•OH]_{ss}$ values over this period were averaged for comparison to experimental values derived from the slope of 1st order pCBA loss over the same period. The model and experimental results are compared in Table 4 and Figure 9.

As noted in Section II, the levels of NO_2^- reached here account for between one half and three quarters of all the •OH scavenging in the solutions, indicating that NO_2^- could negatively impact UV/H_2O_2 AOP performance.

Table 4. Experimental and model NO_2^- and •OH results for bench scale tests 9 through 16.

	Total NO_3^-	Added H_2O_2	Depth	H_2O_2 weighted F	NO_2^- (mg-N/L)		[OH]$_{ss}$ (M)	
Exp. ID	*mg-N/L*	*mg/L*	*cm*	*mJ cm^{-2}*	*Exptl*	*Model*	*Exptl*	*Model*
9	1.24	0	3	1000	0.09	0.10	8.0E-14	4.7E-14
10	11.24	0	3	1000	0.21	0.38	1.3E-13	8.5E-14
11	1.24	10	3	1000	0.14	0.07	3.5E-13	3.1E-13
12	11.24	10	3	1000	0.30	0.29	2.5E-13	2.1E-13
13	1.24	0	9	1000	0.06	0.06	3.7E-14	1.9E-14
14	11.24	0	9	720	0.09	0.14	5.8E-14	5.7E-14
15	1.24	10	9	1000	0.10	0.04	2.3E-13	2.0E-13
16	11.24	10	9	1000	0.19	0.14	1.6E-13	1.5E-13

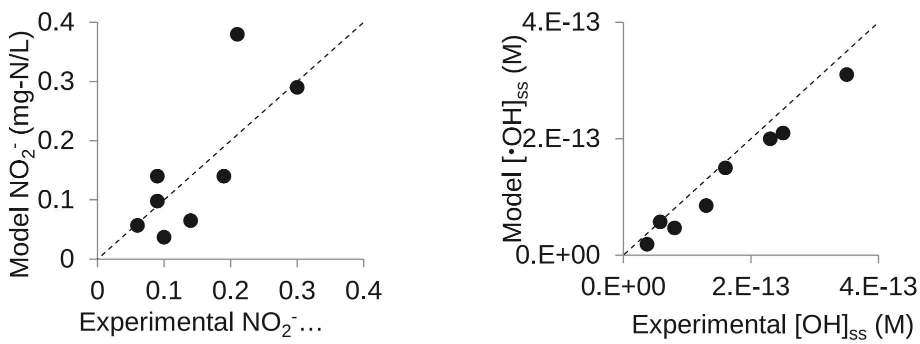

Figure 9. Model NO_2^- and •OH results plotted versus results for bench scale experiments 9 through 16 at the final fluence values indicated in Table 5. Dashes are the 1:1 lines.

On balance, the model matched the experiment quite well, particularly with regard to •OH. Consistent with the experimental results, the model predicts that in the absence of H_2O_2, elevated NO_3^- levels enhance •OH radical production, despite the scavenging effect from NO_2^-. In contrast, and also consistent with experiment, the model predicts that with 10 mg/L H_2O_2, NO_3^- at 10 mg-N/L should decrease [•OH]$_{ss}$ by roughly 30%. With regard to NO_2^-, a tendency was noted for the model to overpredict NO_2^- levels with added NO_3^- in the absence of H_2O_2 and to underpredict NO_2^- levels with added H_2O_2 in the absence of additional NO_3^-. While the cause of these discrepancies is unknown, larger than expected experimental production rates of NO_2^- in the presence of H_2O_2 was reported by Sharpless *et al.*, 2003,[5] who tentatively ascribed the phenomenon to a combination of reduced NO_2^- reaction with •OH due to •OH scavenging by H_2O_2 was present and reaction between O_2^- (from Rxn 12) and •NO_2 to regenerate NO_2^-. The model should be accounting for both of these things via a time dependent $k_{s,tot}$ (see Attachment B) and the use of the γ parameter, which ostensibly includes contributions from O_2^-. However, the discrepancies between model and experiment suggest that additional factors need to be considered for more accurate modeling of NO_2^-.

The model was also run to examine the effects of increasing NO_3^- with H_2O_2 fixed at 10 mg/L and a water depth of 9 cm. The results are shown in Figure 10. The model predicts that

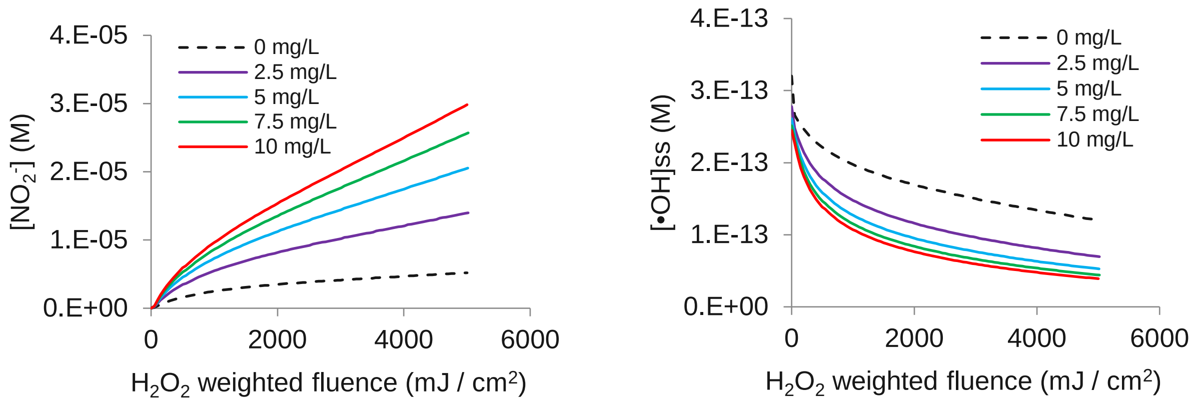

Figure 10. Model NO_2^- and •OH results for various levels of NO_3^- as indicated in the legends. H_2O_2 at 10 mg/L, water depth 9 cm.

with MP irradiation of the LA water, which has very low TOC (approx. 0.4 mg-C/L) and in which a major fraction of the light below 250 nm is absorbed by NO_3^- (10% at 250 nm and 89% at 220 nm in the raw water itself), NO_2^- quickly becomes a major •OH scavenger. This leads to continuously decreasing $[\bullet OH]_{ss}$ with increasing fluence and a negative effect of NO_3^- at all concentrations.

V. Conclusion

Experimental and model results indicate that NO_3^- detrimentally affects UV/H_2O_2 AOP performance in the LA test water when MP irradiation is used. This effect can be ascribed to the NO_2^- formed during NO_3^- photolysis, which is produced mainly at wavelengths below 250 nm, as shown in Figure 11 (right panel). This is due to the fact that both NO_3^- absorption and NO_2^- quantum yields are highest in this wavelength range (Fig 11, left panel). Elevated NO_3^- will likely be detrimental to MP-UV/H_2O_2 applications in any water, despite the additional OH that is produced, due to the production of NO_2^-. However, the data in Fig 11 indicate that LP-UV should not suffer this effect nearly as much. Indeed, the results from the bench scale experiments 23 and 24 showed a net neutral effect of NO_3^- addition with LP-UV.[1]

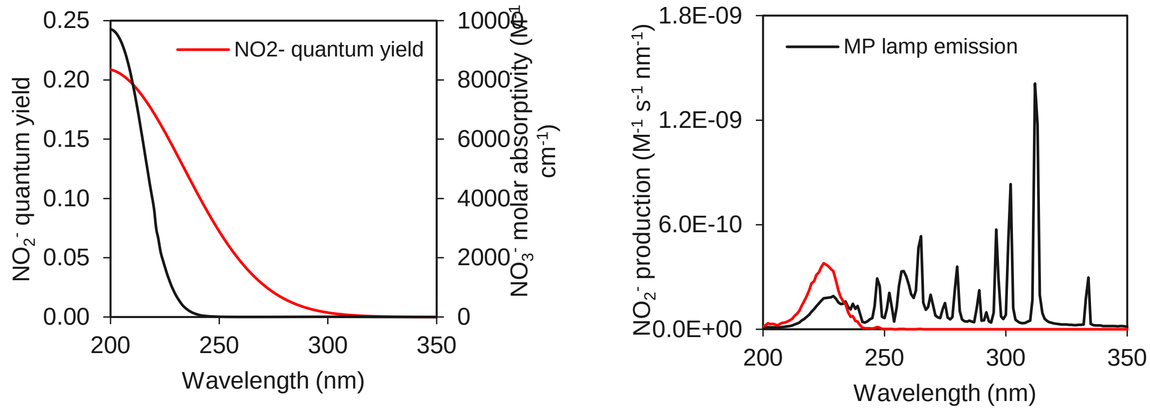

Figure 11. (left) NO_3^- molar absorptivity and NO_2^- quantum yields (left). (right) MP lamp emission spectrum and spectral production rates of NO_2^- in raw LA water with 9 cm water depth. NO_2^- quantum yields are a Gaussian fit to data from ref. 10.

Concluding remarks

Findings from this study highlight scenarios in which the presence of NO_3^- in different water matrices can enhance or inhibit radical production. Although NO_2^- and •OH are simultaneously produced (Rxns 1 and 2) when NO_3^- is irradiated with MPUV, the average •OH production was observed to be lower in samples with added NO_3^- (Figure 4) due to scavenging by NO_2^-. Additional research would need to be conducted to determine the optimum MPUV dose required to minimize NO_2^- formation and maximize •OH production in NO_3^- impacted waters.

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ATTACHMENT A: Data from Experimental Work

Table A1: MPa. Water quality data. Selected water quality parameters were measured before and after UV exposure, the results are presented below. Excel copy available upon request. Max UV dose for MPUV experiments at a water depth 3 cm and 8.88 cm is ~900 mJ/cm^2 and 800 mJ/cm^2, respectively. Max UV dose for LPUV is 1000 mJ/cm^2.

	Lamp:		**Medium pressure UV**							
	Experiment ID:		**1**	**1d**	**2**	**2d**	**3**	**3d**	**4**	**4d**
Experimental Parameters	Water Type		Mili-Q							
	Nitrate (mg/L NO3 as N)		0		10		0		10	
	H_2O_2 (mg/L)		0		0		10		10	
	Water Depth (cm)		3		3		3		3	
	UV Dose (mJ/cm^2)									
Measurements	UVA	0	0.0158		0.0182		0.0160		0.0182	
		max	0.0193	0.0188	0.0212	0.0159	0.0168	0.0177	0.0171	0.0156
	TOC (mg/L)	0	614		614		614		307	
		max	398		688		579		507	
	H_2O_2 (mg/L)	0	–	–	–	--	10.31	10.31	9.83	9.54
		max	–	–	–	--	9.28	9.41	9.38	8.60
	nitrate (mg/L)	0	–	–	10.2		–	--	10.2	
		max	–	–	10.1	10.05	–	--	11	11
	nitrite (mg/L)	0	–	–	DL		–	--	DL	
		max	–	–	0.1795	0.1835	–	--	0.139	0.143
	alkalinity (mg/L as CaCO3)	0	–	–	–	--	–	--	–	–
		max	–	–	–	--	–	--	–	–
	pH	0	–	–	–	--	–	--	–	–
		max	–	–	–	--	–	--	–	–
	E_o (mW/cm^2)		1.579	1.579	0.765	0.765	1.571	1.571	0.765	0.765
	pCBA degradation (s^{-1})		0.000E+00	1.827E-06	1.934E-03	1.963E-03	4.142E-03	4.119E-03	3.187E-03	3.337E-03
	[OH]ss (M)		0.000E+00	3.655E-16	3.868E-13	3.927E-13	8.285E-13	8.238E-13	6.375E-13	6.674E-13

Table A2: MPb. Water quality data. Selected water quality parameters were measured before and after UV exposure, the results are presented below. Excel copy available upon request. Max UV dose for MPUV experiments at a water depth 3 cm and 8.88 cm is ~900 mJ/cm^2 and 800 mJ/cm^2, respectively. Max UV dose for LPUV is 1000 mJ/cm^2.

	Lamp:		Medium pressure UV							
	Experiment ID:		**5**	**5d**	**6**	**6d**	**7**	**7d**	**8**	**8d**
Experimental Parameters	Water Type		Mili-Q							
	Nitrate (mg/L NO3 as N)		0		10		0		10	
	H_2O_2 (mg/L)		0		0		10		10	
	Water Depth (cm)		8		8		8		8	
	UV Dose (mJ/cm^2)									
Measurements	UVA	0	0.0158		0.0279		0.0160		0.0182	
		max	0.0181	0.0190	0.0203	0.0212	0.0166	0.0165	0.0179	0.0188
	TOC (mg/L)	0	307		307		307		307	
		max	769		669		613		546	
	H_2O_2 (mg/L)	0	–	–	–	--	10.40	10.87	9.69	9.33
		max	–	–	–	--	9.02	10.62	8.99	8.99
	nitrate (mg/L)	0	–	–	10.2		–	--	10.2	10.3
		max	–	–	10.3	9.93	–	--	11.3	10.9
	nitrite (mg/L)	0	–	–	DL		–	--	DL	
		max	–	–	0.1325	0.1415	–	--	0.0925	0.103
	alkalinity (mg/L as CaCO3)	0	–	–	–	--	–	--	–	–
		max	–	–	–	--	–	--	–	–
	pH	0	–	–	–	--	–	--	–	–
		max	–	–	–	--	–	--	–	–
	E_o (mW/cm^2)		1.057	1.057	0.479	0.479	1.051	1.051	0.479	0.479
	pCBA degradation (s^{-1})		1.651E-06	0.000E+00	7.998E-04	7.905E-04	4.303E-03	4.242E-03	2.040E-03	1.820E-03
	[OH]ss (M)		3.302E-16	0.000E+00	1.600E-13	1.581E-13	8.607E-13	8.484E-13	4.080E-13	3.640E-13

Table A3: MPc. Water quality data. Selected water quality parameters were measured before and after UV exposure, the results are presented below. Excel copy available upon request. Max UV dose for MPUV experiments at a water depth 3 cm and 8.88 cm is ~900 mJ/cm^2 and 800 mJ/cm^2, respectively. Max UV dose for LPUV is 1000 mJ/cm^2.

	Lamp:		**Medium pressure UV**							
	Experiment ID:		**9**	**9d**	**10**	**10d**	**11**	**11d**	**12**	**12d**
Experimental Parameters	Water Type		LA Water							
	Nitrate (mg/L NO3 as N)		Native		10		Native		10	
	H_2O_2 (mg/L)		0		0		10		10	
	Water Depth (cm)		3		3		3		3	
	UV Dose (mJ/cm^2)									
Measurements	UVA	0	0.0256		0.0279		0.0256		0.0279	
		max	0.0397	0.0358	0.0405	0.0412	0.0336	0.0377	0.0549	0.0375
	TOC (mg/L)	0	432		432		432		432	
		max	1058		4510		1152		1747	
	H_2O_2 (mg/L)	0	–	–	–	--	9.92	10.14	10.04	9.79
		max	–	–	–	--	8.53	8.64	8.48	8.47
	nitrate (mg/L)	0	1.24		10.2		1.24		10.4	
		max	1.175	1.165	9.72	10.05	1.47	1.46	11.45	11.2
	nitrite (mg/L)	0	DL		DL		DL		DL	
		max	0.085	0.0875	0.2085	0.2085	0.1415	0.1365	0.294	0.3165
	alkalinity (mg/L as CaCO3)	0	168		168		168		168	
		max	162		146	--	162	--	162	–
	pH	0	7.40		7.40		7.40		7.40	
		max	7.7	7.93	7.8	7.96	7.98	7.23	7.3	7.26
	E_o (mW/cm^2)		1.116	1.116	0.737	0.737	1.116	1.116	0.737	0.737
	pCBA degradation (s^{-1})		3.957E-04	3.917E-04	6.376E-04	6.260E-04	1.734E-03	1.813E-03	1.256E-03	1.242E-03
	[OH]ss (M)		7.914E-14	7.834E-14	1.275E-13	1.252E-13	3.468E-13	3.627E-13	2.512E-13	2.484E-13

Table A4: MPd. Water quality data. Selected water quality parameters were measured before and after UV exposure, the results are presented below. Excel copy available upon request. Max UV dose for MPUV experiments at a water depth 3 cm and 8.88 cm is ~900 mJ/cm^2 and 800 mJ/cm^2, respectively. Max UV dose for LPUV is 1000 mJ/cm^2.

	Lamp:		Medium pressure UV							
	Experiment ID:		13	13d	14	14d	15	15d	16	16d
Experimental Parameters	Water Type		LA Water							
	Nitrate (mg/L NO3 as N)		Native		10		Native		10	
	H_2O_2 (mg/L)		0		0		10		10	
	Water Depth (cm)		8		8		8		8	
	UV Dose (mJ/cm²)									
Measurements	UVA	0	0.0256		0.0279		0.0256		0.0279	
		max	0.0409	0.0359	0.0421	0.0399	0.0339	0.0374	0.0413	0.0383
	TOC (mg/L)	0	432		432		432		432	
		max	1035		1051		1048		1083	
	H_2O_2 (mg/L)	0	–	–	–	--	8.91	9.51	9.75	9.78
		max	–	–	–	--	8.45	8.84	8.69	8.63
	nitrate (mg/L)	0	1.24		10.2		1.24		10.2	
		max	1.18	1.18	10.4	10.2	1.405	1.445	11.55	11.55
	nitrite (mg/L)	0	DL		DL		DL		DL	
		max	0.059	0.0555	0.085	0.0855	0.097	0.093	0.19	0.1875
	alkalinity (mg/L as CaCO3)	0	168		168		168		168	
		max	166	–	164	--	158	--	168	–
	pH	0	7.40		7.40		7.40		7.40	
		max	6.67	7.88	7.91	7.1	7.26	7.07	7.69	7.89
	E_o (mW/cm²)		0.617	0.617	0.636	0.636	0.599	0.599	0.441	0.441
	pCBA degradation (s^{-1})		1.833E-04	1.855E-04	2.574E-04	2.632E-04	1.144E-03	1.161E-03	8.230E-04	8.011E-04
	[OH]ss (M)		3.667E-14	3.709E-14	5.147E-14	5.264E-14	2.289E-13	2.322E-13	1.646E-13	1.602E-13

Table A5: LPa. Water quality data. Selected water quality parameters were measured before and after UV exposure, the results are presented below. Excel copy available upon request. Max UV dose for MPUV experiments at a water depth 3 cm and 8.88 cm is ~900 mJ/cm^2 and 800 mJ/cm^2, respectively. Max UV dose for LPUV is 1000 mJ/cm^2.

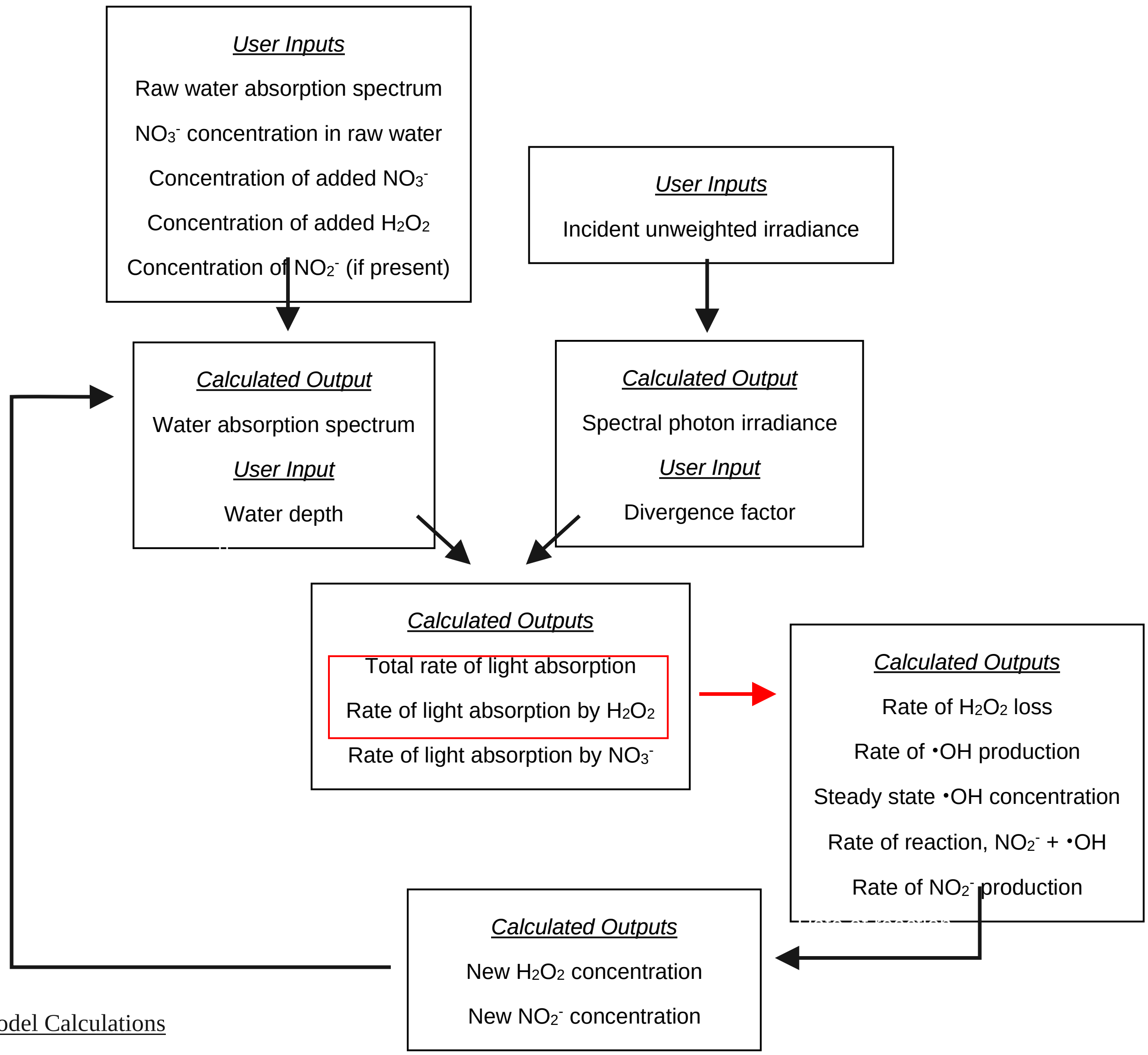
	Lamp:		Low Pressure UV							
	Experiment ID:		17	17d	18	18d	19	19d	20	20d
Experimental Parameters	Water Type		Mili-Q							
	Nitrate (mg/L NO3 as N)		0		10		0		10	
	H_2O_2 (mg/L)		0		0		10		10	
	Water Depth (cm)		3		3		3		3	
	UV Dose (mJ/cm²)									
Measurements	UVA	0	0.0158		0.0182		0.0160		0.0182	
		max	0.0193	0.0184	0.0224	0.0229	0.0115	0.0130	0.0184	0.0184
	TOC (mg/L)	0	614		614		614		614	
		max	746		747		666		745	
	H_2O_2 (mg/L)	0	–	–	–	--	9.90	9.90	9.87	9.88
		max	–	–	–	--	8.45	8.96	9.74	9.20
	nitrate (mg/L)	0	–	–	10.3		–	--	10.3	
		max	–	–	10.5	10.5	–	--	11.6	11.4
	nitrite (mg/L)	0	–	–	DL		–	--	DL	
		max	–	–	0.015	0.015	–	--	0.017	0.016
	alkalinity (mg/L as CaCO3)	0	–	–	–	--	–	--	–	–
		max	–	–	–	--	–	--	–	–
	pH	0	–	–	–	--	–	--	–	–
		max	–	–	–	--	–	--	–	–
	E_o (mW/cm²)		0.791	0.791	0.790	0.790	0.791	0.791	0.790	0.790
	pCBA degradation (s^{-1})		0.000E+00	4.189E-06	1.357E-04	1.432E-04	3.635E-03	3.575E-03	3.365E-03	3.226E-03
	[OH]ss (M)		0.000E+00	8.377E-16	2.715E-14	2.864E-14	7.269E-13	7.150E-13	6.730E-13	6.451E-13

Table A6: LPb. Water quality data. Selected water quality parameters were measured before and after UV exposure, the results are presented below. Excel copy available upon request. Max UV dose for MPUV experiments at a water depth 3 cm and 8.88 cm is ~900 mJ/cm^2 and 800 mJ/cm^2, respectively. Max UV dose for LPUV is 1000 mJ/cm^2.

	Lamp:		Low Pressure UV							
	Experiment ID:		**21**	**21d**	**22**	**22d**	**23**	**23d**	**24**	**24d**
Experimental Parameters	Water Type		LA Water							
	Nitrate (mg/L NO3 as N)		Native		10		Native		10	
	H_2O_2 (mg/L)		0		0		10		10	
	Water Depth (cm)		3		3		3		3	
	UV Dose (mJ/cm^2)									
Measurements	UVA	0	0.0256		0.0279		0.0256		0.0279	
		max	0.0323	0.0324	0.0434	0.0362	0.0374	0.0322	0.0460	0.0394
	TOC (mg/L)	0	432		432		432		432	
		max	1251		1221		1890		1575	
	H_2O_2 (mg/L)	0	–	–	–	--	10.02		10.43	
		max	–	–	–	--	9.17		9.5	9.18
	nitrate (mg/L)	0	1.23		10.3		1.23		10.3	
		max	1.275	1.25	10.25	10.15	1.445	1.405	11.6	11.45
	nitrite (mg/L)	0	DL		DL		DL		DL	
		max	DL		DL		DL		0.024	0.017
	alkalinity (mg/L as CaCO3)	0	168		168		168		168	
		max	94	–	82	--	79	--	82	–
	pH	0	7.40		7.40		7.40		7.40	
		max	7.73	7.86	7.73	7.96	7.84	7.98	7.78	7.94
	E_0 (mW/cm^2)		0.774	0.774	0.768	0.768	0.774	0.774	0.768	0.768
	pCBA degradation (s^{-1})		0.000E+00	0.000E+00	4.509E-06	1.723E-05	1.303E-03	1.444E-03	1.359E-03	1.360E-03
	[OH]ss (M)		0.000E+00	0.000E+00	9.019E-16	3.447E-15	2.607E-13	2.887E-13	2.718E-13	2.720E-13

ATTACHMENT B: Kinetic Model Calculations

Flowchart of Main Model Calculations



Model Calculations

The kinetic model runs in Microsoft Excel using one master spreadsheet ("Inputs and results.xlsx") and 10 "slave" spreadsheets ("Model step A.xlsx" through "Model step J.xlsx"), each of which carries out the calculations described below for 10 time intervals, where step B calls on the final results of step A, step C calls on the final results of step B, etc. Overall, the model includes 101 discrete time steps (100 time intervals) between which several values are iterated.

Several quantities in the model require summation over the relevant spectral range, and such summations were performed from 200 to 350 nm with 1 nm resolution ($\Delta\lambda$). Such spectral quantities are denoted with λ in parentheses, such as $R_{a,H2O2}(\lambda,t)$, and include units of nm^{-1}; $R_{a,H2O2}(\lambda,t)$, for example, is the spectral rate of light absorption by H_2O_2 at time t, with units of Es L^{-1} s^{-1} nm^{-1}. As just indicated, quantities denoted with t in parentheses, such as $a_\lambda(t)$, are time dependent. Quantities denoted with a subscripted λ, such as a_λ, vary with wavelength but do not have spectral units. Details about photolysis quantum yields and values of bimolecular rate constants involving •OH can be found in Sec. II of the main report.

The model begins by calculating the absorption coefficients of the solution, $a_{\lambda,t}$ (cm^{-1}), via Eqn A1, with time set to 0. Here, $a_{\lambda,w}$ is the decadal absorption coefficient of the raw water, $\varepsilon_{\lambda,NO3-}$, $\varepsilon_{\lambda,H2O2}$, and are the molar absorptivity of NO_3^-, H_2O_2, and NO_2^-, respectively.

$$a_\lambda(t) = a_{\lambda,w} + [NO_3^-]\,\varepsilon_{\lambda,NO3-} + [H_2O_2](t)\,\varepsilon_{\lambda,H2O2} + [NO_2^-](t)\,\varepsilon_{\lambda,NO2-} \qquad (B1)$$

The NO_3^- concentration is input as any supplemental NO_3^- added to the raw water. Based on experimental data from bench scale testing showing negligible change in $[NO_3^-]$ up to 5000 mJ cm^{-2} (Attachment A), it remains fixed at its initial value throughout the calculations. The initial concentration of H_2O_2 is set based on the amount added to the water; photolysis (Rxn 9 in the main report) causes it to decrease with time according to Eqn B2, where $R_{a,H2O2}$ (Es L^{-1} s^{-1}) is the rate of light absorption by H_2O_2 (Eqns B3-B5), Φ_{H2O2} is the H_2O_2 photolysis quantum yield (see main report sec. III), and Δt is the user determined time interval between time t and t-1. To compare with results from the bench scale experiments, the time interval was set to achieve total H_2O_2 weighted fluences between 1000 and 5000 mJ cm^{-2}.

$$[H_2O_2](t) = [H_2O_2](t-1) - R_{a,H2O2}(t-1)\,\Phi_{H2O2}\,\Delta t \qquad (B2)$$

$$R_{a,H2O2}(t) = \sum_\lambda R_{a,H2O2}(\lambda,t)\,\Delta\lambda \qquad (B3)$$

$$R_{a,H2O2}(\lambda,t) = R_{a,tot}(\lambda,t)\left(\frac{[H_2O_2](t)\ \varepsilon_{\lambda,H2O2}}{a_\lambda(t)}\right) \qquad (B4)$$

$$R_{a,tot}(\lambda,t) = \frac{E_p^0(\lambda)\ DF\left(1 - 10^{-a_\lambda(t)\,z}\right) x\ 1000}{z} \qquad (B5)$$

In eqns B4 and B5, $R_{a,tot}$ is the rate of light absorption by the solution (Es L^{-1} s^{-1}), E_p^0 (λ) is the spectral photon irradiance (Es cm^{-2} s^{-1} nm^{-1}), DF is the divergence factor (unitless)[2], and z is the water depth (cm). Irradiance values for input to the model are not weighted in any way, and were set here to roughly match experimental values from the bench scale tests. Divergence factors depend on the water depth and were set to equal to experimental values from the bench scale tests.

In Eqn B1, the initial concentration of NO_2^- is zero. It is produced by NO_3^- photolysis (Rxn 11in main report) and thermal reactions that are not accounted for directly due to lack of detailed knowledge of the various radical concentrations needed in order to do so. Rather, those reactions are accounted for as an efficiency adjustment to the rate of removal of NO_2^- by reaction with •OH (γ, Part II, Secs. III and IV in main report). Considering this, the NO_2^- concentration over time is calculated via Eqns B6 to B9.

$$[NO_2^-](t) = [NO_2^-](t\text{-}1) + [R_{NO2-}(t\text{-}1) - \gamma R_{OH,NO2-}(t\text{-}1)]\,\Delta t \qquad (B6)$$

$$R_{NO2-}(t) = \sum_\lambda R_{a,NO3-}(\lambda,t)\,\Phi_{NO2-,\lambda} \qquad (B7)$$

$$R_{a,NO3-}(\lambda,t) = R_{a,tot}(\lambda,t)\left(\frac{[NO_3^-]\,\varepsilon_{\lambda,NO3-}}{a_{\lambda,t}}\right) \qquad (B8)$$

$$R_{OH,NO2-}(t) = k_{OH,NO2-}[NO_2^-](t)[\bullet OH]_{ss}(t) \qquad (B9)$$

Here, R_{NO2-} is the rate of NO_2^- production (M s^{-1}), $R_{OH,NO2-}$ is the rate of reaction between NO_2^- and $\bullet OH$ (M s^{-1}), $R_{a,NO3-}$ is the rate of light absorption by NO_3^- (Es L^{-1} s^{-1}), and other symbols have been previously defined (see Sec. II of the main report).

Equation B9 requires a value for $[\bullet OH]_{ss}$ at each time point. This is calculated using Eqn B10. Here, R_{OH} is the production rate of $\bullet OH$ (M s^{-1}), which is calculated assuming only contributions from H_2O_2 and NO_3^- photolysis (Eqn B11). The pseudo-1st order rate constant for $\bullet OH$ scavenging, k_s (s^{-1}), is calculated via Eqn B12, where $k_{s,w}$ was fit to 8.35×10^4 s^{-1} as discussed in Part II, Sec. III of the main report, and the time dependent H_2O_2 and NO_2^- concentrations were computed as described above.

$$[\bullet OH]_{ss}(t) = \frac{R_{OH}(t)}{k_s(t)} \qquad (B10)$$

$$R_{OH}(t) = R_{a,H2O2}(t)\,\Phi_{H2O2} + \sum_\lambda R_{a,NO3-}(\lambda,t)\,\Phi^{N}_{OH,\lambda} \qquad (B11)$$

$$k_s(t) = k_{s,w} + k_{OH,H2O2}[H_2O_2](t) + k_{OH,NO2}[NO_2^-](t) \qquad (B12)$$

Appendix B Scavenging Report

Scavenging Demand Test: LADWP Waters

Linden Laboratory – University of Colorado Boulder

May 2018

Background and Methods

Water Samples

Samples collected by the Los Angeles Department of Water and Power (LADWP), were from wells NH037, TJ, and NHC. The samples were shipped on ice to the University of Colorado Boulder. Samples were stored at 4°C until water quality analysis and background scavenging testing. Pertinent water quality parameters were determined prior to Advanced Oxidation Process (AOP) treatment (Table 1). An Orion Star A211 meter was used for pH measurements. UV absorbance was measured using a 1 cm path length quartz cuvette by a Cary Bio 100 spectrophotometer (Varian Inc., Palo Alto, TX). Alkalinity was determined using a Hach Digital Titrator according to Hach method 8203. Total organic carbon (TOC) was measured by Sievers 5301 C instrument. Nitrite and nitrate were determined using Hach kits TNT 839 and 835, respectively.

Background Scavenging

Background radical scavenging experiments were carried out in duplicate (test 1 and test 2) for each well water using approximately 8 mg/L of hydrogen peroxide and 500 µg/L of para-chlorobenzoic acid (pCBA) as a probe to measure hydroxyl radical production and scavenging. pCBA reacts with hydroxyl radicals at a rate which far exceeds its reaction rate with UV light, making it an ideal probe to measure the formation and scavenging of hydroxyl radicals in UV-based AOPs. Low Pressure UV - hydrogen peroxide (LPUV/H_2O_2) scavenging experiments were performed using a quasi-collimated LPUV system setup for dual exposures. Instead of containing a single collimated hole (Figure 1), the collimated beam had two side-by-side holes separated by a light-impermeable barrier.

Four LPUV lamps (15 watt, #G15T8) were housed above two 4-inch apertures equipped with a manual shutter. Incident UV irradiance (1.014 mW/cm^2) was measured by a calibrated radiometer (International Light Inc., Model 1700/SED 240/W). UV fluence (i.e. dose) was calculated by multiplying the average irradiance by the exposure time in seconds. The average irradiance was determined by correcting the incident irradiance (radiometer reading) for sample depth, absorbance at 254 nm, sample reflectance, and petri factor (Bolton and Linden 2003).

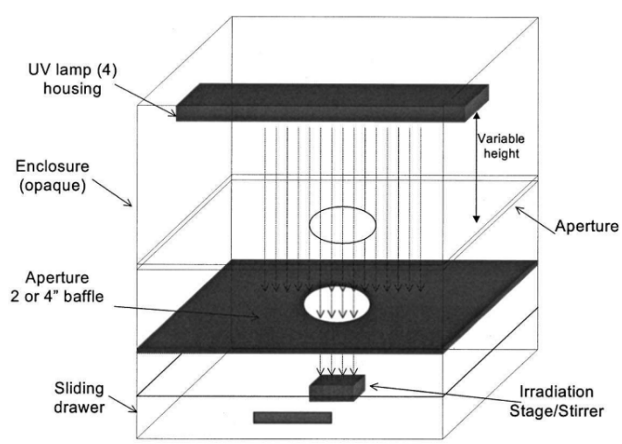


Figure 1. Labeled bench-scale quasi-collimated LP UV system (Bolton and Linden, 2003)

Samples were analyzed for the concentration of the radical probe, pCBA, using an Agilent 1100 series high performance liquid chromatograph (HPLC) and UV detector (at 235 nm) equipped with a reverse phase C-18 column.

The concentration of steady state hydroxyl radical concentration, [HO·], was then calculated using the following relationship:

$$\ln\frac{[pCBA]}{[pCBA]_o} = \frac{-k_{HO\cdot,pCBA}[HO\cdot]_{ss}}{E_o} \times F \qquad (1)$$

where E_0 is the average fluence rate (mW/cm^2), F is the fluence (mJ/cm^2) (i.e., UV dose) and $k_{HO\cdot,pCBA}$ is a time-based reaction rate constant between pCBA and hydroxyl radicals ($M^{-1}s^{-1}$).

In this equation, the quantity $\dfrac{-k_{HO\cdot,pCBA}[HO\cdot]}{E_o}$ is the slope of the plot of ln([pCBA]/[pCBA]$_0$) vs F, and [HO·] can be calculated as:

$$[HO\cdot] = \frac{-slopeE_o}{k_{HO\cdot,pCBA}} \qquad (2)$$

The value for $k_{HO\cdot,pCBA}$ has been reported as 5 x 10^9 $M^{-1}s^{-1}$ by Buxton *et al.*, 1988.

The steady state UV/H_2O_2 model by Glaze et al. (1995) can then be rearranged to calculate the total hydroxyl radical scavenging coming from the sample background:

$$\sum k_s[S] = \frac{E_o\varepsilon_{254}\Phi[H_2O_2]}{U_{254}} \times \frac{1}{[HO\cdot]} \qquad (3)$$

where k_s is the hydroxyl radical reaction rate constant for a given scavenging compound ($M^{-1}s^{-1}$), *[S]* is the concentration of the corresponding scavenging compound (M), ε_{254} is the molar absorption of hydrogen peroxide at 254 nm ($M^{-1}cm^{-1}$), Φ is the quantum yield of hydroxyl radical formation by photolysis of hydrogen peroxide at 254 nm, [H_2O_2] is the concentration of hydrogen peroxide (M), and U_{254} is the wavelength energy (J/mol). Substituting Eq. 2 into Eq. 3 yields:

$$\sum k_s[S] = \frac{E_o\varepsilon_{254}\Phi[H_2O_2]}{U_{254}} \times \frac{k_{HO\cdot,pCBA}}{-slope \times E_o} = \frac{\varepsilon_{254}\Phi[H_2O_2]}{U_{254}} \times \frac{k_{HO\cdot,pCBA}}{-slope} \qquad (3)$$

Results/Discussion

Water Quality

The pH, absorbance (at 254 nm), nitrite, alkalinity, and TOC of the samples are shown in Table 1. An example for the absorbance spectra of well NH037 is presented in Figure 2.

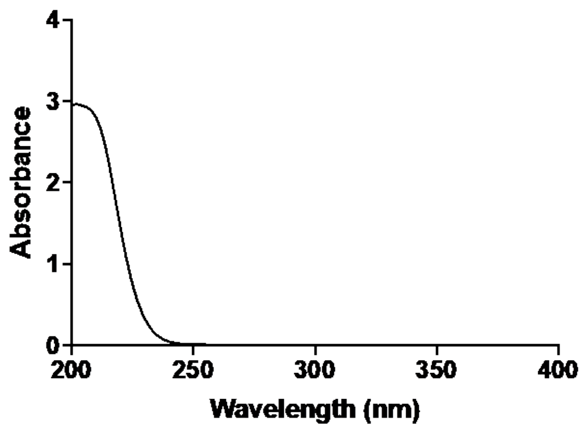


Figure 2. Absorbance spectrum of well NH037, from 200 – 400 nm

Bench-Scale Background Scavenging

In most natural waters hydroxyl radicals are scavenged mainly by two constituents: carbonates ($k_{HO,HCO3}$ = 8.5 x 10^6 L mol^{-1} s^{-1} and $k_{HO,CO3}$ = 3.9 x 10^8 L mol^{-1} s^{-1}), and TOC ($k_{HO,TOC}$ = 2.5 X 10^4 L mg^{-1} s^{-1}). While hydrogen peroxide (~8 mg/L) was added to promote formation of hydroxyl radicals, in excess it is capable of scavenging radicals ($k_{HO\cdot,H2O2}$ = 2.7 x 10^7 L mol^{-1} s^{-1}). Given their established rate constants, the relative contribution of each water quality parameter to the overall scavenging demand can be calculated (Table 1).

Hydrogen peroxide (H_2O_2) concentration was determined prior to UV exposure ([H_2O_2] initial), shown in Table 1. Since hydrogen peroxide has a relatively low molar absorption coefficient at 254 nm only a small fraction is consumed during UV exposure. Hydrogen peroxide concentrations were measured using the molybdate-activated iodide method. This method utilizes a color change that occurs when H_2O_2 reacts with potassium iodide (KI) in a buffered solution containing ammonium molybdate, forming I_3^- which can be detected spectrophotometrically at 352 nm (Klassen, 1994).

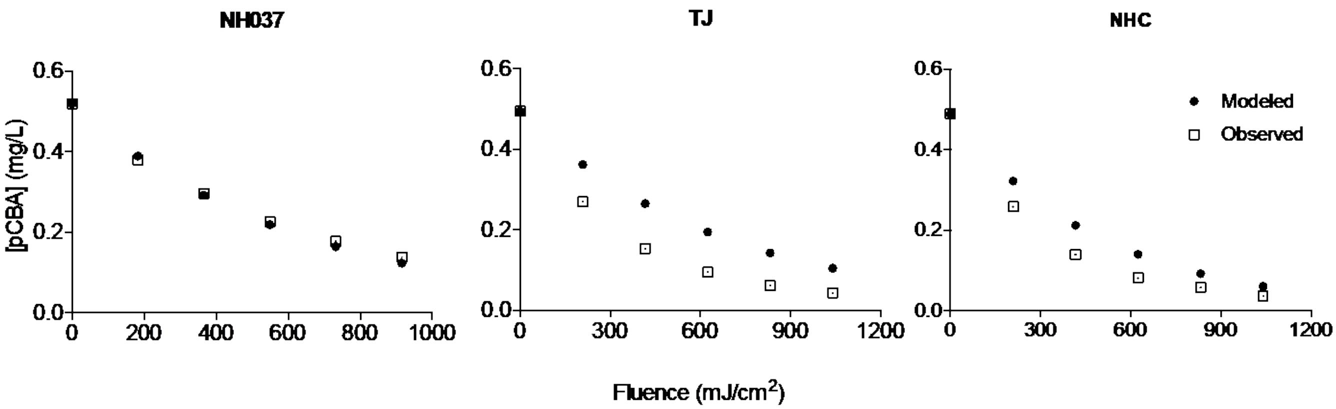
Figure 3 presents the measured degradation of pCBA in the water from wells NH037, TJ and NHC by LPUV/H_2O_2 with ~8 mg/L H_2O_2, and the theoretical decay of pCBA (term ‘model’). The modeled value was calculated using the measured water quality, associated scavenging rates from Table 2, and a steady-state hydroxyl radical model previously described by Rosenfeldt and Linden (2007). This model incorporates the water quality parameters and the spectral characteristics of the LPUV setup.

Table 1. Water quality and LPUV/H_2O_2 scavenging results.

Well: NH037		Test 1	Test 2
pH		7.60	
alkalinity as $CaCO_3$		209	
TOC (mg/L)		0.450	
UV abs $_{254nm}$ (cm^{-1}) (Transmittance)		0.01874 (95.8%)	0.01874 (95.8%)
[H2O2] initial (mg/L)		8.10	7.58
Scavenger [S]	$k_{OH/S}$ (M^{-1} s^{-1} or L mg^{-1} s^{-1})	$k_{OH,S}$[S] (s^{-1})	
TOC	2.50E+04	1.13E+04	1.13E+04
HCO_3^-	8.50E+06	1.77E+04	1.77E+04
CO_3^{-2}	3.90E+08	1.62E+03	1.62E+03
H_2O_2	2.70E+07	6.43E+03	6.02E+03
pCBA	5.00E+09	1.65E+04	1.67E+04
$\Sigma k_{OH,S}$[S] (s^{-1})		5.35E+04	5.32E+04
$\Sigma k_{OH,S}$[S-pCBA] (s^{-1})		3.70E+04	3.66E+04
TOC (mg/L)	-	21%	21%
HCO_3^- (M)	-	33%	33%
CO_3^{-2} (M)	-	3%	3%
H_2O_2 (M)	-	12%	11%
pCBA (M)	-	31%	31%

Well: TJ		Test 1	Test 2
pH		8.01	
alkalinity as $CaCO_3$		152	
TOC (mg/L)		0.754	
UV abs $_{254nm}$ (cm^{-1}) (Transmittance)		0.0207 (95.3%)	0.0209 (95.3%)
[H2O2] initial (mg/L)		7.45	7.55
Scavenger [S]	$k_{OH/S}$ (M^{-1} s^{-1} or L mg^{-1} s^{-1})	$k_{OH,S}$[S] (s^{-1})	
TOC	2.50E+04	1.88E+04	1.88E+04
HCO_3^-	8.50E+06	1.28E+04	1.28E+04
CO_3^{-2}	3.90E+08	3.01E+03	3.01E+03
H_2O_2	2.70E+07	5.96E+03	5.96E+03
pCBA	5.00E+09	1.58E+04	1.58E+04

$\Sigma k_{OH,S}[S]$ (s^{-1})		5.64E+04	5.64E+04
$\Sigma k_{OH,S}[S\text{-}pCBA]$ (s^{-1})		4.06E+04	4.06E+04
TOC (mg/L)	-	33%	33%
HCO_3^- (M)	-	23%	23%
CO_3^{-2} (M)	-	5%	5%
H_2O_2 (M)	-	11%	11%
pCBA (M)	-	28%	28%
Well: NHC		Test 1	Test 2
pH		8.04	
alkalinity as $CaCO_3$		155	
TOC (mg/L)		0.305	
UV abs $_{254nm}$ (cm^{-1}) (Transmittance)		0.0099 (97.7%)	0.00959 (97.8%)
[H2O2] initial (mg/L)		7.46	7.13
Scavenger [S]	$k_{OH/S}$ (M^{-1} s^{-1} or L mg^{-1} s^{-1})	$k_{OH,S}[S]$ (s^{-1})	
TOC	2.50E+04	7.63E+03	7.63E+03
HCO_3^-	8.50E+06	1.30E+04	1.30E+04
CO_3^{-2}	3.90E+08	3.29E+03	3.29E+03
H_2O_2	2.70E+07	5.79E+03	5.79E+03
pCBA	5.00E+09	1.56E+04	1.56E+04
$\Sigma k_{OH,S}[S]$ (s^{-1})		4.53E+04	4.54E+04
$\Sigma k_{OH,S}[S\text{-}pCBA]$ (s^{-1})		2.97E+04	2.97E+04
TOC (mg/L)	-	26%	26%
HCO_3^- (M)	-	44%	44%
CO_3^{-2} (M)	-	11%	11%
H_2O_2 (M)	-	19%	19%
pCBA (M)	-	52%	52%



F**igure 3.** Modeled degradation of pCBA for test 1 and 2 with ~8 mg/L H_2O_2.

Table 2 summarizes the experimental and theoretical hydroxyl radical concentration and scavenging rates of the water samples.

Table 2. Comparison of modeled and experimentally determined hydroxyl radical concentration and scavenging rates for LPUV/H_2O_2.

Well: NH037	Test 1	Test 2
$[H_2O_2]$ mg/L	8.10	7.58
Scavenging Rate	$k_{OH}[S]$ (s^{-1})	
$k_{OH}[S]$, $_{TOT\text{-}Model}$	3.70E+04	3.66E+04
$k_{OH}[S]$, $_{TOT\text{-}Exp.}$	3.78E+04	3.79E+04
Steady State ·OH	$[OH]_{ss}$(M)	
$[OH]_{ss\text{ - Model}}$	2.52E-13	2.38E-13
$[OH]_{ss\text{ – Exp.}}$	2.21E-13	2.18E-13

Well: TJ	Test 1	Test 2
$[H_2O_2]$ mg/L	7.45	7.55
Scavenging Rate	$k_{OH}[S]$ (s^{-1})	
$k_{OH}[S]$, $_{TOT\text{-}Model}$	4.06E+04	4.06E+04
$k_{OH}[S]$, $_{TOT\text{-}Exp.}$	2.36E+04	2.32E+04
Steady State ·OH	$[OH]_{ss}$(M)	
$[OH]_{ss\text{ - Model}}$	2.14E-13	2.14E-13
$[OH]_{ss\text{ – Exp.}}$	3.69E-13	3.74E-13

Well: NHC	Test 1	Test 2
$[H_2O_2]$ mg/L	8.10	7.58
Scavenging Rate	$k_{OH}[S]$ (s^{-1})	
$k_{OH}[S]$, $_{TOT\text{-}Model}$	2.97E+04	2.97E+04
$k_{OH}[S]$, $_{TOT\text{-}Exp.}$	2.24E+04	2.19E+04
Steady State ·OH	$[OH]_{ss}$(M)	
$[OH]_{ss\text{ - Model}}$	2.94E-13	2.94E-13
$[OH]_{ss\text{ – Exp.}}$	3.90E-13	3.99E-13

Measured steady-state hydroxyl radical production (using the probe pCBA) is lower than other waters tested in this laboratory previously. The reported upper limit of achievable hydroxyl radical steady-state concentration is around 10^{-12} M (Oppenlander, 2003). Hydroxyl radical concentration results coupled with low UV absorbance (254 nm) values indicate that all three well waters are viable candidates for UV/AOP treatment, although at possible elevated doses compared to other waters.

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Klassen, N. V.; Marchington, D.; McGowan, H. C. E. H2O2 determination by the I3 − method and by KMnO4 titration. Anal. Chem. 1994, 66, 2921−2925.

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Appendix D NHW Reporting Forms

Daily UV AOP Reactor Operational Report

Reporting Period:
System/Treatment Plant:
PWSID:

Operating Data for UV Reactor # 1

Reactor No	Operational Data								
	Day	Run Time (hrs)	Total Production (MG)	Average Calculated Log Reduction				Average Hydrogen Peroxide Dose (mg/L)	Average UVT (%)
				1,4-dioxane	TCE	PCE	1,1-DCE		
1	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	11								
	12								
	13								
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	26								
	27								
	28								
	29								
	30								
	31								
	Min:								
	Max:								
	Total:								

Daily Operational Summary Report

Reporting Period:
System/
Treatment Plant:
PWSID:

Operating Data for UVAOP

Operational Data									
Day	Run Time (hrs)	Total Production (MG)	Average Hydrogen Peroxide Dose (mg/L)	Average Calculated Log Reduction				Average UVT (%)	Average Post Combined GAC Hydrogen Peroxide Concentration (mg/L)
				1,4 Dioxane	TCE	PCE	1,1-DCE		
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
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24									
25									
26									
27									
28									
29									
30									
31									
Min:									
Max:									
Total:									

Reporting Period:
System/
Treatment Plant:
PWSID:

Sampling Data																		
Day	Weekly Grab Sample Hydrogen Peroxide Concentration (mg/L)																	
	GAC 1	GAC 2	GAC 3	GAC 4	GAC 5	GAC 6	GAC 7	GAC 8	GAC 9	GAC 10	GAC 11	GAC 12	GAC 13	GAC 14	GAC 15	GAC 16	GAC 17	GAC 18
1																		
2																		
3																		
4																		
5																		
6																		
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31																		
Min:																		
Max:																		
Total:																		

Generated:
Report Version: 1.0

Weekly UVT Analyzer Calibration Check Report

Reporting Period:
System/Treatment Plant:
PWSID:

Operating Data for Analyzers

		UVT						Post-Cleaning/Calibration UVT				
Date	UVT Analyzer	Benchtop	On-line Analyzer	UVT % Difference	UVT Analyzer Within Calibration?	Cleaned?	Calibrated?	Benchtop	On-line Analyzer	UVT % Difference	UVT Analyzer Within Calibration?	Notes
Comments:												

Certification:
All calibration checks were within the acceptable tolerance during this month.

Recalibration was required and is documented, above.
Generated:
Report Version: 1.0

Monthly Operational Summary Report

Reporting Period:
System/Treatment Plant:
PWSID:

			Average Log Reduction			
Unit Number	**Total Run Time (hrs)**	**Total Production (MG)**	**1,4-dioxane**	**TCE**	**PCE**	**1,1-DCE**
1						
2						
3						
4						
Total:						

Of the 32 UV sensors, **0** have been checked for calibration and **0** were within the acceptable range of tolerance.
0 UVT analyzer calibration checks performed.

GAC Number	**Total Production (MG)**	**Maximum Bed Volumes Treated**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
Total:		

Quarterly UV Sensor Calibration Check Report

Reporting Period:
System/Treatment Plant:
PWSID:

Operating Data for UV Reactor

Reactor Number	Date	Duty Sensor Number	UV Sensor Operating Time (years)	Reference Sensor Serial Number	Duty UV Sensor Reading (W/m2)	Reference UV Sensor Reading (W/m2)	Calibration Ratio	Calibration Ratio <= Setpoint: 1.2?

Certification:
Number of UV Sensors Calibrated:
0
Number of UV Sensors Out of Calibration:

Generated:
Report Version: 1.0

Appendix E LADWP Emergency Notification Plan (ENP)

State Water Resources Control Board
Division of Drinking Water

WATER QUALITY EMERGENCY NOTIFICATION PLAN

Name of Utility: City of Los Angeles Department of Water and Power

Physical Location/Address: Water Quality Division 111 N. Hope Street, Room 1213 Los Angeles, CA 90012

The following persons have been designated to implement the plan upon notification by the Division of Drinking Water (DDW) of the State Water Resources Control Board (SWRCB) that an imminent danger to the health of the water users exists:

Water Utility: Contact Name & Title	Email Address	Telephone Day	Telephone Evening	Telephone Cell
1. Elisa Reynolds, Manager of Water Quality Control	elisa.reynolds@ladwp.com	(213-367-4274	(213) 905-2930	(213) 905-2930
2. Dianna Jones, Manager of Regulatory Affairs & Consumer Protection	dianna.jones@ladwp.com	(213) 367-3307	(310) 329-9486	(213) 798-5574
3. Jonathan Leung, Assistant Director of Water Quality	jonathan.leung@ladwp.com	(213) 367-1032	(213) 280-1901	(213) 276-8315
4. Razmik Manoukian, Director of Water Quality	razmik.manoukian@ladwp.com	(213) 367-3191	(310) 930-9879	(213) 798-5429

The implementation of the plan will be carried out with the following State DDW and County Health Department personnel:

State DDW & County Health Department: Contact Name & Title	Telephone Day	Telephone Evening
1. Chi Diep, P.E., District Engineer SWRCB, Division of Drinking Water	(818) 551-2016 Fax (818) 551-2054	M (213) 309-3822
2. Karen Wong, P.E., Associate Sanitary Engineer Juan Arriola, P.E., Associate Sanitary Engineer Thomas Tsui, P.E., Associate Sanitary Engineer SWRCB, Division of Drinking Water	(818) 551-2037 (818) 551-2034 (818) 551-2036	(626) 833-3828 (310) 963-9644 (626) 757-4262
3. Scott Abbott, Branch Director Gary Hirschtick, Service Manager Lusi Mkhitaryan, Chief, Drinking Water Program LA County DPH-Environmental Health Environmental Protection Branch–Local Primacy 5050 Commerce Drive Baldwin Park, CA 91706-1423	(626) 430-5260 (626) 430-5216 (626) 430-5420	(213) 270-5568 (213) 270-5568 (213) 270-5568

4. **If the above personnel cannot be reached, contact:**

Office of Emergency Services Warning Center (24 hrs) (800) 852-7550 or (916) 845-8911
When reporting a water quality emergency to the Warning Center, please ask for the California State Water Resources Control Board – Division of Drinking Water Duty Officer.

NOTIFICATION PLAN

Attach a written description of the method or combination of methods to be used (radio, television, door-to-door, sound truck, etc.) **to notify customers in an emergency.** For each section of your plan give an estimate of the time required, necessary personnel, estimated coverage, etc. Consideration must be given to special organizations (such as schools), non-English speaking groups, and outlying water users. Ensure that the notification procedures you describe are practical and that you will be able to actually implement them in the event of an emergency. Examples of notification plans are attached for large, medium and small communities.

Report prepared by:

Razmik Manoukian, Director

Date 4/30/2020

City of Los Angeles Department of Water and Power
Public Water System No. 1910067

WATER QUALITY EMERGENCY NOTIFICATION PLAN
As of April 2020

Upon determination by the City of Los Angeles Department of Water and Power (LADWP) or notification by the State Water Resources Control Board – Division of Drinking Water (DDW) that an imminent danger to the health of the water users exists, this emergency notification plan may be implemented by one of the following persons of the Department:

Senior Assistant General Manager-Water	(213) 367-1022	Richard F. Harasick
Director of Water Quality	(213) 367-3191	Razmik Manoukian
Manager Regulatory Affairs & Consumer Protection	(213) 367-3307	Dianna Jones

Implementation of the plan may be ordered by the State DDW, Deputy Director (Mr. Darrin Polhemus), located at 1001 "I" Street, 24th Floor, Sacramento, CA 95814, (916) 449-5577, or a designated officer, and carried out in coordination with the following public health agencies:

CALIFORNIA WATER BOARDS, DIVISION OF DRINKING WATER
Metropolitan District, Drinking Water Field Operations Branch
Metropolitan District Office (818) 551 2004
Mr. Chi Diep, Metropolitan District Engineer (818) 551-2016
500 N Central Avenue, Suite 500
Glendale, California 91203

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC HEALTH
Local Primacy Agency (626) 430-5420
Lusi Mkhitaryan, Chief, Drinking Water Program
5050 Commerce Drive
Baldwin Park, CA 91706

Upon determination that this public notification plan is to be implemented, the following persons will be notified immediately through Department personnel:

- General Manager of the City of Los Angeles Department of Water and Power
- President of the Board of Water and Power Commissioners
- Mayor of the City of Los Angeles
- President of the Los Angeles City Council
- Chairperson of the Commerce, Energy and Natural Resources Committee of the Los Angeles City Council

City of Los Angeles Department of Water and Power
Public Water System No. 1910067

WATER QUALITY EMERGENCY NOTIFICATION PLAN
As of April 2020

It is acknowledged that different circumstances may require modification of this generalized plan, especially for a service area the size served by the LADWP. Therefore, this plan is intended to be flexible and to allow rapid adjustment as required to meet the needs of a particular situation.

The Director of Water Quality, in cooperation with the Communications and Public Affairs Division, will prepare a statement describing the nature, extent, and estimated duration of the water quality emergency. Maps, drawings, and other illustrative material will be included as needed. LADWP will do the following:

- Regulatory Affairs and Consumer Protection will provide the content of the statement to DDW and the Los Angeles County Department of Public Health personnel.
- Communications and Public Affairs will issue the statement in English and Spanish and distribute to local English and Spanish television and radio stations.
- Communications and Public Affairs will translate the notices in all 25 languages identified in LADWP service area, and will distribute to local daily and ethnic newspapers through the established procedures.
- The Customer Services Division and each of the five District Water Trouble Boards will also be furnished with sufficient information to answer customer inquiries involving the emergency.

The statement will also be uploaded to LADWP website, on the 'Water Quality Update" webpage http://www.ladwp.com/waterquality and an "alert" will be displayed on the LADWP Home Page.

Although use of the electronic news media should be an effective and rapid method of notification to persons living in the City service areas, supplementary methods of notification, or alternative methods may be used depending on the size and terrain of the area involved.

1. Emergency notification using NotifyLA, a reverse 911 database maintained by the City Office of Emergency Management.

2. Door-to-door distribution of a notice describing the nature, extent, and expected duration of the emergency.

3. Street signage located at major traffic intersections of affected area.

4. Use of the City of Los Angeles Fire or Police Department vehicles equipped with public-address equipment. Messages delivered by this means would be prepared as described under the news media section of this plan.

5. Social media – such as Twitter, Facebook, and Nextdoor to broadcast the message out and get customer attention.