APPENDIX I

Work Plan and Sampling and Analysis (WP-SAP) for Upcountry Maui Groundwater Nitrate Investigation – Maui, Hawaii

Final

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WORK PLAN

And

SAMPLING AND ANALYSIS PLAN (SAP)

For

UPCOUNTRY MAUI GROUNDWATER

NITRATE INVESTIGATION

MAUI, HAWAII

Final

Prepared by:
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June 2017

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SECTION 1 INTRODUCTION

This Work Plan (WP) was prepared by the Department of Health (DOH), Safe Drinking Water Branch (SDWB) to guide the sampling of wells in east Maui to investigate the source of the elevated nitrate concentrations in the groundwater. The area of elevated groundwater nitrate is on the west slope of the Haleakala Volcano of east Maui where the upslope area will be referred to as Upcountry Maui. This WP defines the DOH scope of work for characterizing the chemical and physical parameters of the groundwater in Upcountry Maui. The primary purpose of this WP is to detail the procedures and describe the quality assurance measures that will ensure integrity of the study analysis and data.

1.1 BACKGROUND

Elevated nitrate concentrations have been found in Upcountry Maui. A sample collected from the Pukalani Golf Course Well in 2010 had a nitrate concentration of 6.8 mg/L. Further investigation found the nitrate concentration at the Baldwin Ranch Estates drinking water well drilled last year was 8.7 mg/L. The Maximum Contaminant Limit (MCL) for nitrate for nitrate in drinking water is 10 mg/L. A review of other wells in the area also showed that many had elevated nitrate concentrations. This investigation seeks to identify the extent and probable source(s) of the contamination and provide data needed to formulate a mitigation plan or otherwise resolve high nitrate concentrations.

1.2 DESCRIPTION OF CURRENT STUDY

1.2.1 Project Objectives and Scope

The primary purpose of this investigation is to provide critical data about the source of nitrate in Upcountry Maui including the distribution of nitrate contamination in the aquifer and identify the most likely source(s) of contamination. The secondary purpose of this investigation is to gather data on groundwater chemistry to better define the groundwater flow paths from the areas of recharge to drinking water wells. Geographically, the study area includes the drinking water wells on the west slope of Haleakala, the potential groundwater recharge areas upgradient of the drinking water wells, and the potential sources of nitrate contamination within this area. Figure 1-1 show the island of Maui and the study area.

In summary, this study proposes to identify the source of the nitrate in the study area as a first step to develop plans to mitigate or otherwise resolve the elevated groundwater nitrate problem.

1.2.2 Project Tasks

The following tasks will be performed during this study.

1. Review of the available nitrate and other groundwater chemistry of the Upcountry Maui wells (completed as part of preparing this WP);
2. Perform a desktop inventory of the potential sources of nitrate contamination (completed as part of this WP);
3. Identify the wells and the groundwater parameters that need to be sampled (completed as part of preparing this WP);

4. Sample the wells for the designated constituents;
5. Interpret the data collected to identify the nitrate contamination source(s); and
6. Deliver a comprehensive report documenting the activities, data collection, and the conclusions of this study.

The final report will evaluate sources of nitrate contamination, identify the most likely contaminant source(s), characterize to the extent practical the groundwater flow paths from the points of recharge to the drinking water wells, and make recommendations for resolving the problem.

1.3 PROJECT ORGANIZATION

The key personnel and their role in this investigation is listed below:

Mr. Robert Whittier, P.G. is the DOH SDWB Source Water Protection Program (SWPP) geologist will plan and execute the project including collecting the samples, measuring the field parameters, interfacing with the laboratories, and interpreting the data.

Mr. Norris Uehara is the DOH SDWB Groundwater Pollution Control Section Supervisor and will supervise the SWPP geologist in the execution of this project. Mr. Uehara will review the Quality Assurance Project Plan (QAPP), sampling and analytical results, and the data interpretation.

Ms. Joanna Seto, P.E. is the DOH SDWB Chief and is responsible for the overall management and oversight of this project.

Mr. Alan Dillon is the DOH SDWB General Profession IV**,** will provide DOH QA oversight of this project ensuring all Quality Assurance (QA) and Data Quality Objectives (DQOs) are met.

Mr. Daniel Chang is the DOH SDWB Monitoring and Analysis Section Supervisor, will provide monitoring assistance on this investigation.

Ms. Natalie Walsgrove is the School of Ocean and Earth Science and Technology (SOEST) Biogeochemistry Laboratory Supervisor and will ensure proper analytical techniques and laboratory protocols and quality assurance are employed during nitrogen and water isotope analysis.

Mr. Joseph Lichwa is laboratory supervisor for the University of Hawaii Water Resources Research Center, Water Quality Laboratory (WRRC). Mr. Lichwa will ensure proper analysis of the major ion Chemistry.

Mr. Danilo Licudine is the laboratory supervisor for the DOH State laboratory Division Environmental Health Administration Analytical Services Branch (EHASB), Water Pollution Chemistry Section. Mr. Licudine will ensure proper analysis of the groundwater nutrient concentrations.

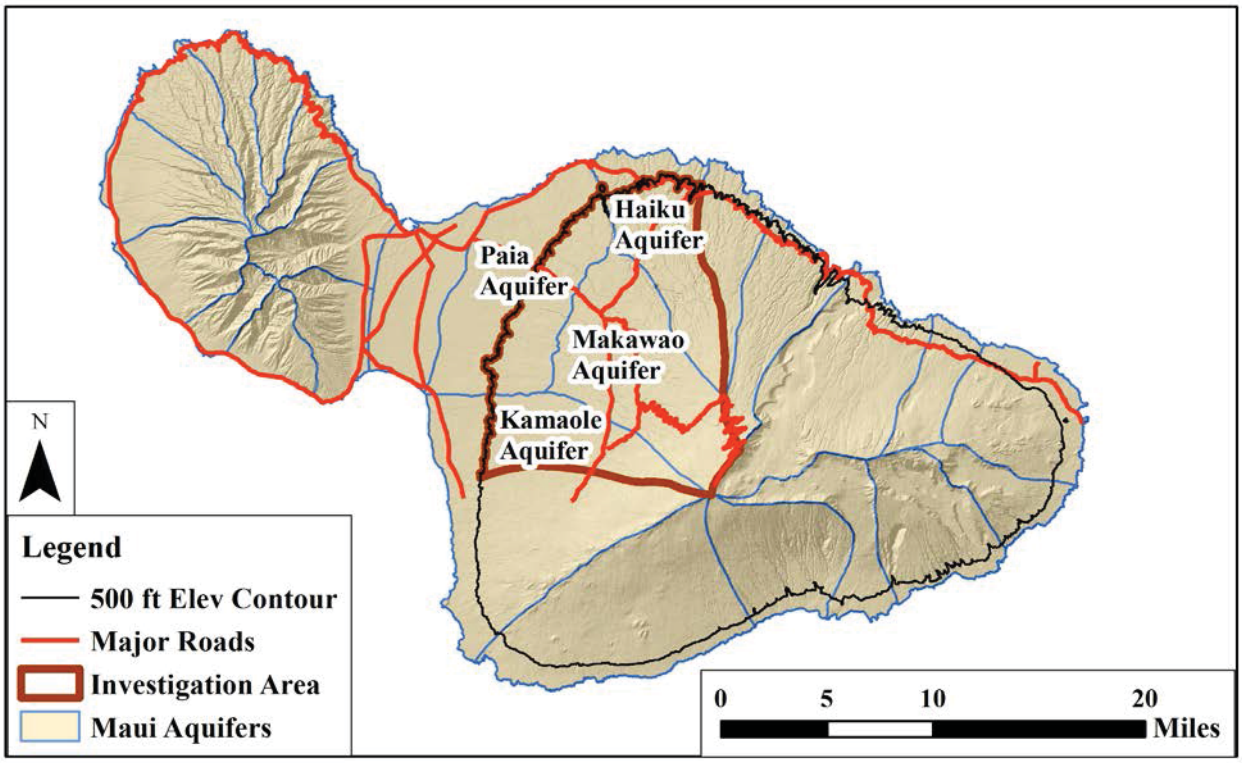

Figure 1-1. Map Showing Maui and the Location of the Investigation Area

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SECTION 2 SITE DESCRIPTION AND NITRATE DISTRIBUTION

The nitrate concentration in Upcountry Maui is approaching the maximum contaminant limit (MCL) for drinking water of 10 mg/L. This section reviews the hydrology/hydrogeology of the investigation area, the distribution of nitrate in the groundwater, and the potential sources of nitrate contamination.

2.1 DESCRIPTION OF THE STUDY AREA

2.1.1 Physical Setting

Maui is the second largest of the Main Hawaii Islands (MHI) and lies near the southeast extent of the State of Hawaii. The Hawaiian island chain is formed as the Pacific Tectonic Plate passes over a mid-ocean hotspot. Maui, like most of the MHI, is made up of two volcanoes (Langenheim and Clague, 1987). Haleakala forms the eastern part of Maui that is separated from the West Maui Volcano by a central isthmus that providing a natural division between eastern and western Maui. The Haleakala Volcano, rises to 10,023 ft (3055 m) above sea level. Haleakala is much younger than the West Maui Volcano, with the shield building stage of this volcano ending between 0.93 and 0.97 million years ago (Gingerich, 1999a and b). Haleakala has three well defined rift zones, one radiating from the central caldera to the north-northwest, one to the east, and the third rift zone extends to west-southwest. In East Maui irrigated agriculture exists on the central isthmus between the urban centers of Kahului and Kihei. Further upslope diversified agriculture dominates. Smaller residential communities exist on the western and windward slopes of Haleakala at the low to mid-level elevations. The middle to upper elevations of Haleakala are conservation land dominated by the Haleakala National Park. The study area is the west facing slope of Haleakala. This includes the portions of the Haiku, Makawao, and Paia Aquifers that are at an elevation of 500 feet above mean sea level (ft msl) or greater and the north half of the Kamaole Aquifer that is at an elevation of 500 ft msl or greater (Figure 1-1).

2.1.2 Regional Groundwater Hydrology

The precipitation that falls on Upcountry Maui is partitioned between surface runoff, evapotranspiration, soil moisture storage, and groundwater recharge. Recharge, (the fraction of groundwater that reaches the water table), flows radially out from the central highlands to discharge areas along the coast. Figure 2-1 shows the recharge distribution for East Maui and the study area for this investigation (Engott and Vana, 2007; and Gingerich, 2008). Recharge ranges from over 500 inches per year (in/yr) at the high elevations to less than 10 in/yr along the coast (Engott and Vana, 2008).

In the subsurface, the groundwater becomes a lens of freshwater floating on the underlying saltwater with a water table elevation of less than a few tens of feet above sea level. This Ghyben-Herzberg principal that states the thickness of the freshwater lens is 41 times the elevation of the water table above sea level. This is only an estimation, however, and the actual thickness of the freshwater lens can deviate from this value due to factors such as non-horizontal flow and heterogeneous geology (Izuka and Gingerich, 1998). The mixing of the two waters in the basal lens along the groundwater flow path results in a sloping transition rather than a sharp interface between fresh and saltwater.

As the groundwater approaches the shoreline, it may encounter sedimentary deposits and formations that retard its flow. These formations, referred to collectively as caprock, have an effective hydraulic conductivity that is significantly lower than that of thin bedded lavas forming volcanic formations of the study area. This results in a thicker freshwater lens due to the flow impedance of the caprock that retards saltwater intrusion into the aquifer. This condition exists in the central isthmus area between east and west Maui. The slopes of Upcountry Maui consist of a thick veneer of more recent Kula Volcanics overlying the shield building stage Honomanu Basalts (Izuka et al., 2016). Gingerich (2008) modeled the Kula Volcanics and the Honomanu Basalt as a single hydrogeologic unit. However, the Kula Volcanics are generally viewed as having lower permeability than the Honomanu Basalts (Stearns and Macdonald, 1942; Izuka et al., 2016). For groundwater transport that has little bearing in the study area since the contact between the Kula Volcanics and the Honomanu Basalt is above the saturated zone (Gingerich, 2008). However, recharge infiltrating into the unsaturated zone may be influenced by the structure and lower permeability of the Kula Volcanics resulting in perched water.

The water transport characteristics of the various aquifer materials vary greatly along the flow path. In a groundwater model that included central Maui, Gingerich (2008) assigned horizontal longitudinal and transverse hydraulic conductivities of 11,083 and 3,694 ft/d respectively and a vertical hydraulic conductivity of 13.85 ft/d for the Kula/Honomanu Basalts in the Upcountry Maui area. For the sedimentary deposits he used values of 17 and 0.38 ft/d for the horizontal and vertical hydraulic conductivity, respectively.

2.1.3 Land Use

In Upcountry Maui, the land utilization is predominantly agriculture with small urban centers and rural zones at the mid-elevations. Pineapple and sugar cultivation once dominated most of the study area, but have now ceased. However, residual fertilizer from past agriculture still likely add to groundwater nitrate load. Portions of this land remain fallow or have been converted to low density housing and diversified agriculture. The upper elevations are zoned as conservation land. Figure 2-2 shows the current land use zoning for East Maui (Hawaii Office of Planning, 2015).

2.2 UPCOUNTRY MAUI NITRATE CONTAMINATION

2.2.1 Distribution of Nitrate in Upcountry Maui

The concentration of groundwater nitrate in Upcountry Maui varies from less than 0.5 mg/L to concentrations approaching the MCL of 10 mg/L. The nitrate in groundwater from natural sources is generally less than 0.5 mg/L. A review of the DOH Safe Drinking Water Information System Contaminant Database (SDWIS-CDb) shows the vast majority of wells located in areas with little or human impact within the source area have nitrate concentrations less than 0.5 mg/L. However, elsewhere in the state there are exceptions to this general trend. In the Kaupulehu area of West Hawaii Island there are groundwater nitrate concentrations of greater than 2 mg/L (Fackrell et al. 2016). This is consistent with concentrations measured in the public drinking water wells serving the Hualalai Resorts, where drinking water compliance monitoring has recorded nitrate concentrations as high as 4.3 mg/L (SDWIS-CDb, data extracted 1/26/17). These nitrate concentrations are unexpectedly high since there are no identified anthropogenic source for the elevated nitrate in the Kaupulehu area. Predominantly, throughout the State, groundwater nitrate concentrations approaching the MCL of 10 mg/L are only associated with sugar cane cultivation and seed corn agriculture (Ling, 1996). Whittier and El-Kadi

(2014) compared the nitrate concentrations in drinking water wells with concentrations predicted by OSDS leachate transport model and found no convincing evidence that OSDS were responsible for any significant elevation of groundwater nitrate. The new data emerging from Upcountry Maui is the first to make a possible connection between elevated concentrations of groundwater nitrate and OSDS. The reason for concern is that the groundwater nitrate concentrations in upcountry Maui are approaching the MCL with no corresponding sources such as sugar cane or seed corn agriculture to account for the high nitrate concentrations.

In the area of Pukalani, Makawao, and Hailemaile the groundwater nitrate concentrations vary from less than 0.5 mg/L to more than 8 mg/L. Table 1 lists the wells in the area and summarizes the nitrate concentration. Figure 2-3 is a map showing the most recent nitrate concentrations in the area wells. The Baldwin Ranch Estates Well (BRE-1) has the highest concentration of 8.7 mg/L that was in a sample collected on 7/14/2015. The next highest nitrate concentration was in the Pukalani Golf Course Well. The sample collected from this well on 9/01/2010 had a concentration of 6.7 mg/L. By contrast the Pookela Well had a nitrate concentration of 0.1 mg/L in a sampled collected on 01/2/2016.

Table 2-1. Nitrate Concentrations in the Upcountry Maui Wells

Well Name	Well ID	Minimum	Average	Maximum	Date of Max.	Most Recent	Date
		(mg/L)	(mg/L)	(mg/L)		(mg/L)	
Baldwin Ranch Estates 1	6-5220-002	NA	8.7	NA	NA	8.7	7/14/15
Haiku Well	6-5419-001	1.9	2.0	2.3	11/21/16	2.3	11/21/16
Kaupakulua Well	6-5317-001	0.1	0.7	0.8	8/14/01	0.8	3/31/16
Maui Highlands Wells 1, 2	6-4425-001,2	0.5	0.6	0.9	8/5/09	0.6	9/07/16
Maunaolu-Smith Well	6-5320-002	0.3	4.7	6.3	2/10/09	4.6	7/25/16
Pookela Well	6-5118-002	0.5	0.5	0.5	2/24/09	0.1	1/28/16
Pukalani Golf Course	6-5021-001	NA	6.7	NA	NA	6.7	9/1/10
West Kuiaha Meadows Well	6-5418-002	0.7	0.8	0.8	3/28/05	0.8	3/19/07
Hamakaupoko Wells	6-5320-001,2	3.3	4.8	6.8	2/1/00	4.7	3/30/17
Omaopio-Esty	6-4821-001	3.6	4.3	4.8	8/23/06	4.8	8/23/06
Pulehu Farms	6-4719-001	3.0	8.0	16.2	8/27/07	3.0	9/24/07

2.2.2 Potential Sources of Nitrate Contamination

The Hawaii Source Water Assessment Program Report (SWAP), Volume 1 – Approach Used for Hawaii Source Water Assessments (Whittier et al., 2004) details potential sources of contamination to groundwater and drinking water wells. Table 5-2 of SWAP Volume 1 list of potential contaminating activities (PCAs) and the contaminants these activities might produce. This table was reviewed to identify those activities that could result in nitrate contamination of the groundwater.

The primary sources of groundwater nitrate are leaching of fertilizers, and human or animal wastes. Figure 2-4 shows the Upcountry Maui drinking water wells, the most recent nitrate concentrations, and

the nitrate producing PCAs in the area. Most of the wells showing elevated nitrates are on the upper edge of former sugar cane cultivation. These wells are also located down gradient of a large number of Onsite Sewage Disposal Systems (OSDS). The other potential sources of nitrate in the area are former pineapple cultivation, tree and row crops. However, when reviewing the SDWIS-CDb these do not seem to be a significant source of nitrate. In the Lahaina Aquifer, wells located within or at the upper reaches of former sugar cane fields had nitrate concentrations significantly higher than groundwater beneath areas where only pineapple was formerly grown. This correlation indicates that former sugar cane land is much more likely source of elevated nitrate than former pineapple land. In Upcountry Maui the former sugar cane operations were predominantly down gradient from the impacted wells, significantly decreasing the possibility former sugar cane agriculture is the source of elevated nitrate in the groundwater.

Data currently available indicates that the nitrate plume is over 6 miles wide extending from the Hamakuapoko Wells in the north to the Omaopio-Esty Well in the south. Also, the nitrate source(s) seems to be located downslope from the Pookela and Kaupakulua Wells since the nitrate concentration in these wells is less than 1 mg/L. The only PCAs that cover that large of a swath are historical pineapple and OSDS. Animal feedlots are upgradient of the some of the wells with the highest nitrate contamination, but are not present throughout the apparent plume area. As described above, elevated (> 1 mg/L) is not strongly associated with pineapple cultivation elsewhere. Thus OSDS seem to correlate best with the elevated groundwater nitrate contamination.

Based on distribution, correlation with areas of elevated nitrate, estimated nitrogen load; OSDS are the most likely source of the nitrate contamination. An OSDS inventory conducted by the University of Hawaii for DOH indicated that there are over 10,000 OSDS within the investigation area (Whittier and El-Kadi, 2014). Of these OSDS, it is estimated that about 7,400 are cesspools. Whittier and El-Kadi estimated that over 1,000 kg/d of nitrogen (which will become nitrate) may be leached each day from these OSDS. Figure 2-5 shows the modeled distribution of nitrate in the groundwater from OSDS leachate based on the study of Whittier and El-Kadi (2014). Also shown on Figure 2-5 is the most recent nitrate concentrations in the Upcountry Maui wells. Identical color shading was used to display both the modeled and measured nitrate concentrations. There is generally good agreement between the modeled and measured distribution of groundwater nitrate, further strengthening the hypothesis that OSDS are the source of contamination. To further evaluate agriculture as a potential nitrate the SDWIS-CDb for the Upcountry Maui Wells was reviewed to identify wells a history of agricultural chemical detections had. Only two wells, the Haiku Well (3-5419-001) and the Maonalua-Smith Well (3-5320-002) had positive agricultural chemical contamination. A review of new drinking water source applications found the Baldwin Ranch Estates Well (3-5220-002) also had detections of agricultural chemicals. Table 2-2 below summarizes the concentrations of the agricultural and nitrate concentrations at these wells. The incidence of agricultural detections occur in wells with elevated nitrate. However, the contaminants detected are associated with pineapple cultivation. Elsewhere in Hawaii pineapple is not associated with significantly elevated groundwater nitrate. Regardless it is important to note that this investigation will include isotopic analysis of the dissolved nitrate that does provide a method to distinguish between agricultural and wastewater/animal waste sources of nitrate.

Table 2-2. A Summary of Agricultural Contaminant Detections Compared to Nitrate Concentrations

		Dibromo-chloropropane (DBCP)	Ethylene Dibromide (EDB)	1,2,3-Trichloropropane (TCP)	Nitrate (most recent)
	Units	mg/L	mg/L	mg/L	mg/L
	MCL	0.04	0.04	0.6	10
Well	Well ID				
Moanaolu-Smith Well	6-5320-002	0.014-0.40	0.028-0.24	ND	4.6
Haiku Well	6-5419-001	0.01-0.026	ND	ND	2.3
Baldwin Ranch Estates Well	6-5220-002	0.016	0.048-0.064		8.7
Kaupakalua Well	6-5317-001	ND	ND	ND	0.8
Pookela Well	6-5118-002	ND	ND	ND	0.1
West Kuiaha Meadows Well	6-5418-002	ND	ND	ND	0.8
Maui Highlands Wells	6-4425-001,2	ND	ND	ND	0.6

2.3 SUMMARY

As described in this section, much of the groundwater in Upcountry Maui has elevated nitrate concentrations. In the Baldwin Ranch Estates 1 Well this concentration is approximately 90 percent of the MCL. This movement toward the MCL will necessitate the consideration and preparation for treatment of the water. Once the concentration meets or exceeds the MCL, treatment of the drinking water will be necessary before it can be distributed to the domestic users. The most likely source of the nitrate contamination is the large number of OSDS in this area. Currently the linkage between the groundwater nitrate contamination and the potential OSDS source is by proximity of the impacted wells to the upgradient OSDS. This investigation will further evaluate the possible connection between impacted groundwater and potential contamination sources using isotopic composition of the groundwater nitrate. As described in Section 3, the isotopic composition of nitrate can be used to discriminate between different sources of contamination. Section 3 describes the sampling strategy while Section 4 describes the Quality Assurance measure that will be used during this investigation.

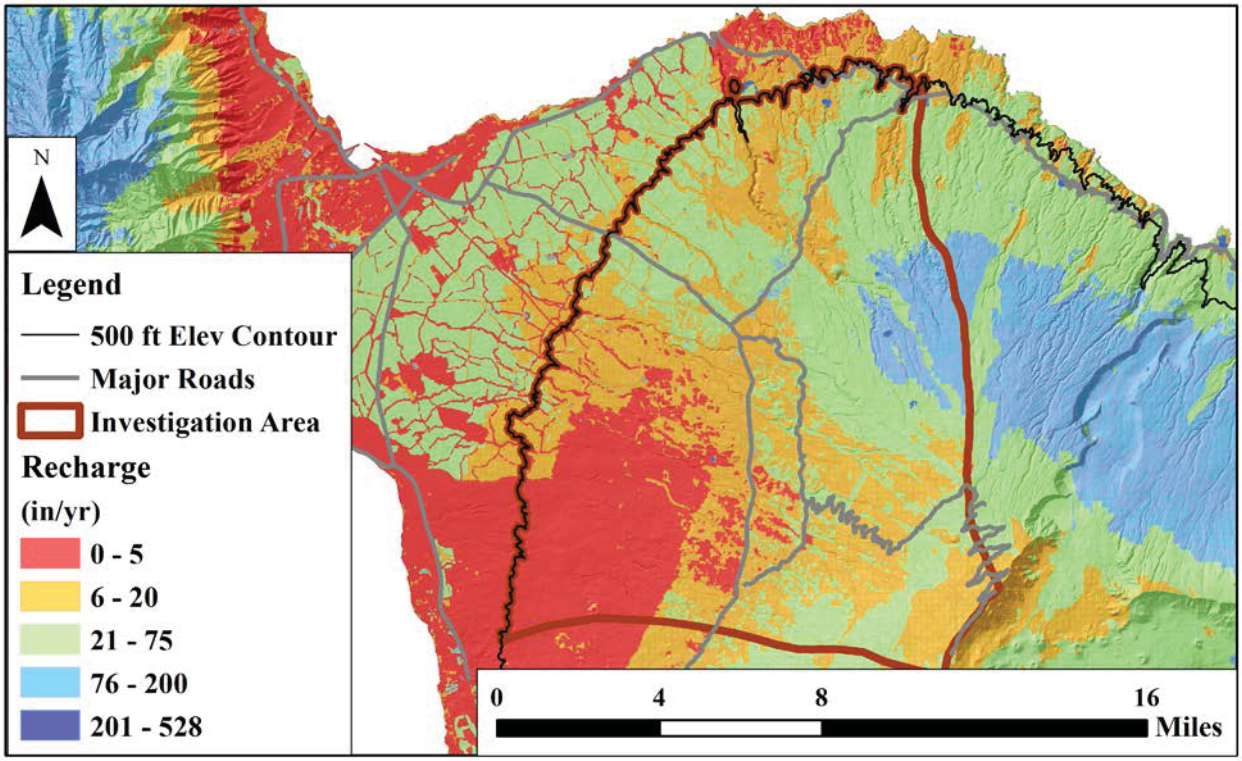


Figure 2-1. Distribution of Groundwater Recharge in East Maui

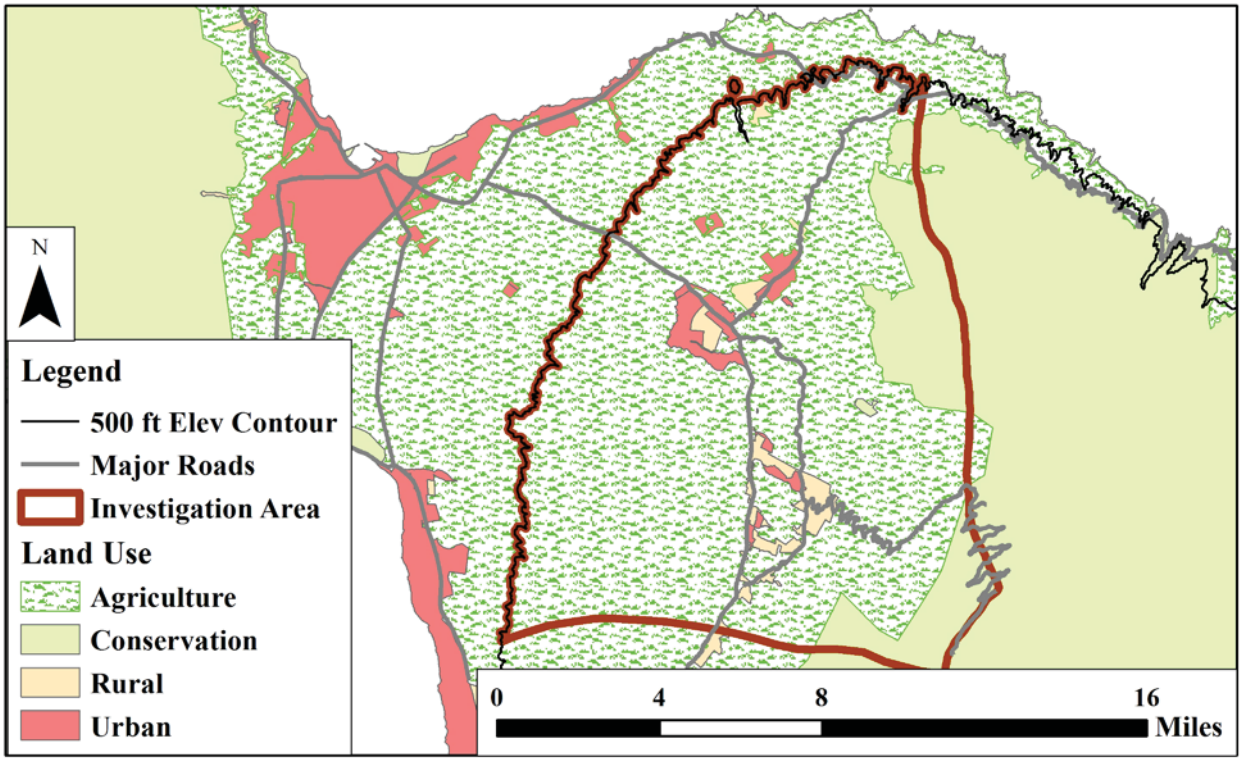


Figure 2-2. Land Use Designations for East Maui

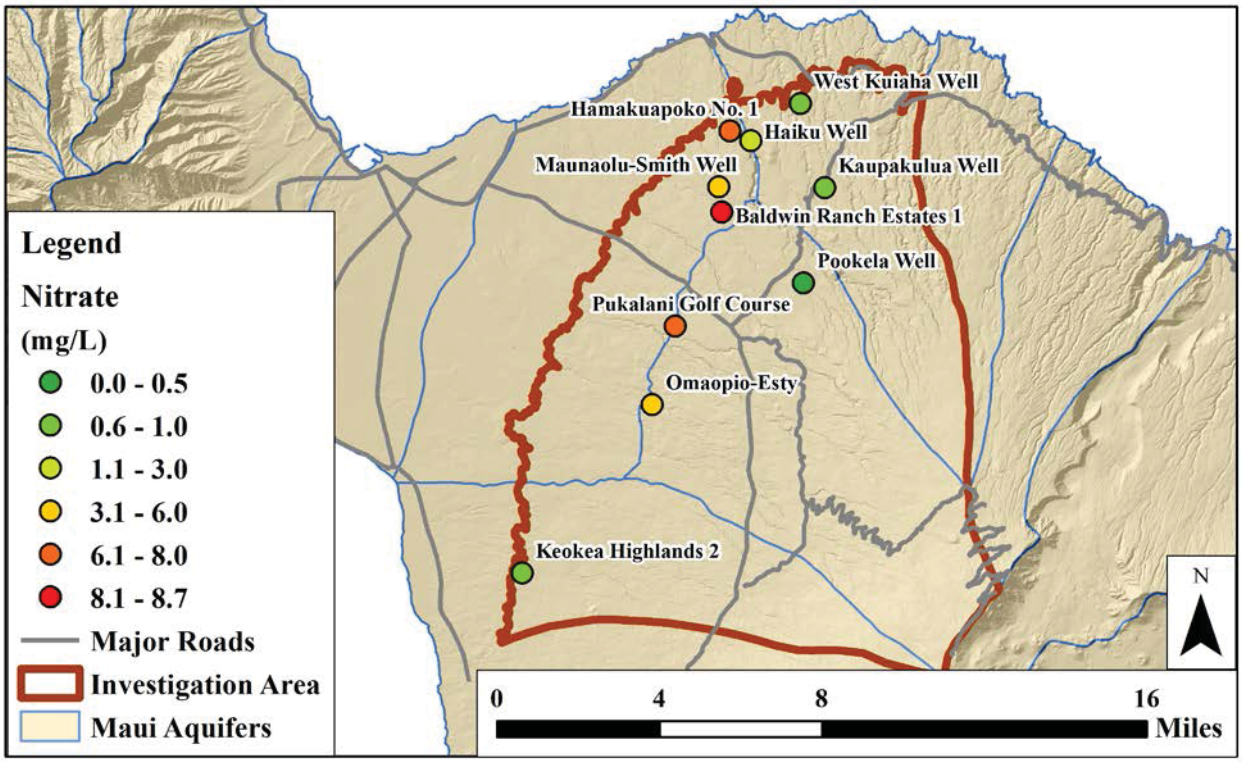
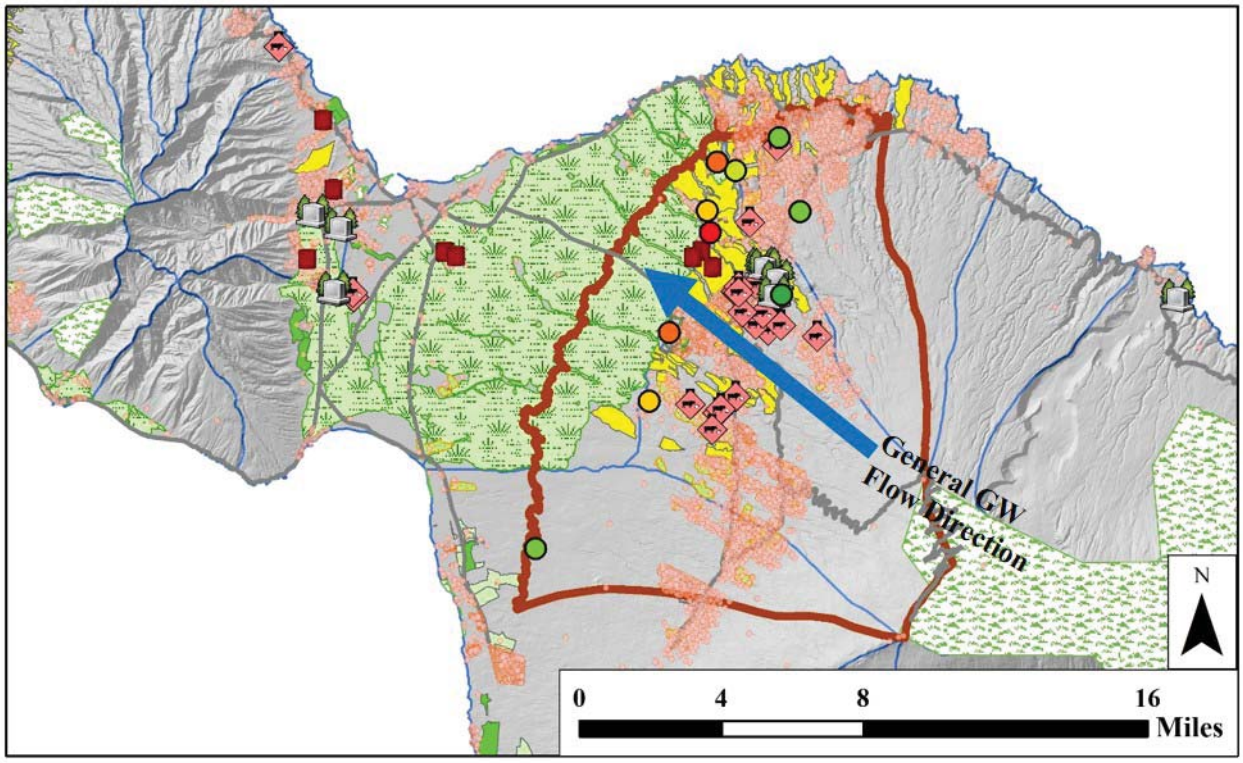


Figure 2-3. Groundwater Nitrate Concentrations in Upcountry Maui



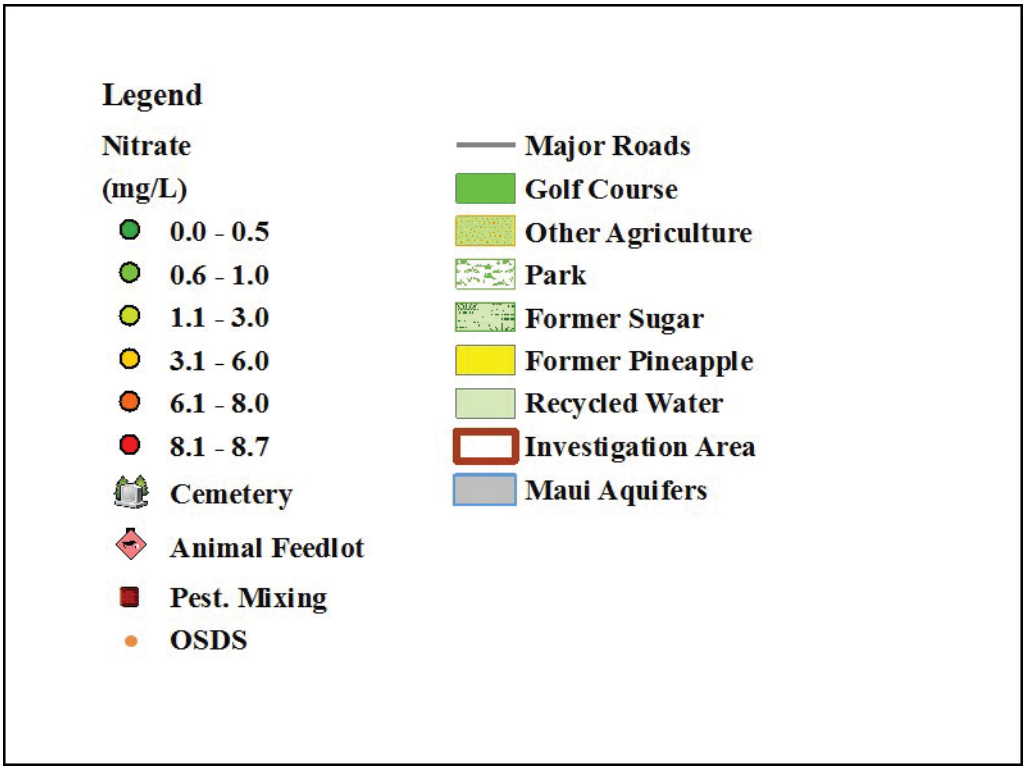


Figure 2-4. Groundwater Nitrate Concentrations and Potential Sources of Nitrate

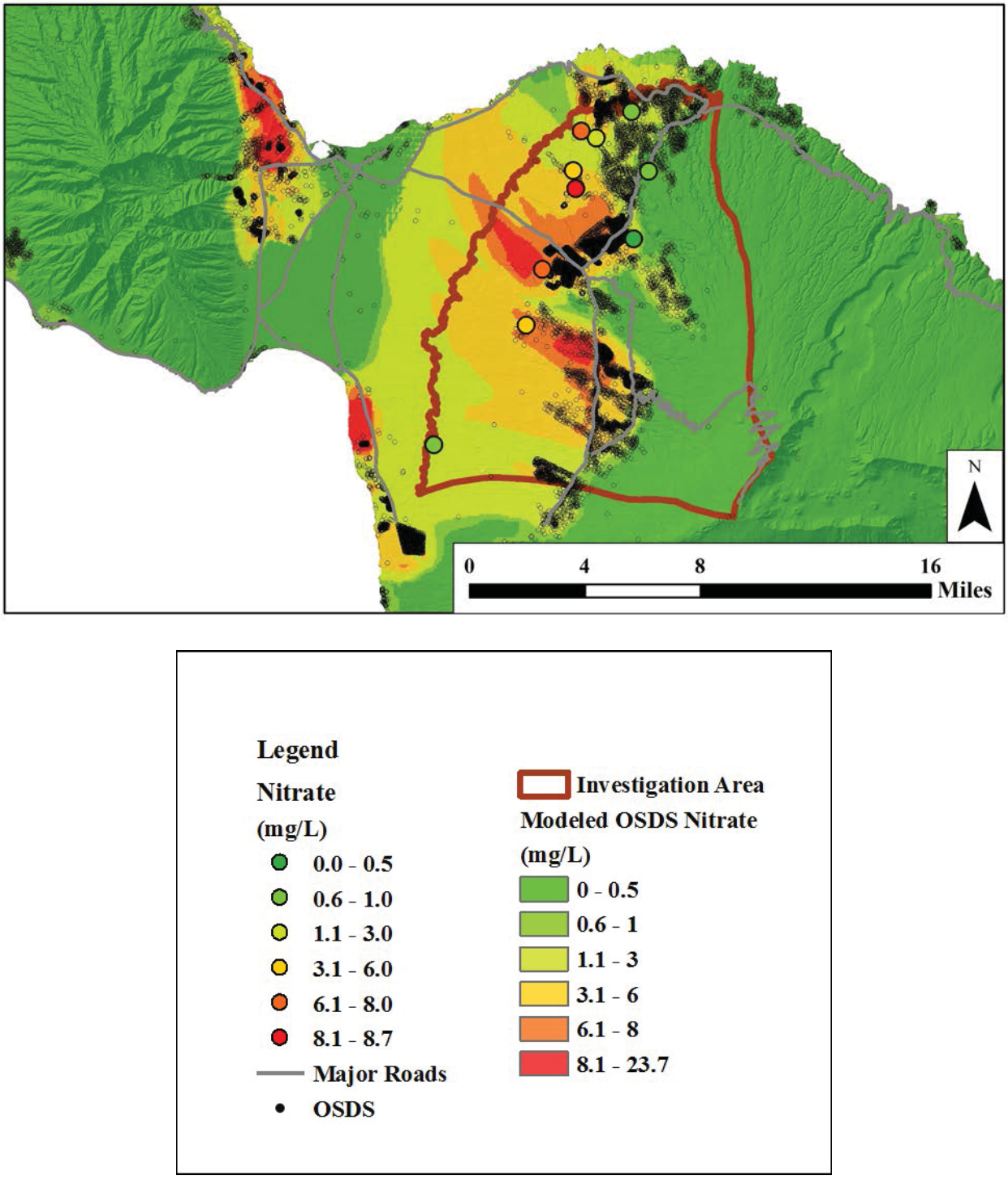


Figure 2-5. The Measured Groundwater Nitrate Concentration Compared to the Modeled Groundwater Nitrate Concentration From OSDS Discharge

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SECTION 3 SAMPLING AND ANALYSIS PLAN

3.1 INTRODUCTION

The approach to evaluating the source(s) of elevated groundwater nitrate in Up Country Maui consists of a single round of groundwater sample collection from the study area wells. Key to determining the source of the nitrate contamination is to characterize the spatial distribution of the nitrate contamination and analyze the isotopic composition of the dissolved nitrate. Multiple studies have shown that animal waste (including wastewater) is elevated in nitrogen with an atomic weight of 15 (see Section 3.3.3.2 for more discussion on nitrogen isotopes). Understanding groundwater flow paths is also critical to linking points of known nitrate contamination to the source of this contamination. This will be done analyzing the major ion, and oxygen and hydrogen isotopic composition of the groundwater. See Section 3.3.3.2 for more details. The results of these approaches will be consolidated and evaluated to determine the most likely source of the nitrate contamination in the groundwater in Upcountry Maui.

3.2 NON-SAMPLING ACTIVITIES

3.2.1 Planning and Site Reconnaissance

Prior to initiating field activities the sampling points must be identified and the permission for access obtained. Since OSDS is a likely source of the elevated nitrate, the distribution of OSDS in Upcountry Maui was overlain on wells in this region. Twenty wells were identified as being good candidates for sampling. Of the wells identified, permission has been obtained to access 14 wells. Figure 3-1 shows the distribution nitrate PCAs and the wells this investigation proposes to sample, while Table 3-1 lists the wells and their owners for which access has been granted. Two wells, the Pulehu Farms Well and the Hailimaile Well are currently out of service due to having no power. If this problem is resolved these wells will also be sampled. Also, only one of the Hamakuapoko Wells will be sampled since they are co-located.

Site reconnaissance will include doing a roadway survey of potential sources of nitrate contamination. The nitrate PCAs identified in Figure 2-3 will be visited to the extent practical to evaluate the degree to which they may be contributing nitrate to the groundwater. For example, 12 animal feedlots are suspected to be in the investigation area. To the extent practical, these lots will be visited to evaluate whether or not there is a sufficient nitrogen load to result in the significantly elevated nitrate in the groundwater in Upcountry Maui.

Table 3-1. List of Sampling Locations

Well No.	Well Name	Owner/Operator	Use	Comments
6-5320-002	Maunaolu 1	David Woodham/Purall	Drinking Water	
6-4821-001	Omaopio-Esty	Edward Esty/Purall	Drinking Water	
6-5418-002	Kuiaha-Smith	Smith Development/Purall	Drinking Water	
6-4424-001	Keokea Highlands 2	Maui Highlands Properties/Purall	Drinking Water	
6-5118-002	Pookela MDWS	Maui Department of Water Supply	Drinking Water	
6-5317-001	Kaupakulua	Maui Department of Water Supply	Drinking Water	
6-5320-001	Hamakuapoko 2	Maui Department of Water Supply	Drinking Water	
6-5419-001	Haiku	Maui Department of Water Supply	Drinking Water	
6-5420-002	Hamakuapoko I	Maui Department of Water Supply	Drinking Water	
6-5021-001	Pukalani Golf	Pukalani Golf Club, LLC	Irrigation	
6-5220-002	Baldwin Ranch Est. 1	Baldwin Ranch Estates	Drinking Water	No Pump Installed
6-4422-001	Waiohuli	Pacific Islands Water Science Center, USGS	Observation	No pump installed
6-4719-001	Pulehu Farms	Mark Walker (KSD Hawaii)/ITC Water Management	Drinking Water	Currently out of service
6-5220-001	Haliimaile	Maui Land & Pineapple Company, Inc	Irrigation	Currently out of service

3.3 GROUNDWATER SAMPLING

3.3.1 Sampling Rationale

Sampling activities include a single round of groundwater sampling in the Upcountry Maui wells. This section presents the rationale for identifying potential chemicals of concern, screening criteria, evaluating the groundwater chemistry and determining the probable source of the elevated nitrates.

3.3.2 Groundwater Sampling Equipment

Table 3-1 lists the groundwater sampling equipment that will be used during this investigation, the purpose, and preventive maintenance requirements.

Table 3-2. Groundwater Sample Collection Equipment Summary

Equipment	Purpose	Preventive Maintenance Requirements
YSI ProPlus Water Quality Analyzer	Document the water quality parameters of the samples collected including temperature, pH, specific conductivity, dissolve oxygen concentration, and oxidation reduction potential	Remove batteries for long term storage. See Appendix A, pages 58-68 for specific preventive maintenance requirements
Hach DR-820/90 Colorimeter and reagents	Screen samples for nitrate and nitrite concentration prior to delivery to the stable isotope laboratory	Remove batteries for long term storage and cleaning sample cells. See Appendix B-1, Page B1-27 for sample cell cleaning procedures
Geographic Position Survey Instrument	Document the location of sampling points and any PCAs observed during the investigation	None
Alkalinity Test Kit	Measure the acid buffering capacity of the groundwater	Clean glassware and titrator after use
HydraSleeves®	Used to collect samples from wells without pumps	None, single use only
HydraSleeves® Retrieval Mechanism	Deploy and retrieve HydraSleeves® samplers	Decontaminate between samples
Digital Camera	Provide photo documentation of field activities	Remove batteries for long term storage. Clean lenses daily when in use
Nitrile gloves	Used to protect the integrity of the samples from contamination	None, single use only
Spray bottle, laboratory detergent, and scrub brush	Decontaminate equipment that will be re-used. Primarily weight and hangers for HydraSleeves®	None

Equipment	Purpose	Preventive Maintenance Requirements
Coolers and chemical ice	Sample storage and preservation	

3.3.3 Chemicals of Concern, Nitrate Source Indicators, and General Groundwater Chemistry and Field Parameters

The focus of this project is to characterize the magnitude and distribution of nitrate in the Upcountry Maui groundwater. Thus the chemical of primary concern is nitrate. The next focus of this investigation is to determine the source of nitrates. This involves "finger printing" the groundwater nitrate to a probable source and evaluating the groundwater flow path from potential source areas to the drinking water well receptors. This is described in more detail in Section 3.3.3.2.

3.3.3.1 Nitrate and Other Groundwater Nutrients

Nitrate is the primary chemical of concern since it is a groundwater contaminant with a regulatory limit. The MCL for nitrate is 10 mg/L and the Baldwin Ranch Estates 1 Well is currently at nearly 90 percent of that limit. Total nitrogen in the groundwater is also of concern since other forms of dissolved nitrogen commonly oxidize to nitrate. For example, nitrite may be present in anoxic water, but will be transformed to nitrate should the water chemistry become aerobic. All of the major forms of inorganic dissolved nitrogen will be analyzed as total nitrogen. Although phosphorus is not a drinking water contaminant, elevated phosphorus frequently occurs where nitrate is also elevated. Should the contaminant plume extend to the coast, phosphate if present would be a contaminant to the coastal zone. Finally dissolved silica analysis will also be done. Dissolved silica can be useful in evaluating the geology the groundwater flows through. The DOH State Laboratory Division Environmental Health Analytical Services Branch (EHASB) will analyze the groundwater samples for ammonia nitrogen, nitrite+nitrate, total nitrogen, phosphorus, and dissolved silica concentrations.

Nitrate is the contaminant of concern. However, the nitrogen cycle is complex and there is an exchange between nitrogen species determined by such things as the oxidation/reduction potential of the water, microbial activity, and time. Figure 3-2, modified from Manahan (2004) Figure 6.10, shows the nitrogen cycle. Wastewater nitrogen would enter the cycle in the block labeled "Nitrogen in organic manner such as NH_2 groups in protein". Through microbial action and oxidation most of the nitrogen will be converted to the nitrate, which is stable form in oxidizing groundwater. Intermediate steps would include the ammonium (NH^+_4) and nitrite (NO^-_2) species. Since the sources of nitrogen are 1,000 ft or more above the water table it is highly probable that nitrate will dominate the dissolve nitrogen species. However, analysis will be done for all major inorganic nitrogen species and total nitrogen.

3.3.3.2 Nitrate Source Indicators

Three groundwater chemistry approaches will be taken to determine the source of the nitrate contamination:

1. Finger printing the nitrate source using stable isotopes of nitrogen and oxygen that make up nitrate;

2. Use stable isotopes of hydrogen and oxygen to evaluate the upgradient extent of the zone of contribution to the well; and

3. Correlating the composition of the dissolved solids in the groundwater with land use activities to evaluate the path that groundwater travels from zones of recharge to zones of well capture.

Stable Isotopes of Nitrate

The purpose of this investigation was to identify to the extent practical the source of the elevated nitrates Upcountry Maui groundwater. The potential sources include: 1) leaching of fertilizers; 2) contamination of groundwater by wastewater; and 3) leaching of livestock and other animal waste products. Discriminating between the sources cannot be done by measuring the nitrate concentration alone. However, nitrate sources differ in the isotopic composition of nitrogen and oxygen. Fertilizer and animal wastes are isotopically heavier than fertilizer and natural nitrogen sources (Kendall and McDonnell, 1998). Commonly, the isotopic composition of nitrogen is expressed as the ratio the nitrogen-15 isotope to the nitrogen-14 isotope in the water sample compared to the same ratio in atmospheric nitrogen. This is expressed as a delta-^{15}N value ($\delta^{15}N$) (Kendall and McDonnell, 1998). Since nitrate contains atoms of oxygen, the isotopic composition of this element is also of interest. For oxygen the ratio is that of the heavy and rarer isotope, oxygen 18, to that the common isotope, oxygen 16. Similar to nitrogen, the ratio is symbolized by a $\delta^{18}O$ value.

Figure 3-2 graphs the representative $\delta^{15}N$ and $\delta^{18}O$ values for likely sources for nitrate including:

- Naturally occurring nitrate in rain and soil,
- Fertilizers,
- Animal waste, and
- Wastewater.

A process called "denitrification" can also influence the isotopic composition of nitrate, by bacteria using nitrate as a nutrient source while decomposing organic carbon. Denitrification bacteria preferentially utilize the lighter isotopes of nitrogen and oxygen resulting in the remaining nitrate being isotopically heavier than the starting composition. This process is shown as the denitrification line on Figure 3-2. While the isotopic composition of the remaining nitrate would get heavier, the nitrate concentration would decrease since the process converts nitrate to nitrogen gas. The expected results of denitrification of fertilizer nitrate would be a low concentration of isotopically heavy nitrate.

The nitrate stable isotope analysis will be done at the Biogeochemistry Laboratory at the University of Hawaii at Manoa, Honolulu, Hawaii. The isotopic composition of nitrate will be analyzed using the bacterial conversion of aqueous nitrate to gaseous nitrous oxide. The isotopic composition of the nitrous oxide will then be quantitatively measured using an isotope ratio mass spectrometer. Details of this process are described in Appendix C.

Stable Isotopes of Oxygen and Hydrogen in Water

Stable isotope analysis of the groundwater can be used to estimate the recharge elevation that water captured by a well. Water contains the common isotopes of hydrogen (^{1}H) and oxygen (^{16}O) with an atomic weight of 1 and 16 respectively. Water is also made of other minor but heavier isotopes. For this study we are concerned about the ratio of the hydrogen isotope with an atomic weight of 2 (^{2}H) and of oxygen with atomic weight of 18 (^{18}O) to the common isotopes ^{1}H and ^{16}O. The ratio of the heavy isotopes to the light isotopes, referred to as delta deuterium ($\delta^{2}H$) and delta 18O ($\delta^{18}O$), are affected by the physical environment and the processes such as evaporation and precipitation that the water is subjected to. These processes are energetic and favor the light isotopes during evaporation and heavy isotopes during precipitation. The end result is that as precipitation moves upslope to the interior of our islands, the isotopic composition gets lighter in a predictable manner (Scholl et al, 1995 and 2002; Tillman et al., 2014; and Fackrell et al., 2016). This relationship can be used to estimate the elevation at which the groundwater was recharged and thus identify the extent upgradient that contributes water to the well (Scholl et al., 1995 and 2002; and Fackrell et al., 2016). The oxygen and hydrogen stable isotope analysis will be done at the Biogeochemistry Laboratory at the University of Hawaii at Manoa, Honolulu, Hawaii.

Major Ion Analysis

The major dissolved solids in groundwater, primarily dissolved ions, record a history of the interaction between water and the solid matrix during infiltration and groundwater transport. The groundwater chemistry is also a record of impact of anthropogenic activities on the land surface or shallow subsurface. For this investigation ions associated with wastewater and agricultural activities would be the highest concern. These include boron, chloride, sulfate, and potassium. Major ion analysis will also be a second check on the nitrate/nitrite and phosphate analysis since these species are part of the major ion analysis. Combined with the alkalinity analysis described below, the quality of the chemical analysis can be evaluated by computing the electrical charge balance of the water (Dever, 1997). The major ion analysis will be done at the University of Hawaii, Water Resources Research Center Water Quality Laboratory. The analysis will be done using ion chromatography.

Alkalinity Analysis

Alkalinity is an analysis of the acid buffering capacity of the groundwater. For this investigation it will be used as a parameter in evaluating the quality of the major ion analysis since alkalinity is a variable in the charge balance calculations. Alkalinity can also indicate if the groundwater has passed through a carbonate sequence or through a zone where natural attenuation of contamination has resulted in the respiration of carbon dioxide by the contamination remediation microbes. The alkalinity analysis will be done by DOH SDWB personnel using titration of dilute sulfuric acid. The details of this procedure can be found in Appendix D.

3.3.4 Field Chemistry

The field chemistry serves two purposes; 1) to characterize the basic water quality physical and chemical parameters, and 2) screen the nitrate/nitrite concentration in the sample water as a reference for the nitrate isotope analysis. The water quality parameters will be measured using a YSI ProPlus Water Quality Analyzer and include:

- Temperature,
- pH,
- Specific Conductivity,
- Dissolved oxygen concentration, and
- Oxidation/reduction potential (ORP).

3.3.5 Field Nitrite and Nitrate Analysis

The Biogeochemical Stable Isotope Facility (BSIF) at the University of Hawaii needs the nitrite and nitrate concentrations in the sample aliquot at the time the sample is frozen to determine specifics of the isotopic analytical process. This will be done after sample collection and just prior to freezing using a Hach DR890 Colorimeter. Nitrite will be analyzed for using Hach Method 8507, while nitrate will be analyzed using Hach Method 8309. The details for these procedures can be found in Appendix B-2 and B-3 respectively.

3.4 GROUNDWATER SAMPLING PROCEDURES

Samples will be collected from about 12 wells where the nitrate concentration is expected to range from background to near the MCL of 10 mg/L.

3.4.1 Groundwater Sampling – Pumped Wells

3.4.1.1 Well Purging and Water Quality Parameter Measurement

The sampling team will coordinate with well operators to collect samples. The well operator will start the pump and it will be run for a sufficient amount of time to clear the well of stagnant water. With production wells this will occur shortly after starting pump due to the large volumes pumping rates. Regardless the well will be purged for at least 5 minutes. At that point a series of water quality measurements will be taken with the water quality analyzer. Usually this will be done using the flow cell and tubing that are part of the water quality analyzer instrument package and described in Appendix A. The tubing will be connected to the sampling port of the pump but left disconnected from the flow cell. The valve for the sampling port will be opened slightly until the discharge rate is 1 to 2 liters per minute. Flow rates greater than this risk pressuring the flow, biasing the dissolved oxygen measurements, and damaging the dissolved oxygen probe. Once the flow is established the discharge tubing will be connected to flow cell with the WQA sonde inserted. Readings of temperature, pH, and specific conductivity will be taken once per minute until the change between readings less than 0.2 ^{o}C for temperature, 0.1 units for pH, and 5 percent for specific conductivity. When the purge parameters have stabilized, a final set of readings that include all WQA parameters listed in Section 3.2.4 will be taken and recorded on the Field Sampling Form (Appendix E, Form E-1) . The sampling port valve will then be shut and flow cell will then be disconnected from the sampling port. The samples may now be collected from the well.

3.4.1.2 Sample Collection

When the well has been purged for at least 5 minutes, groundwater samples will be collected from the wells. The fitting and tubing used during well purging and water quality parameter measurements will be

removed and a new-decontaminated fitting and length of tubing will be connected to the sampling port. The sampling port valve will be cracked and water will be allowed to flow through the fitting and tubing for about 0.5 minutes. A 0.45 micron filter will then be connected to the tubing and will be purged from about another 0.5 minutes. The sample containers can now be filled. All sample containers except those for alkalinity, oxygen and hydrogen isotope analysis will filled to the shoulder of the bottle. The containers for alkalinity, and oxygen and hydrogen isotope analysis will be filled to overflowing. The cap for these containers will then rinsed with sample water. The alkalinity, and oxygen and hydrogen isotope containers will then be capped and the bottles checked for head space bubbles. If a bubble is present, the containers will be uncapped and water added then recapped. This process will be continued until there is no headspace bubble in the alkalinity, and oxygen and hydrogen isotope bottles. When the sample containers are filled, the sample valve will be shut off and the fitting and tubing disconnected. These will then be placed in s container reserved for equipment that is to be decontaminated prior to the next use. Section 3.4.5 describes the sample containers and preservation need for the samples.

3.4.2 Groundwater Sampling – Wells without Pumps

Wells with no downhole pumps will be sampled with HydraSleeves. A HydraSleeve is a no-purge, depth specific sampling method that consists of a plastic sleeve suspended from a line with weight at the bottom (Appendix F). As the sleeve is lowered down through the water column, the orifice at the top remains closed due to hydrostatic pressure. When the sleeve is at the desired sampling depth the sleeve is raised about 3 ft at a rate of 1 ft per second or more then slowly lowered to starting depth. This process is repeated about 2-3 times to fill the sleeve. Details of HydraSleeve sampling procedures can be found in Appendix F. Table 3-3 lists the well construction details for the wells with no pumps. Prior to going to the field, the depth from the ground surface to the water table and to the open or screened interval of the well will be determined. A sufficient length on nylon line will placed on a retrieval reel and the depth to water for each well will be marked on the line. Dedicated lengths of line for each well will be cut so that the sleeve can be lowered to the desired depth without the reused portion of the line entering the water. This is to prevent cross contamination between wells and minimize the need for decontamination in the field. The dedicated line will be connected to the retrieval reel line and the sleeve and weight connected to HydraSleeve in accordance with procedures in Appendix F. The HydraSleeve will then be lowered to the desired sampling depth and jigged as described in Appendix F to open and fill the sleeve. The sleeve will then be retrieved and the sample bottles filled using procedures described in Appendix F. If more sample volume is needed a new sleeve will be used.

Table 3-3. Well Construction Data for Wells to be Sampled with HydraSleeves®

Well No.	Well Name	Well Elevation (ft msl)	Length of Solid Casing (ft)	Approximate Water Level (ft msl)	Sample Depth (ft below ground surface)
6-5220-002	Baldwin Ranch Est. 1	1047.9	1073	5.5	1075
6-4422-001	Waiohuli	1864	1834	5.6	1870

3.4.2.1 Sample Collection

The major difference between sample collection with a HydraSleeve and with a pump is in filtering the sample. The HydraSleeve Standard Operating Procedures (SOP) (Appendix F) gives the procedures for filling the sample containers. The only samples that require filtering are major ions and nitrogen isotopes. The aliquots for these analyzes can be filtered by attaching a funnel to the filter using a short length of tubing. The sample is dispensed from the HydraSleeve® into the funnel. A small amount of water is allowed flow onto the groundwater to purge the filter. The discharge from the filter will then be directed to the sample container. The funnel and connecting tubing will be decontaminated prior to sampling. The filters are single use only and will be disposed of after sample collection.

3.4.3 Sample Identification

A label will then be placed on the bottle containing the following information:

- Date of collection,
- Time of collection,
- Site name where the sample was collected,
- Whether or not sample was filtered,
- Analysis to be performed, and
- The name(s) of the sampler(s).

This information will also be recorded on the daily field sampling form, Form E-1 in Appendix E.

3.4.4 Sample Handling

Upon collection, samples will be labeled and stored in coolers with wet or chemical ice for transport from the field to the field office. While in the field office the ice will be changed frequently enough to ensure that the samples are cooled and maintained at a temperature of between 0 and 6 ^{o}C. Any wet ice will be changed out with chemical ice prior to transport of the samples by air. Samples to be analyzed by the DOH SLD EHASB will be shipped via overnight air freight. Samples to be analyzed by the other laboratories will be delivered the day after completion of the sampling. All samples will be place in shipping containers with chemical ice and shipped to Honolulu via overnight air freight or checked as luggage. The samples shipped via air freight will be picked up the following day and delivered to the laboratories for analysis.

Standard Chain of Custody (COC) protocol will be adhered to throughout the sample handling process, from collection to interisland transport, and delivery to the laboratory.

3.4.5 Sample Containers, Preservation Techniques, and Holding Times

Table 3-4 lists the containers, sample quantity, preservation method, and holding times for groundwater samples. The holding times are taken from current DOH guidelines.

Table 3-4. Recommended Sample Container, Preservatives, and Holding Times for Groundwater Samples

Constituents	Container	Volume	Field Preservation	Lab Preservation	Holding Time
Nitrate-Nitrite Nitrogen (NO2+NO3)	Brown HPDE	1 L	Cool below 6 °C	Freeze at <-20 °C (filtered)	28 days if frozen within 48 hours of sample collection
Ammonia Nitrogen (NH_4)	Brown HPDE	1 L	Cool below 6 °C	Freeze at <-20 °C (filtered)	28 days if frozen within 48 hours of sample collection
Total Nitrogen	Brown HPDE	1 L	Cool below 6 °C	Freeze at <-20 °C (unfiltered)	28 days if frozen within 48 hours of sample collection
Total Phosphorus	Brown HPDE	1 L	Cool below 6 °C	Freeze at <-20 °C (unfiltered)	28 days
Dissolved Silica	Brown HPDE	1 L	Cool below 6 °C	Cool below 6 °C	28 days
Nitrate Isotopes ($\delta^{15}N$ & $\delta^{18}O$)	White HPDE	500 ml	Cool below 6 °C	Freeze at <-20 °C	None when frozen
Water Isotopes ($\delta^{2}H$ & $\delta^{18}O$)	glass with septum	40 ml	None	None	None
Major Ion	Amber HPDE	125 ml	None	None	28 days
Alkalinity	Amber glass with septum	250 ml	Cool below 4 °C	Cool below 4 °C	As soon as practical, 14 days maximum
NO2/NO3 Screening Analysis	HPDE White	125 ml	Cool below 4 °C	Cool below 4 °C	48 hours

Note: Sample volume for Ammonia Nitrogen, NO3+NO2, Total Nitrogen, Total Phosphorus, and Dissolved Silica will be in the same 1 L brown HPDE container. The contents of this container will be frozen by the laboratory after an aliquot is extracted for dissolved silica analysis.

3.4.6 Sample Analysis

Groundwater samples will be analyzed for the constituents listed in Table 3-5 below. This table also lists the analyzing laboratories. The major dissolved inorganic nitrogen species will be analyzed for using EPA Method 353.2 (Nitrate + Nitrite) and EPA Method 350.1 (Ammonia Nitrogen). Since the groundwater table is 1000 ft or more below the ground surface, it is expected that the majority of the dissolved nitrogen (inorganic and organic) will be oxidized to nitrate. However, the presence of organic nitrogen will screened for using by analyzing the samples for the total dissolved nitrogen concentration. The digestion of samples with potassium persulfate under UV photo-oxidation oxidizes all forms of inorganic and organic nitrogen to nitrate (NO_3) which is then quantitatively reduced to nitrite (NO_2) by passing the digested sample through a cadmium reduction. Thus, there are two steps in the analysis; the digestion process and the actual analysis using an automated nutrient analyzer. The result is the total organic plus inorganic content of the samples. A significant difference between the Nitrate + Nitrite concentration and the Total Nitrogen concentration would indicate the presence of organic nitrogen. See Appendix G for details of the Total Nitrogen analysis.

Table 3-5. Groundwater Analysis Summary

Water Quality Parameter	**Method Number or Description**	**Analyzing Laboratory**
Nitrate + Nitrite Nitrogen (NO3+NO2)	EPA Method 353.2	Environmental Health Analytical Services Branch (EHASB)
Ammonia Nitrogen (NH_4)	EPA Method 350.1	Environmental Health Analytical Services Branch (EHASB)
Total Nitrogen	Photo-oxidation of organic nitrogen with ultraviolet light then nitrate analysis using EPA 353.1	Environmental Health Analytical Services Branch (EHASB)
Total Phosphorus	EPA Method 365.1	Environmental Health Analytical Services Branch (EHASB)
Dissolved Silica	EPA Method 370.1	Environmental Health Analytical Services Branch (EHASB)
Nitrate Isotope Analysis	Isotopic ratio mass spectrometry	University of Hawaii – Biogeochemical Stable Isotope Facility (BSIF)
Water Isotope Analysis	Cavity Ring-Down Spectrometry	University of Hawaii – Biogeochemical Stable Isotope Facility (BSIF)
Alkalinity Analysis	Hach Method 8203	SDWB Personnel

Water Quality Parameter	Method Number or Description	Analyzing Laboratory
Screening Nitrite Analysis	Hach Method 8507	SDWB Personnel
Screening Nitrate Analysis	Hach Method 8039	SDWB Personnel

3.5 ANALYZING LABORATORIES

3.5.1 Environmental Health Analytical Services Branch (EHASB)

The EHASB provides chemical and microbiological analytical services to DOH programs and to various federal, state and county agencies concerned with air pollution, drinking water, recreational waters, water pollution, and foods. EHASB evaluates and certifies laboratories involved in regulatory monitoring for contaminants in drinking water and dairy products. The EHASB laboratories are certified by the U.S. Environmental Protection Agency for the analysis of drinking water and by the Food and Drug Administration for the analysis of dairy products and shellfish. Below is the contact information for the EHASB:

Wanda Chang
EHASB Branch Chief
2725 Waimano Home Road,
Pearl City, Hawaii 96782
Phone: (808) 453-6671
Fax: (808) 453-6685
wanda.chang@doh.hawaii.gov

3.5.2 University of Hawaii – Biogeochemical Stable Isotope Facility

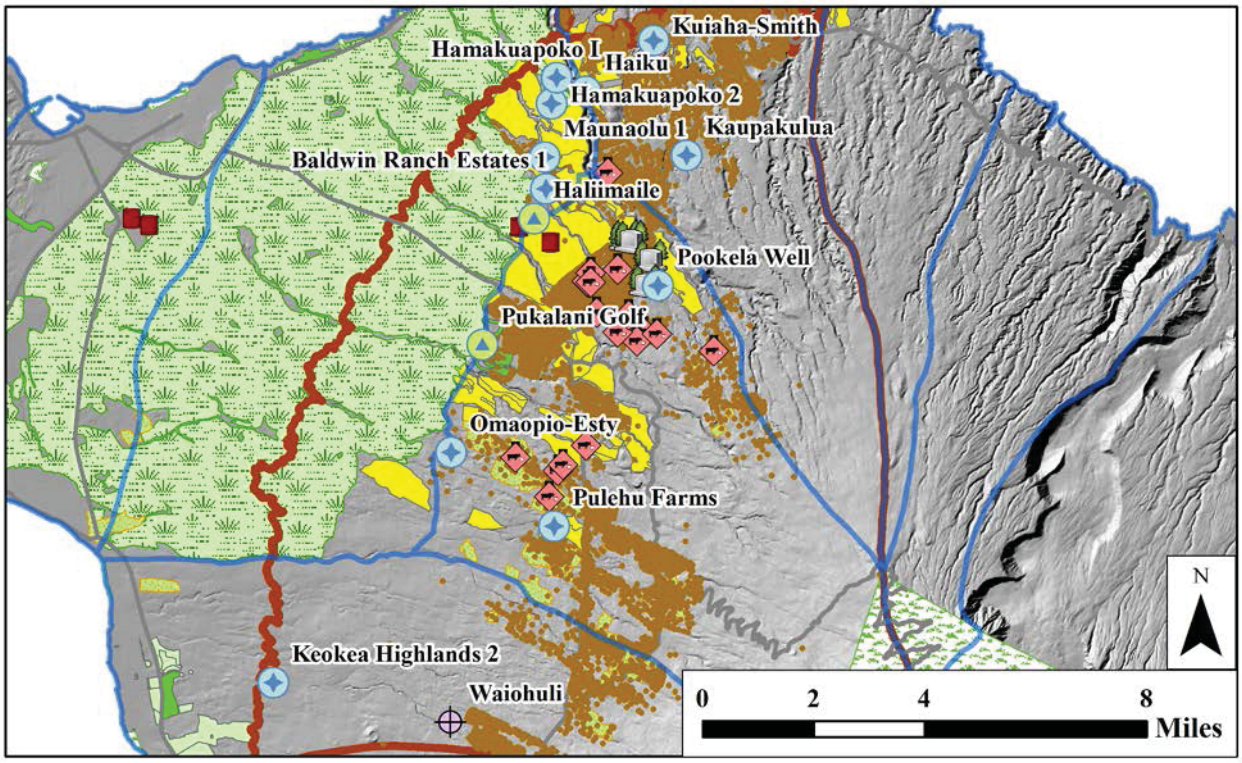
The University of Hawaii – Biogeochemical Stable Isotope Facility (BSIF) is a research facility that measures stable isotopes of carbon, nitrogen, hydrogen, and oxygen in a variety of solid, liquid, and gas samples. This analysis includes the stable isotopes making up nitrate ($\delta^{15}N$ and $\delta^{18}O$) and water ($\delta^{2}H$ and $\delta^{18}O$) that are critical to this investigation. The BSIF is part of the School of Ocean and Earth Science and Technology (SOEST) on the Manoa campus of the University of Hawaii. Below is the contact information for the BSIF.

Biogeochemical Stable Isotope Facility
School of Ocean and Earth Science and Technology
University of Hawaii at Manoa
1680 East-West Road. POST 726
Honolulu, Hi 96822
Lab Phone: 808-956-5362
Lab Fax: 808-956-5512
Lab email: isobiogeo@soest.hawaii.edu

3.5.3 University of Hawaii – Water Resources Research Center, Water Quality Laboratory

The WRRC Analytical Laboratory is housed in 700 sq. ft. of space in the engineering building, Holmes Hall, room 181. WRRC works closely with the department of Civil and Environmental Engineering, and, together, they have furnished the laboratory with up-to-date, and state-of-the-art, equipment for the analysis of environmental pollutants at trace levels of parts per million (ppm), parts per billion (ppb), and even parts per trillion (ppt). This includes Volatile and Semi Volatile Organic compounds like Petroleum Hydrocarbons, Industrial Solvents, Explosives, Pharmaceuticals & Personal Care Products (PPCPs), and Endocrine Disruptors like Organochlorine Pesticides, Polychlorinated Biphenyls (PCBs), Polynuclear Aromatic Hydrocarbons (PAHs) and dissolved inorganic solids.

Water Resources Research Center
Holmes Hall 283, 2540 Dole St.
Honolulu, HI 96822
Phone: 808-956-7847
Email: wrrc@hawaii.edu
Fax: 808-956-5044



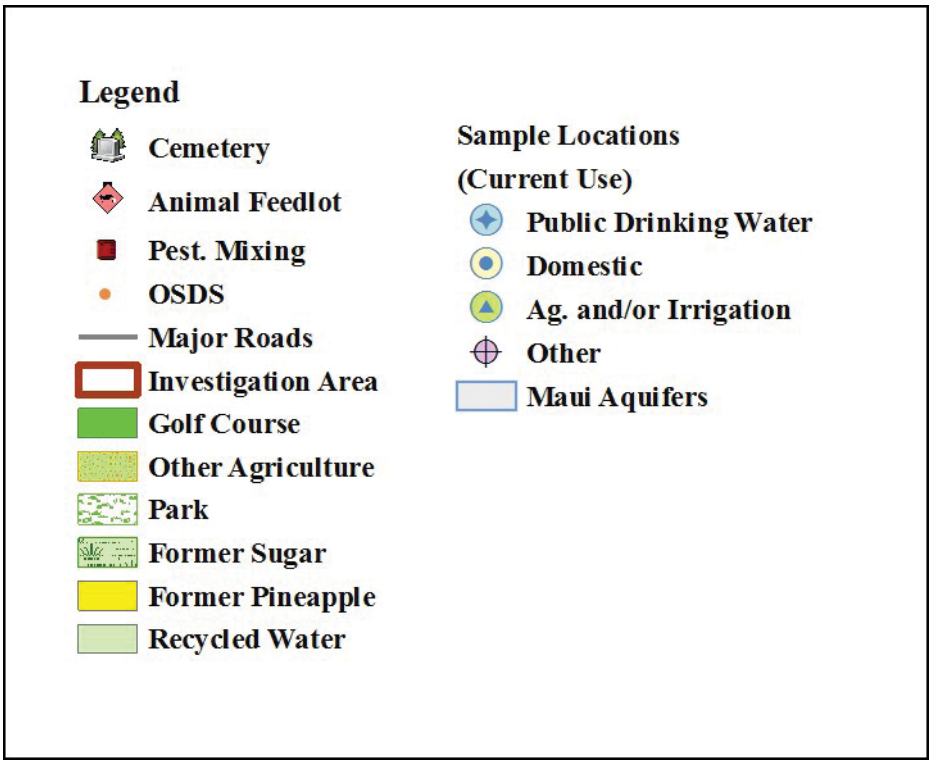


Figure 3-1. A Map of the Planned Sampling Locations and Nitrate PCAs

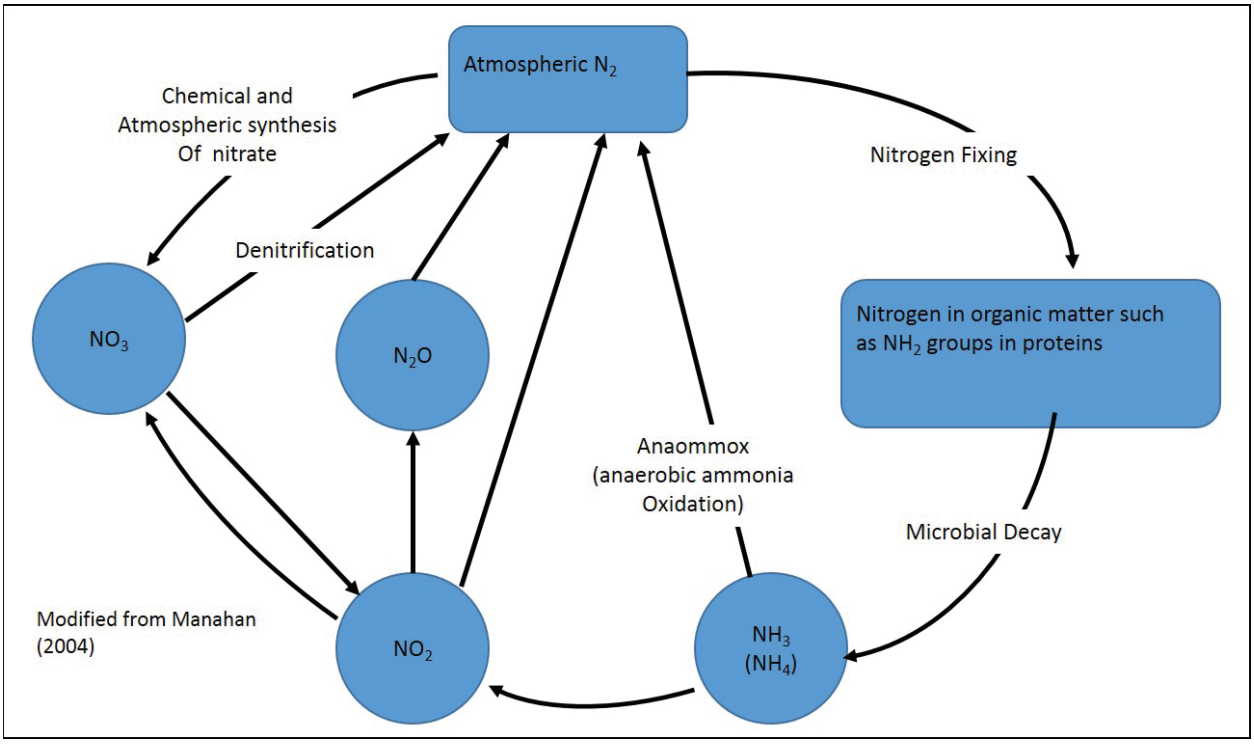


Figure 3-2. A Diagram of the Nitrogen Cycle Showing the Major Nitrogen Species

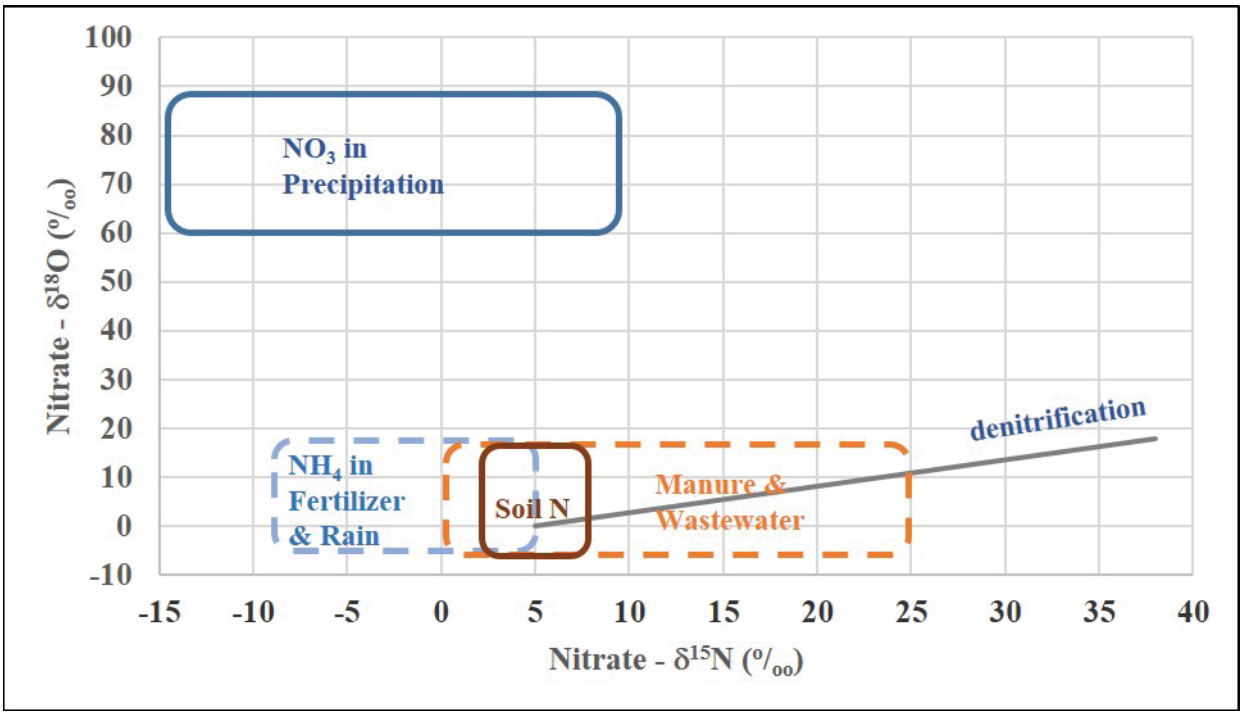


Figure 3-3. A Graph of $\delta^{15}N$ versus $\delta^{18}O$ and the Isotopic Composition Ranges of Different Nitrate Sources

SECTION 4
QUALITY ASSURANCE PROGRAM PLAN

4.1 INTRODUCTION

This section presents the Quality Assurance Project Plan (QAPP) for Upcountry Maui Nitrate Investigation sampling activities. This QAPP is intended to be used in conjunction with the Sampling and Analysis Plan (SAP) (Section 3) in order to ensure that all groundwater sampling and analysis activities included with this project are conducted in a manner consistent with industry standard methods and techniques in order to provide data representative of conditions present at the site. The QAPP includes discussions of the following:

- Sample collection, sample handling, and quality control procedures;
- Laboratory analytical and quality control procedures;
- Data reporting and documentation;
- Oversight and assessment; and
- Corrective actions.

4.2 DATA QUALITY OBJECTIVES

The primary objectives of this investigation and sample collection are to define the spatial distribution of elevated nitrate in Upcountry Maui and determine the most likely source(s) of the nitrate contamination. Analytical results will be compared to the more general distribution of nitrate and land use on Maui. The isotopic composition of the nitrate will be compared to various source end-members to determine the activities responsible for the contamination. The secondary objective of this investigation is to better define the groundwater flow paths from areas of recharge to capture by drinking water wells. Groundwater flow paths will be evaluated by correlating the groundwater inorganic chemistry with regional land uses and correlating the isotopic composition of the groundwater with the isotopic composition of rain fall on the leeward slopes of Haleakala as estimated by Scholl et al. (2002).

The usability of the data collected during this investigation will depend on its quality. A large number of sample collection and analysis process factors have the potential to impact the overall quality of the data generated. Adhering to proper sample collection techniques, observing and documenting sample custody protocols and using qualified laboratories and approved analytical methods will ensure that the quality of the data generated during the investigation will meet the project objectives.

4.3 SAMPLE COLLECTION AND SAMPLING HANDLING PROCEDURES

A copy of the investigation work plan, which outlines the appropriate field procedures, will be taken to the field by sampling personnel. Prior to sampling, this WP will be reviewed by DOH supervisors. All supplies and consumables will be inspected to endure they are acceptable for use and meet the quality requirements of this investigation. Sampling and sample handling procedures are designed to ensure that samples are consistently collected, labeled, preserved, and transported in a manner that maintains their integrity for their intended purposes.

4.3.1 Sample Collection Method

Samples will be collected in accordance with the procedures details in Section 3.3.

4.3.2 Sample Logs, Labeling, and Chain of Custody

Bound, paginated, and waterproof field notebooks will be maintained by investigation personnel to provide daily records of significant events, observations, and measurements during field tasks. Each sample container sent to the laboratories must have its own sample identification label as described in Section 3.

COC documentation (Appendix E, Form E-2 or similar) will be maintained for samples during all phases of sample collection, transport, and receipt at the laboratories.

A label will then be placed on the bottle containing the following information:

- Date of collection,
- Time of collection,
- Site name where the sample was collected,
- Whether or not it was filtered,
- Analysis to be performed, and
- The name(s) of the sampler(s).

This information will also be recorded on the daily field sampling form, Form E-1 in Appendix E.

4.3.3 Sampling Handling and Shipping

See procedures in Section 3.3.4.

4.3.4 Field Instrumentation

Refer to Section 3.2.2 and Table 3-2.

Preventive maintenance, calibration, and accuracy verification will be performed in accordance with the specifications of the respective manufacturers and described in Appendices A and B. Equipment will be properly stored when not in use.

4.3.4.1 Field Instrument Calibration

The only field equipment requiring calibration is the WQA. The WQA will calibration within 24 hours prior to its use in the field and daily while in use. An accuracy verification check will also be done within 24 hours after the last sample is taken to show that there was no instrument drift. If excessive drift is noted during the calibration tests or at the end of sampling accuracy verification, the data collected using the WQA back to the last valid accuracy verification test will be considered invalid for the parameter not meeting accuracy requirements. Table 4-1 below lists the parameters measured the calibration and drift requirements, and a reference to the procedure to perform the calibration. All calibrations except the dissolved oxygen shall use NIST traceable standards. The results of the WQA

calibrations and end of sampling accuracy validation will be recorded in paginated field notebook dedicated to field equipment QA/QC and on Form E-3 (Appendix E) or an electronic equivalent.

Table 4-1. Calibration and Drift Requirements and Procedures

Parameter	Units	Standard Solutions	Calibration Tolerance	End of Sampling Accuracy Tolerance	Corrective Action
Temperature	Degrees centigrade (°C)	Water bath approximately 25 °C compare with NITS traceable thermometer	+/- 0.5 °C	+/- 0.5 °C	Correct temperature data based on difference between WQA and thermometer
Specific Conductivity	Micro-siemens per centimeter (µs/cm)	Calibration standard of approximately 500 µs/cm (low value). Upscale check approximate 10,000 µs/cm or greater (upscale value)	Calibration +/- 2.5% Upscale +/- 5%	Low value +/- 5 % Upscale +/- 5%	If calibration value out of tolerance, clean probe and recalibrate. If upscale value out of tolerance compute correction function
pH	pH units (-log of hydrogen ion activity)	4, 7, 10 pH standard solutions	+/- 0.1 pH unit	+/- 0.2 pH units	If calibration fails, re-check with new solutions. If still out of tolerance, replace pH probe
Dissolved Oxygen	Per Cent (%)	100% water vapor saturation	+/- 5%	+/- 5	If calibration fails, clean probe surface, renew solution, and recalibrate
Oxidation/Reduction Potential	millivolts	Approximately 230 mv	+/-5%	+/- 5%	If calibration fails replace OPR probe

4.3.5 Equipment Decontamination

All equipment coming into contact with samples and that are reused during sampling will be decontaminated to prevent cross-contamination between samples. The reused equipment will be hangers and weights for the HydraSleeves, and tubing and connectors for sampling from production wells. Once used, the equipment will be segregated from the unused sampling equipment in a cooler marked "USED" so accidental re-use does not occur in the field. Upon return to the lab or maintenance area used equipment will be cleaned as soon as possible with a mixture of potable water and detergent. The detergent will be Alconox^{R} or another approved laboratory detergent. The equipment will be rinsed with potable water. Finally, the equipment will be given a final spray rinse with distilled water then placed in a rack to dry.

The Water Quality Analyzer, colorimeter sample cells, and the alkalinity glassware and titration tube, while not coming in contact with samples submitted for laboratory analysis, will still be decontaminated between sample collections. This will consist of a rinse with potable water followed by a spray down with purified water.

4.3.6 Acceptance of Supplies and Consumables

All field consumables will be inspected by the investigation personnel prior to use and discarded if 1) the integrity has been altered, 2) standards are past their expiration dates, and 3) there is a possibility that using the consumable will sacrifice the integrity of the sampling effort.

4.4 SAMPLING QUALITY CONTROL AND CORRECTIVE ACTION

Field and laboratory QC samples will be collected and analyzed in accordance with accepted analytical and scientific procedures consistent with information gathering investigations.

4.4.1 Field Quality Control

Quality assurance of samples collected in the field will be ensured through the use of trained sampling personnel, documented and standardized procedures, collection of field QC samples, replicate analysis of non-laboratory analyzed samples, and accuracy verification of field analysis equipment.

4.4.1.1 QC (Blind Duplicate) Samples

Field duplicates are two (or more) field samples taken at the same time in the same location. They are intended to represent the same sample population and are taken through all steps of the analytical procedure in an identical manner. These samples are used to assess precision of the entire data collection activity, including sampling, analysis, and site heterogeneity.

Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and are treated in an identical manner during storage, transportation, and analysis. The samples may be either collocated samples or subsamples ("sample splits") of a single sample collection. The sample containers are assigned a unique identification number in the field. Specific locations should be designated for collection of field duplicate samples prior to the beginning of sample collection. A minimum of one duplicate or replicate sample shall be included for each two sampling days during the

sampling program. Any duplicate sample analysis with a difference greater than 10 percent will have that difference noted in the remarks and a "D-" flag qualifier listed in the results table.

4.5 LABORATORY ANALYTICAL PROCEDURES AND QUALITY ASSURANCE MEASURES

4.5.1 Nutrient Analysis

The nutrient analysis will include the major nitrogen species, Ammonia, Nitrate+Nitrite, Total Phosphorus, and Dissolved silica. This analysis will be done using EPA standard colorimetric methods. See Table 3-5 for details.

4.5.2 Ion Chromatography

The major ion analysis will be done using EPA method 300.1 is for anions: DETERMINATION OF INORGANIC ANIONS IN DRINKING WATER BY ION CHROMATOGRAPHY https://www.epa.gov/sites/production/files/2015-08/documents/method_300-1_1997.pdf . Although there is no EPA method, the cation analysis will also use ion chromatography. This analysis will be done on dual Thermo Scientific/Dionex ICS-1100 ion chromatographs, one for anions, and one for cations. Calibration is performed using NIST traceable standard solutions provided by Thermo Scientific.

4.5.3 Nitrate Isotope Analysis

The isotopic composition of aqueous nitrate is measured after bacterial conversion to nitrous oxide using isotope ratio mass spectrometry at the University of Hawaii, Biogeochemical Stable Isotope Facility (BSIF) in Honolulu, Hawaii. Accuracy if verified using solutions of international isotopic reference materials (USGS 32, USGS 34, NIST 3, and USGS 35 when measuring the $\delta^{18}O$) and an in-house standard that has been characterized against those reference materials and verified via inter-laboratory comparison are analyzed in duplicate alongside samples using the exact same treatment principle. The measured values of those reference materials are then used to determine the isotopic composition of the unknown samples (i.e. isotope ratio mass spectrometry). Details of this analytical method are outlined in McIlvin and Casciotti (2011), Appendix H.

4.5.4 Water Isotope Analysis

The water isotope analysis will also be done at the BSIF. Isotopes in water samples will be evaluated using Cavity Ring-Down Spectrometry, and values comparable with the Isotopic Ratio Mass Spectrometry were obtained (Godoy et al., 2012). Cavity Ring Down Spectrometry (CRDS) is a direct absorption technique with a significantly higher sensitivity than conventional absorption spectroscopy. CRDS is based on light circulating in an optical cavity and measures of the rate of absorption, rather than the magnitude of absorption, of that light. Three in-house standards of varying $\delta^{2}H$ & $\delta^{18}O$ composition that have been characterized using international standards waters from the International Atomic Energy Agency for interlab comparison. These standards are run between every 10-12 samples. The "check sample" is Evian bottled water that was transferred to a glass crimp seal vial at time of characterization and is also analyzed every 10-12 samples. The results are processed using Picarro's post-process software "Chemcorrect" to flag for organic contamination. See Appendix H.

4.6 NON-LABORATORY ANALYTICAL PROCEDURES AND QUALITY ASSURANCE MEASURES

This investigation will involve chemical analysis not done in the laboratory or in the field. These analysis include screening analysis for nitrite and nitrate concentration to provide the BISF with the sample chemistry data needed to facilitate the nitrate isotope analysis. Also included in this category is the alkalinity analysis of the groundwater samples.

4.6.1 Colormetric Analysis

Colormetic analysis will be done to screen the water samples for nitrite and nitrate concentrations prior to the nitrate isotope analysis. These analyses will be done with a Hach DR820/90 colorimeter and premeasured Hach reagents.

4.6.1.1 Colormetric Accuracy Verification

The accuracy of the colormetric analysis will be verified using standard solutions for nitrite and nitrate. The target accuracy is +/- 10% agreement between the colorimeter readout and standard solution concentration. Document the results of the accuracy tests in a paginated field note book for dedicated to this purpose and on Form E-4 of Appendix E or an electronic equivalent.

- Nitrite - prepare a standard solution with a concentration of 0.1 mg/L NO2-N in accordance with procedures in Appendix B-2, page 342. Run analysis in accordance with procedures in Appendix B-2, pages 339-340. If the difference is greater +/-10% note the difference in percent and correct the sample concentrations accordingly.

- Nitrate - use the standard solution method described on page B3-5. Run the analysis in accordance with procedures on pages B3-1 through B3-4. If the difference in concentration is greater than +/-10% perform a Standard Adjust in accordance with procedures on Page B3-5.

4.6.1.2 Nitrite Analysis

The BISF needs to know the nitrite and nitrate concentration of the sample prior to doing the nitrate isotope analysis. This analysis will typically be done just prior to delivery of the samples to the laboratory. If the laboratory is unable to analyze the samples immediately (which is usually the case) the samples will be frozen to prevent any nitrogen chemistry change in the samples. The nitrite analysis will be done using Hach Method 8507, which is the reaction between nitrite and sulfanilic acid to form an intermediate kiazonium salt. This couples with chromotropic acid to produce a pink colored complex. The Hach DR890 converts the intensity of the pink color to a nitrite concentration. Details of this procedure can be found in Appendix B2.

4.6.1.3 Nitrate Analysis

Nitrate analysis will be done using Hach Method 8039, which is the reduction of nitrate to nitrite using cadmium reduction. This produces an amber colored diazonium salt, the color intensity of which is converted to a nitrate concentration by the Hach DR-820/90 Colorimeter. Details of the analysis can be found in Appendix B3.

4.6.2 Alkalinity Titration

Alkalinity is a measure of the acid buffering capacity of the water. It is also an indirect measure of the concentration of the common carbonate species, carbonate, bicarbonate, and carbonic acid. Alkalinity analysis is done to characterize the chemistry of the groundwater, screen for microbial mediated remediation that may be occurring, and providing the concentration of a major ion to compute the ionic charge balance. In the presence of oxygen microbial remediation of organic contamination results in respiration of carbon dioxide increasing the alkalinity of the groundwater (Wiedemieir et al., 1999). To assess the quality of the major ion analysis, a charge balance calculation is done to see how closely the total cation and anion charges balance. Since water has a net charge of zero the charges should be equal and opposite. The alkalinity analysis is done using Hach Method 8203, which is quantitative titration of the water sample with sulfuric acid. Sulfuric acid is added to the water to pre-determined pH end points indicated by pH color indicator solution. The details of this analysis can be found in Appendixes D1 and D2.

4.7 LABORATORY QUALITY ASSURANCE MEASURES

4.7.1 Environmental Health Analytical Services Branch (EHASB)

Currently, the EHASB performs all non-isotope laboratory analysis for the water contamination/pollution programs. The EHASB has a formal quality control (QC) program as well as Quality Assurance Officers for chemistry on staff to ensure that the proper QA/QC procedures are carried out.

The laboratory control samples will be analyzed the by the EHASB concurrently with the samples collected during this investigation.

Laboratory QC checks will include the following QC samples:

- Calibration verification,
- Laboratory Duplicate,
- Method blanks, and
- Matrix spike.

4.7.1.1 Calibration Verification

The analytical instruments will be challenged for accuracy using traceable standards of known concentration. Standards will be run prior an analytical set and following an analytical set to confirm there was no drift of the analyzer accuracy.

4.7.1.2 Laboratory Duplicate

A Laboratory Duplicate (LD) sample is an internal laboratory split sample that is prepared and analyzed in a manner identical to that of the original project sample. The results will be used to evaluate the precision of the laboratory analyses. Results will be expressed as relative percent difference (RPD) between analytical results for the duplicate and the original sample.

4.7.1.3 Method Blank

A MB, or preparation blank, sample will consist of analyte-free deionized water or clean soil for analysis of aqueous or solid samples. The MB sample will be carried through each step of the analytical method. The MB data will be used to evaluate any laboratory contamination during analysis. MB samples will be analyzed and reported for each analytical batch.

4.7.1.4 Matrix Spike

A MS sample is an aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A MS sample is used to document the bias of a method in a given sample matrix. The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix. An extra aliquot of sample will be collected for MS analyses as required by the analytical laboratory. Samples for MS analysis will be designated on the COC form by field sampling personnel. The laboratory is not required to use the designated samples for MS/MSD analyses if the samples are batched with other samples and sufficient volume of other samples is available to perform MS analyses at the required frequency.

4.7.2 University of Hawaii, Biogeochemical Stable Isotope Facility (BISF)

Stable isotope analysis will be done at the University of Hawaii, BSIF in Honolulu, Hawaii. The paragraphs below describe the Quality Assurance Measures that will be taken for stable isotope analysis

The isotopic composition of aqueous nitrate is measured after bacterial conversion to nitrous oxide using isotope ratio mass spectrometry. Accuracy if verified using solutions of international isotopic reference materials (USGS 32, USGS 34, NIST 3, and USGS 35 when measuring the $\delta^{18}O$) and an in-house standard that has been characterized against those reference materials and verified via inter-laboratory comparison are analyzed in duplicate alongside samples using the exact same treatment principle. The measured values of those reference materials are then used to determine the isotopic composition of the unknown samples (i.e. isotope ratio mass spectrometry). Details of this analytical method are outlined in McIlvin and Casciotti (2011).

Isotopes in water samples will be evaluated using Cavity Ring-Down Spectrometry, and values comparable with the Isotopic Ratio Mass Spectrometry are obtained (Godoy et al., 2012). Cavity Ring Down Spectrometry (CRDS) is a direct absorption technique with a significantly higher sensitivity than conventional absorption spectroscopy. CRDS is based on light circulating in an optical cavity and measures of the rate of absorption, rather than the magnitude of absorption, of that light. Three in-house standards of varying $\delta^{2}H$ & $\delta^{18}O$ composition that have been characterized using international standards waters from the International Atomic Energy Agency for interlab comparison. These standards are run between every 10-12 samples. The "check sample" is Evian bottled water that was transferred to a glass crimp seal vial at time of characterization and is also analyzed every 10-12 samples. The results are processed using Picarro's post-process software "Chemcorrect" to flag for organic contamination.

4.7.3 University of Hawaii, Water Resources Research Center, Water Quality Laboratory

The major ion analysis will be done using EPA method 300.1 is for anions: DETERMINATION OF INORGANIC ANIONS IN DRINKING WATER BY ION CHROMATOGRAPHY https://www.epa.gov/sites/production/files/2015-08/documents/method_300-1_1997.pdf. Although there is no EPA method the cation analysis will also be done using ion chromatography. This analysis will done on a dual Thermo Scientific/Dionex ICS-1100 ion chromatographs, one for anions, and one for cations. Calibration is performed using NIST traceable standard solutions provided by Thermo Scientific.

4.7.4 Analytical Data Quality Review

4.7.4.1 Accuracy

Accuracy is defined as the degree of agreement of a measurement to an accepted reference or true value. When applied to a set of observed values or measurements, accuracy will be a combination of random and systematic (bias) error. Analytical accuracy will be defined as the percent recovery (%R) of an analyte in a reference standard or spiked sample. Accuracy limits for the MS samples are established by individual laboratories. The acceptance criteria for accuracy are dependent on the analytical method, and are based on historical laboratory data. The percent differences (%Ds) of the continuing calibration is also an indication of accuracy. Sample results are qualifier codes "UJ" for non-detects and "J" for detects, if the %D for a continuing calibration is out of control. This will only apply to laboratory nutrient analysis (nitrite + nitrate, total nitrogen, total phosphorus, and dissolved silica).

4.7.4.2 Precision

Precision is defined as the agreement between a set of replicate measurements without assumption or regard about the true value. Precision limits for laboratory measurements will be evaluated from the sample/sample duplicate analyses results. Field sampling precision will be evaluated from field duplicate sample analyses results. The following criteria will be used to evaluate field duplicate samples:

- For analytes with the sample concentration greater than five times the detection limit, the duplicate sample results should agree within 15 percent for water samples.

- For analytes with either or both sample concentrations less than five times the reporting limit, duplicate sample concentrations should agree within five times the reporting limit.

The RPD measured between two duplicate samples will serve as the quantitative measure of precision. Precision for sampling is evaluated separately from precision for analytical data. Field collocated samples help clarify the distinction between uncertainty due to analytical variability and heterogeneity of the sample matrix. These field duplicates are collocated samples from the same locations and at the same time as the original samples.

Laboratory duplicate samples, MS and Lab Duplicate analyses results will be used to assess analytical precision.

4.7.4.3 Completeness

Completeness is defined as the overall percentage of valid analytical results (including estimated values) compared to the total number of analytical results reported by the laboratory. The completeness goal for this project will be 90 percent. Successful completion of data acquisition can only be accomplished if both the field and laboratory portions of the project are performed according to the procedures described in the QAPP.

4.7.4.4 Representativeness

Representativeness is the degree that data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness will be achieved by conducting sampling in compliance with the sample collection procedures described in the SAP (Section 3). The SAP sections details preliminary sample points; however, once on site, the number of samples collected at the investigation site will be reassessed to insure that the site is adequately sampled. Sample locations will be biased towards areas where OSDS modeling and historical data indicate that groundwater is most likely to be impacted by elevated nitrate. A sufficient number of samples will be collected outside of the expected impacted area to characterize non-contaminated aquifer conditions.

The sampling design includes the wells in the region of concern that span a range of expected nitrate concentrations from background to near the MCL. The wells sampled cover the area the OSDS groundwater nitrate model indicates are likely to be affected by the large concentrations of OSDS in this area.

4.7.4.1 Comparability

Comparability expresses the confidence with which one data set can be compared to another. Comparability can be related to accuracy and precision because these quantities are measures of data reliability. Data are considered comparable if collection techniques, measurement procedures, methods, and reporting are equivalent for the samples within a sample set. Comparability for sampling will be determined to be acceptable based on the following criteria:

- A consistent approach to sampling was applied throughout the investigation;
- Samples were consistently preserved; and
- Sampling was performed during the same time of year and under similar physical conditions.

4.8 DATA REPORTING AND DOCUMENTATION

The analyzing laboratories will prepare and provide analytical and QC documentation. For this project, the following reporting requirements will be required so that a data review independent of the laboratory can be performed as described below. The following items present the key components of the hard copy deliverables:

- Original copy COC forms (or certified copies)
- Cover sheet listing the samples included in the report and narrative comments describing problems encountered during analysis

- Tabulated presentation of analytical results and any laboratory assigned data qualifiers (data qualifiers will be defined and documented in the case narrative)
- Tabulated presentation of laboratory QC analysis.

Required records include:

- Field Sampling Form (Appendix E, Form E-1)
- Chain of Custody Form (Appendix E, Form E-2
- WQA Calibration Record (Appendix E, Form E-3
- DR820/90 Accuracy Verification Form (Appendix E, Form E-4)
- Field notes that describe all field activities, personnel participating, site conditions, and weather in a paginated waterproof note book.

The records will be maintained in the project folder for at least one-year.

4.9 OVERSIGHT AND ASSESSMENT

The QA/QC protocols and procedures presented in the WP will be implemented for all project activities. The plans and procedures implemented in the field and laboratory will be evaluated by direct oversight of activities, surveillance, and review of documentation and data. The oversight and assessment of project activities will be performed by the QA Manager or designee. If problems or incidences of nonconformance are identified, the following sections identify personnel who will deal with them and corrective measures that will be implemented.

4.10 CORRECTIVE ACTION

The ultimate responsibility for maintaining quality throughout the investigation rests with the Upcountry Maui Nitrate Investigation Project Manager. The day-to-day responsibility for ensuring the quality of field and laboratory activities rests with the Upcountry Maui Nitrate Investigation Field Manager.

When errors, deficiencies, or out-of-control situations exist, the QA program provides systematic procedures, called "corrective actions," to resolve problems and restore proper functioning to the analytical system. Laboratory personnel are alerted that corrective actions may be necessary if QC data are outside the acceptable limits for precision and accuracy.

Corrective action procedures are often handled at the bench level by the analyst, who checks the instrument calibration, and verification standards. If the problem persists or cannot be identified, the matter is referred to the QA manager or Project Manager for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA Manager.

Corrective action is dictated by the type and extent of the non-conformance. Corrective action may be initiated and carried out by non-supervisory staff, but final approval and data review by management is necessary before reporting any information. All potentially affected data must be thoroughly reviewed for acceptance or rejection.

Samples are monitored closely so that they can be analyzed within the recommended holding time. However, should a sample be analyzed outside of holding time, a Holding Time Violation Notification is filled out and the QA Manager is informed immediately.

The QA and Project Managers share the responsibility of reviewing all laboratory analytical activities to ensure compliance with the QC requirements outlined in this QAPP. This review serves as a control function in that it should be conducted frequently so deviations from method requirements will be immediately identified and corrected.

4.10.1 Field Corrective Action

The Upcountry Maui Nitrate Investigation Project Manager will review the procedures being implemented in the field for consistency with the established protocols. Sample collection procedures (e.g., preservation, labeling, etc.) will be checked for completeness. When procedures are not strictly in compliance with the established protocol, the deviation will be documented and reported to the Upcountry Maui Nitrate Investigation Project Manager. Non-conformances will be expeditiously identified and controlled. No additional work that is dependent on a nonconforming activity that potentially affects data quality will be performed until the identified nonconformance is corrected.

Corrective actions will be defined by the Upcountry Maui Nitrate Investigation Project Manager and documented as appropriate. After implementation of the corrective action, the Field manager will provide the Upcountry Maui Nitrate Investigation Project Manager with a written memorandum documenting field implementation. The memorandum will become part of the project files.

4.10.2 Laboratory Corrective Action

The Laboratory QA/QC Officer or designee will be responsible for initiating corrective action as necessary. Non-conformances or problems occurring at the laboratory will be reported to the Upcountry Maui Nitrate Investigation Project Manager within one working day of identification. Appropriate corrective action will be required if analyses of QC samples or laboratory conditions do not meet criteria specified in the respective methods, the Laboratory QAPP, or this WP.

The EHASB section supervisor or designee will review the laboratory data generated for this project to determine if project QA objectives are met. If any non-conformances are found in the laboratory analytical results or documentation procedures during data assessment and validation, the impact of those non-conformances on the overall project QA objectives will be assessed. Appropriate actions, including re-sampling, reanalysis, etc., may be recommended to the Upcountry Maui Nitrate Investigation Project Manager so that the project objectives can be achieved.

4.10.3 Corrective Action Following Data Assessment

The Project Manager or his designee will review the field and laboratory data generated for this project to determine if project QA objectives are met. If non-conformances are found in the field procedures, sample collection procedures, field documentation procedures, laboratory analytical and documentation procedures, or data review procedures, the impact of those nonconformance on the overall project objectives will be assessed. Appropriate actions, including re-sampling, reanalysis, etc., will be recommended to the Upcountry Maui Nitrate Investigation Project Manager so that the project objectives can be accomplished.

Table 4-2. Examples of Common Problems Encountered and Their Resolution

Issue	Resolution
COC form not completed properly or thoroughly	The QA manager will send revised COC form to laboratory, and contact field sampling team to make them aware of the deficiencies.
Not enough sample volume	Laboratory will notify field sampling team of efficiency and may require re-sampling.

4.10.4 Reports to Management

The QA Manager or Project Manager may request that a specific laboratory QA report be prepared, based on results of reviews and potential corrective actions. If required, the QA report will discuss the status of the project, including the results of performance and system audits, the results of data quality assessments, QA problems, and methods to resolve these problems.

Data will be reviewed to ensure it meets the following criteria for acceptability:

- Documentation is complete (calibration records, field sampling records, chain of custody for samples delivered to a laboratory);
- Calibration of instrumentation falls with an acceptable range and that calibration solutions are not expired and have been stored and maintained properly;
- Number of samples are sufficient to meet the project goals (i.e. regional distribution of nitrate and other nitrogen species, and $\delta^{15}N$);
- Duplicate sample and analysis results fall within acceptable range (+/- 10%)
- DR890 nitrite and nitrate Standards Check (+/-10%)

The data will be evaluated by comparing the nitrogen isotopic composition with that of known end members, primarily animal waste, fertilizers, and natural soil nitrogen similar to methods used by Dailer et al, 2010; and Hunt, 2014.

4.11 REPORTING REQUIREMENTS

4.11.1 Milestone Updates

Milestones for the project include:

1. *Assessment of available data* – Complete.
2. *Upcountry Maui Nitrate Investigation Work Plan* – Complete upon approval of this Work Plan.
3. *Material Procurement and Well Access Agreements* - will begin upon approval of the Work Plan and is expected to take 30 days.
4. *Groundwater Sampling* – will commence approximately 45 days after approval of the Work Plan (scheduled for the week of 17 July, 2017).
5. *Field Reconnaissance* – will commence with field sampling 45 days after approval of the Work Plan (scheduled for the week of 17 July, 2017).

6. *Groundwater Chemistry Analysis* – will be completed approximately 75 days after approval of the Work Plan
7. *Preliminary analysis and interpretations* – will be completed approximately 100 days after approval of the work plan.
8. *Draft Report* – will be completed approximately 120 days after approval of the work plan.
9. *Final Report* – will be completed approximately 160 days after approval of the work plan.

Figure 4-1 is a chart showing the milestones and the number of days after approval of the Work Plan that each milestone should be met.

4.11.2 Draft Nitrate Contamination Study Report

At the conclusion of the study DOH will produce a compressive draft report that will provide an accurate, unbiased, and scientifically-defensible report related to the source of nitrate contamination in Upcountry Maui This report will be reviewed by DOH and USEPA. All review comments will be addressed to the mutual satisfaction of all of the organizations involved.

4.11.3 Final Nitrate Contamination Study Report

The review comments from the review of the draft report will be incorporated into a final nitrate contamination study report

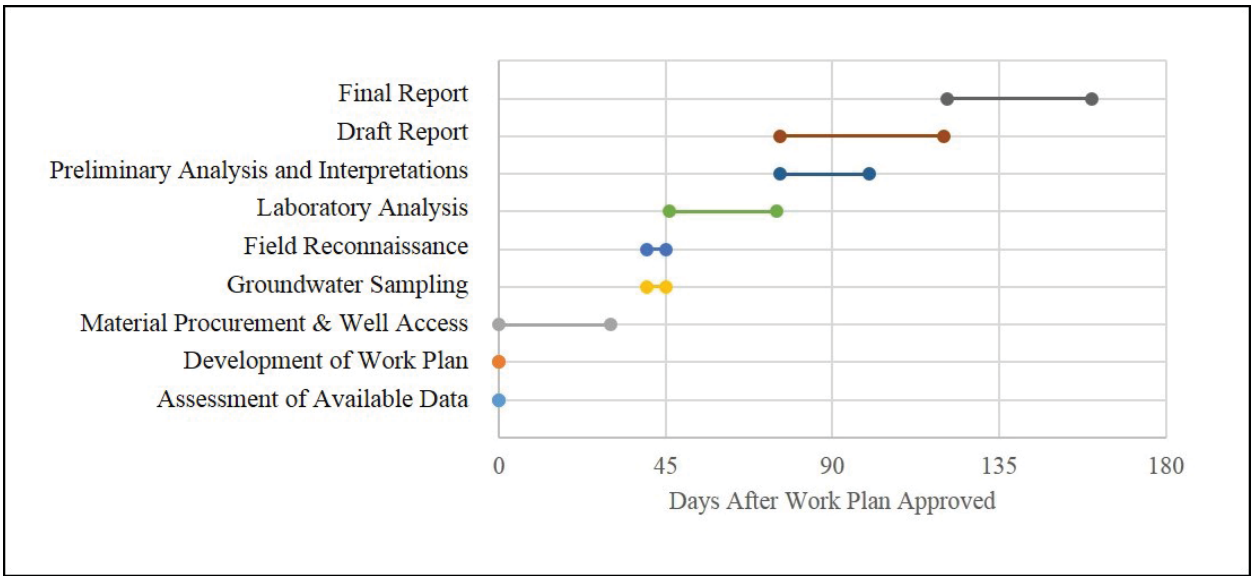


Figure 4-1. Milestones for the Upcountry Maui Nitrate Investigation

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SECTION 5
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APPENDIX A

YSI® ProPlus User's Manual

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YSI®

Professional *Plus*

USER MANUAL

Item # 605596
Rev D
Drawing # A605596
March 2009

CONTENTS

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WARRANTY

The YSI Professional Plus Instrument (Pro Plus) is warranted for three (3) years from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damage caused by defective batteries. Pro Plus field cables are warranted for two (2) years from date of purchase by the end user against defects in material and workmanship (6 months for non-field rugged cables*). Pro Plus sensors (pH, ORP, pH/ORP combo, Polarographic DO) are warranted for one (1) year from date of purchase by the end user against defects in material and workmanship (6 months for ammonium**, nitrate**, chloride**, and Galvanic DO). Pro Plus systems (instrument, cables & sensors) are warranted for 90 days from date of purchase by the end user against defects in material and workmanship when purchased by rental agencies for rental purposes. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937 767-7241, 800-897-4151 or visit www.YSI.com (Support tab) for a Product Return Form. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by:

1. failure to install, operate or use the product in accordance with YSI's written instructions;
2. abuse or misuse of the product;
3. failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
4. any improper repairs to the product;
5. use by you of defective or improper components or parts in servicing or repairing the product;
6. modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI's LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

* The warranty period for the non-field rugged cables (605107, 605177, 605108, 605178, 605109, 605179) is listed as 6 months. However, the true "working life" of these sensors may be 3-9 months depending on storage and usage in solutions other than clean aqueous samples.

** The warranty for the ammonium, nitrate, and chloride sensors (605104, 605105, 605106) is listed as 6 months. However, the true "working life" of these sensors may be 3-9 months depending on storage and usage in solutions other than clean aqueous samples.

INTRODUCTION

Thank you for purchasing the YSI Professional Plus (Pro Plus). The Pro Plus features a waterproof (IP-67) case, backlit display and keypad, user-selectable cable options, USB connectivity, large memory with extensive site list capabilities, and a rugged, rubber over-molded case.

Reading the entire manual before use is recommended for an overall understanding of the instrument's features.

GETTING STARTED

INITIAL INSPECTION

Carefully unpack the instrument and accessories and inspect for damage. Compare received parts with items on the packing list. If any parts or materials are damaged, contact YSI Customer Service at 800-897-4151 (+1 937 767-7241) or the authorized YSI distributor from whom the instrument was purchased.

BATTERY INSTALLATION

The Pro Plus requires (2) alkaline C-cell batteries which are included with the purchase of a new instrument. Battery life depends on parameters and usage. Under normal conditions, battery life is approximately 80 hours for continuous use at room temperature. To install or replace the batteries:

1. Turn the instrument over to view the battery cover on the back.
2. Unscrew the four captive battery cover screws.
3. Remove the battery cover and install the new batteries, ensuring correct polarity alignment on the instrument or the removed cover. (Figure 1)
4. Replace the battery cover on the back of the instrument and tighten the four screws. Do NOT over-tighten.

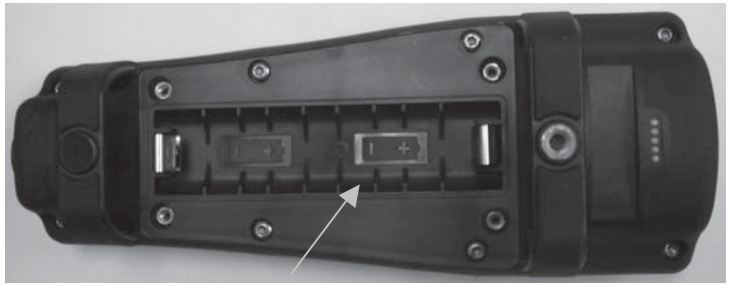


Figure 1. Pro Plus with battery cover removed. Notice battery symbols indicating polarities.

> *Batteries must be installed in the instrument even if powering the unit via the USB connection. This will retain the correct date and time if the PC is turned off. If the USB power is disconnected and there are no batteries in the instrument, the date and time will need to be reset upon subsequent power on.*

NOTE - On subsequent battery changes you will have approximately 2 minutes to change the batteries before the clock resets. If the clock resets, the instrument will automatically bring up the Date/Time menu the next time it is powered on in order to update this information. This is important, especially if you intend to log data!

SETUP

The Pro Plus instrument has several compatible field-rugged cable/sensor options, each with temperature:

Cable:	*Available Sensors:*
Cable number 60520-x	DO/temp (605780 for lab BOD)
Cable number 60530-x	Conductivity/temp
Cable number 60510-x	ISE*/temp
Cable number 6051010-x	ISE*/ISE*/temp
Cable number 6051020-x	ISE*/DO/temp
Cable number 6051030-x	ISE*/conductivity/temp
Cable number 6052030-x	DO/conductivity/temp
Cable number 605790-x	DO/conductivity/ISE*/ISE*/temp (Quatro**)

*ISE (Ion Selective Electrode) notates a port that can accept pH, ORP, Ammonium, Nitrate, Chloride, and, in some cases, a pH/ORP combination sensor.

**Cable 605790 will be referred to as a Quatro cable throughout this manual.

All cables come in standard lengths of 1, 4, 10, 20, and 30-meters (3.28, 13, 32.8, 65.6, and 98.4-feet) with options for special order lengths up to 100-meters (328-feet) on the 60520-x cables. Contact YSI or your local representative for additional information.

In addition there are several cable options with built in sensors for the measurement of pH and ORP that are not considered field-rugged (non-replaceable sensors, less rugged single-junction sensors). These cables are recommended for lab use or controlled conditions where a more rugged, field cable is not necessary. These cables include:

Cable number 605107	1-meter cable; single-junction pH sensor
Cable number 605177	4-meter cable; single-junction pH sensor
Cable number 605108	1-meter cable; single-junction ORP sensor
Cable number 605178	4-meter cable; single-junction ORP sensor
Cable number 605109	1-meter cable; single-junction pH/ORP sensors
Cable number 605179	4-meter cable; single-junction pH/ORP sensors

STANDARD PRO SERIES SENSOR INSTALLATION

Throughout the manual, the term "sensor" refers to the removable portion or electrode sensing portion of the cable assembly. For example, the DO sensor or pH sensor is the part that can be removed from a field cable and replaced with a new sensor. The conductivity sensor is not removable from a non-Quatro cable but still refers to the "sensing" portion and will be referred to as a sensor. This section covers most of the sensor installations on a Professional Series cable bulkhead including the following sensors:

2003 - Polarographic DO (black)	1001 - pH	1003 - pH/ORP	1005 - Chloride
2002 - Galvanic DO (gray)	1002 - ORP	1004 - Ammonium	1006 - Nitrate

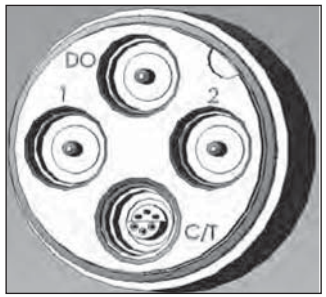
See the next section of this manual for installation instructions for the Quatro cable's Conductivity/Temperature sensor.

Dual sensor bulkhead ports are numbered 1 and 2, see figure to the left. Please refer to the following tables to determine correct sensor installation into each port of a two port cable.

	Port 1 Options	*Port 2 Options*
1010 dual cable	pH	pH
	ORP	ORP
	pH or pH/ORP*	pH or pH/ORP*
	ammonium	ammonium
	chloride	chloride
	nitrate	nitrate
		none (port plug)
* If using a 6051010 cable, a sensor must be installed in port 1 for correct operation. If you install a pH/ORP combo sensor into a 6051010 cable, ORP will not be measured. It is not recommended to use a pH/ORP combo sensor on a 6051010 cable.		

	Port 1 Options	*Port 2 Options*
1020 dual cable	pH	Polarographic DO
	ORP	Galvanic DO
	pH or pH/ORP	none (port plug)
	ammonium	
	chloride	
	nitrate	
	none (port plug)	
If using a 1020 cable, install a pH, ORP, pH/ORP, Ammonium, Nitrate or Chloride sensor in port 1 and a DO sensor in port 2.		

If using a 605103 pH/ORP combination probe on a 6051020 or 6051030 cable you can report both pH and ORP. However, it is recommended to set ISE1 as pH and ISE2 as ORP in the Sensor Setup menu.



The Quatro cable bulkheads are labeled 1, 2, DO, and CT, see figure to the left. All sensors except the Conductivity/Temperature sensor can be installed following the Standard Pro Series Sensor Installation instructions. Conductivity/Temperature sensor installation is described in the next section. For ease of installation, YSI recommends that you install a sensor into port 1 first; followed by DO installation, then port 2, and lastly C/T.

	Port 1 Options	*Port 2 Options*	*DO Port Options*	*CT Port Options*
Quatro Cable (pn: 605790)	pH	pH	Polarographic DO	5560 Conductivity/ Temperature sensor only
	ORP	ORP	Galvanic DO	
	pH or pH/ ORP*	pH or pH/ ORP*	none (port plug)	
	ammonium	ammonium		
	chloride	chloride		
	nitrate	nitrate		
		none (port plug)		
* If using a Quatro cable, a sensor must be installed in port 1 for correct operation of port 2. If you install a pH/ORP combo sensor into a Quatro cable, ORP will not be measured. It is not recommended to use a pH/ORP combo sensor on a Quatro cable.				

Before installing either dissolved oxygen sensor, the instrument must be configured for the sensor being installed. See the Setup - Dissolved Oxygen section of this manual for instrument configuration instructions. Failure to do this may result in damage not covered under warranty.

First, ensure both the sensor connector and sensor port on the cable are clean and dry. To connect the sensor, grasp the sensor with one hand and the sensor connection end of the cable (bulkhead) in the other. Push the sensor into the connector on the cable until it is properly seated and only one o-ring is visible. Failure to properly seat the probe may result in damage. Twist the sensor clockwise to engage threads and finger tighten (Figure 2). Do not use a tool. This connection is waterproof. Please refer to the sensor installation sheet that is included with each sensor for detailed instructions.

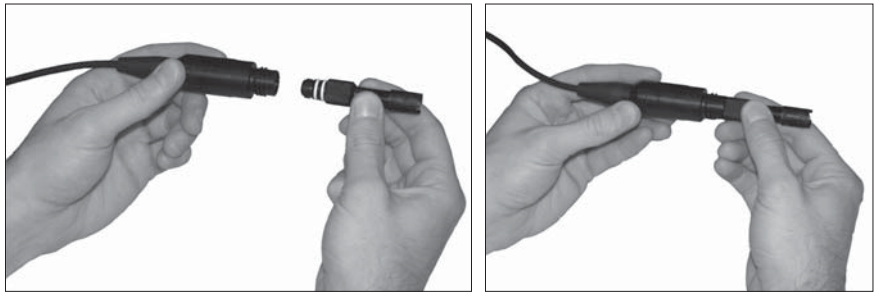


Figure 2. The image on the left shows a clean, dry sensor being aligned with the bulkhead. On the right, the sensor has been pushed into the bulkhead and is being screwed into place.

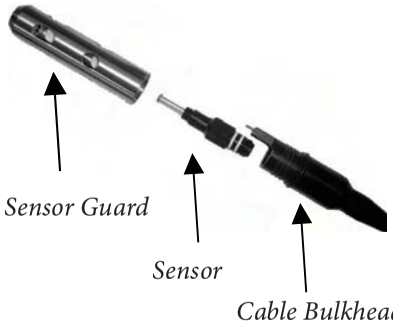


Figure 3. The sensor(s) will install directly in the cable bulkhead. Once installed, the sensor guard will protect the sensor during sampling (DO cap membrane not shown).

CONDUCTIVITY/TEMPERATURE SENSOR INSTALLATION IN A QUATRO CABLE

As mentioned, the installation of the Conductivity/Temperature sensor (model 5560) in a Quatro cable is different from all other Pro Series sensor installations. Follow these instructions when installing a conductivity/temperature sensor in a Quatro cable:

1. Locate the C/T port and, if replacing, remove the old sensor using the installation tool to loosen the stainless steel retaining nut. Once the stainless steel retaining nut has been completely unscrewed from the bulkhead, remove the old sensor from the bulkhead by pulling the sensor straight out of the bulkhead.
2. Apply a thin coat of o-ring lubricant (supplied with the sensor) to the o-rings on the connector side of the new sensor.

> *Visually inspect the port for moisture. If moisture is found, it must be completely dried prior to sensor installation.*

3. Align the connectors of the new sensor and the port. With connectors aligned, push the sensor in towards the bulkhead until you feel the sensor seat in its port. You will experience some resistance as you push the sensor inward, this is normal
4. Once you feel the sensor seat into the port, gently rotate the stainless steel sensor nut clockwise with your fingers, Do not use the tool.
5. The nut must be screwed in by hand. If the nut is difficult to turn, STOP, as this may indicate cross threading. If you feel resistance or cross threading at any point, unscrew the nut and try again until you are able to screw the nut down completely without feeling any resistance. Damage to your cable/sensor may occur if you force the parts together.
6. Once completely installed, the nut will seat flat against the bulkhead. At this point, use the tool that was included with the sensor to turn the nut an additional ¼ to ½ turn so it cannot come loose (figure 4). DO NOT over tighten.

> *Do not cross thread the sensor nut. Seat nut on face of bulkhead. Do not over tighten.*

Please refer to the sensor installation sheet that is included with the conductivity/temperature sensor for detailed instructions.

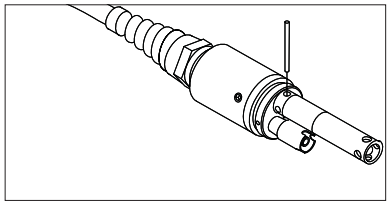


Figure 4. Installation tool used to tighten stainless steel retaining nut of 5560 conductivity/temperature sensor.

INSTALLING PORT PLUGS IN UNUSED PORTS

As necessary, install a port plug into any port that does not have an installed sensor. This will protect the bulkhead from water damage. Port plugs and a tube of o-ring lubricant are included with all Quatro cables. These items can be ordered separately if needed. To install a port plug, apply a thin coat of o-ring lubricant to the two o-rings on the port plug. After application, there should be a thin coat of o-ring lubricant on the o-rings. Remove any excess o-ring lubricant from the o-ring and/or port plug with a lens cleaning tissue. Next, insert the plug into an empty port on the bulkhead and press firmly until seated. Then, turn the plug clockwise to engage the threads and finger-tighten until the plug is installed completely. Do ***not*** use a tool to tighten the plug.

CONNECTING THE CABLE TO AN INSTRUMENT

To connect a cable, align the keys on the cable connector to the slots on the instrument connector. Push together firmly, then twist the outer ring until it locks into place (figure 5). This connection is water-proof.

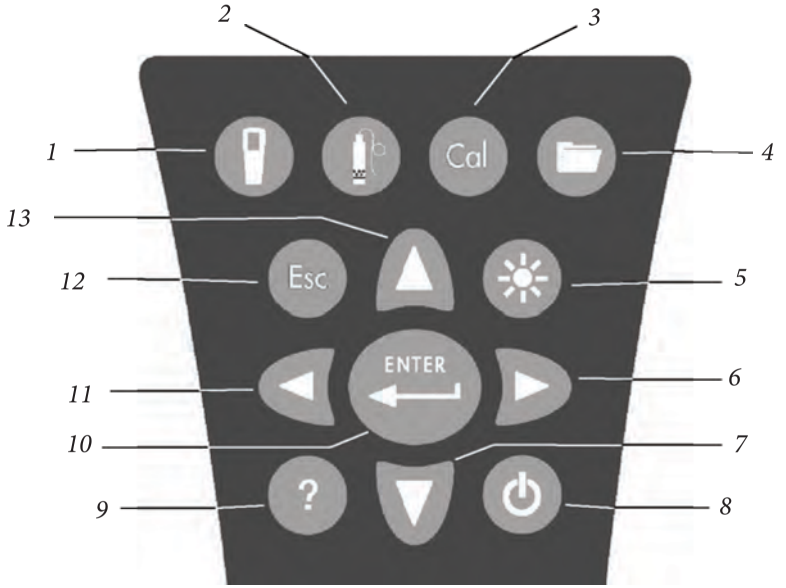
Figure 5. Note the keyed connector. The cable and instrument connectors can only be mated once the keys are properly aligned.

> *When a sensor is not installed, the sensor and cable sensor connectors are NOT water-proof. Do not submerge the cable without a sensor or port plug installed in all available ports.*
>
> *When the cable is disconnected, the cable's instrument connector and the connector on the instrument maintain an IP-67 rating.*

SENSOR STORAGE

The cable assembly is supplied with a storage container, or sleeve, that installs on to the cable. The container is used for short-term storage (less than 30 days). Be sure to keep a small amount of moisture (tap water) in the container during storage. This is done to maintain a 100% saturated air environment which is ideal for short-term sensor storage (see Care, Maintenance, and Storage for more detailed information). Do not submerge the sensors in an aqueous solution. The intent is to create a humid air storage environment.

KEYPAD

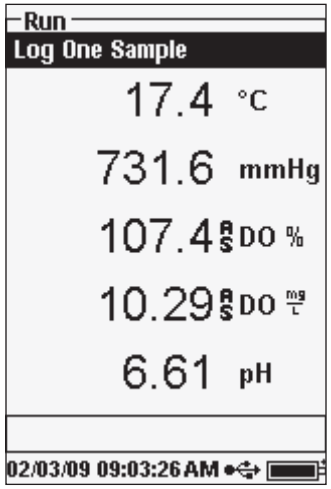


Number	*Key*	*Description*
1		**System** Opens System Menu from any screen. Use to adjust system settings.
2		**Sensor** Opens Sensor Menu from any screen. Use to enable sensors and display units.
3	Cal	**Calibrate** Opens Calibrate Menu from any screen. Use to calibrate all parameters except temperature.
4		**File** Opens File Menu from any screen. Use to view data and GLP files, set up site and folder lists, and delete data.
5		**Backlight** Press to turn the instrument backlight on and off and to adjust the display contrast when pressed with the left or right arrow key.

Number	Key	Description
6		**Right Arrow** Use to navigate right in alpha/numeric entry screens. Can be pressed simultaneously with Backlight key to increase display contrast.
7		**Down Arrow** Use to navigate through menus and to navigate down in alpha/numeric entry screens.
8		**Power** Press to turn the instrument on. Press and hold for 3 seconds to turn off.
9		**Help** Press to receive hints & tips during operation.
10		**Enter** Press to confirm selections, including alpha/numeric key selections.
11		**Left Arrow** Use to navigate left in alpha/numeric entry screens. Press to return to previous menu in all screens except alpha/numeric entry. Can be pressed simultaneously with Backlight key to decrease display contrast.
12		**Exit/Escape** Exits back to Run Screen. When in alpha/numeric entry screen, escapes to previous menu.
13		**Up Arrow** Use to navigate through menus and to navigate up in alpha/numeric entry screens.

MAIN DISPLAY

Press the Power key to turn the instrument on. The instrument will briefly display the splash screen with the YSI logo then go directly to the main run screen. The first time the instrument is powered up or if the instrument has had a battery change (with batteries removed for more than 2 minutes), you will need to set the date and time. Follow the instructions under **System Menu | Date/Time**.



The display at the left shows the run mode (main display) with temperature in °C, barometer in mmHg, DO in % and mg/L, and pH as the reported parameters. The date, time and battery level are indicated at the bottom of the screen. The logging preference of Log One Sample at a time is indicated at the top of the screen.

This screen also shows the message line towards the bottom of the display above the date and time. In this case, it doesn't show a message but messages will appear frequently to indicate calibration steps, set date and time, etc.

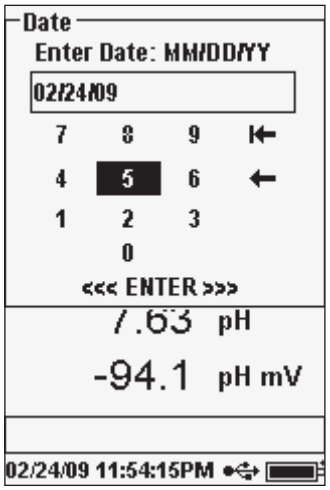
A USB symbol will show up on the bottom of the display when connected to a PC through USB with the communications saddle. The instrument will display full battery power when it is receiving power through the USB connection.

> ***Contrast*** *– the contrast adjustment can be accomplished by pressing the backlight key and the left or right arrow key at the same time.*

MENU LAYOUT

Press Esc at anytime in the menus to escape back to the Run screen. The left arrow can be used to go back to the previous menu in all screens except alpha/numeric entry screens. You must use Esc to get out of the alpha/numeric screens if you want to exit before finishing or without saving changes. Functions that are enabled appear as a circle with a dot ⊙ or a box with a check mark ☑. Disabled functions appear as a circle only ○ or an empty ☐.

ALPHA/NUMERIC ENTRY



The numeric screens will display numbers only (shown on the left). Alpha/numeric screens will display numbers across the top and letters along the bottom rows (shown on the right). Letters appear as a common keyboard arrangement.

When an alpha or numeric character is required, the screen will show the alpha/numeric entry screen. To select a character, highlight it by using the arrow keys to move the highlight box over the desired selection. Then, press **Enter** on the keypad to confirm the selection. After confirming the selection, it will appear in the line at the top of the display.

For capital letters or lower case entry, highlight "SHIFT" and press **Enter** on the keypad to change the characters from upper to lower case.

To delete the entire line of the current entry, highlight |← and press **Enter** on the keypad. The ← symbol functions as a backspace key in the alpha/numeric entry screens by deleting one character at a time. Use the "SPACE" function to add a space between characters.

When you have finished entering the correct information (16 character max), highlight <<<ENTER>>> at the bottom of the screen and press **Enter** on the keypad to confirm.

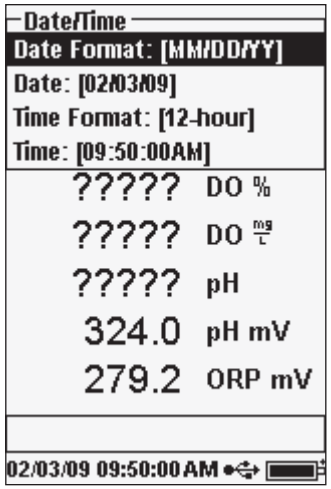
The ◀ key cannot be used to escape to the previous menu from an alpha/numeric entry screen. Instead, use the Esc key to go back to the previous menu when in alpha/numeric entry screens.

SYSTEM MENU

Press System to access any of the following menu items.

The System menu will allow you to access the setup options of the instrument including; **Date/Time**, **GLP**, **Language**, **Radix Point**, **Logging**, **Auto-Shutoff**, **Backlight**, **SW** (Software) **Version**, **Serial #**, and **Unit ID**. Any item with [brackets] shows the current setting inside the brackets. For instance, in the example at the left, Radix Point is currently set to [Decimal]. The brackets will also give a quick visual clue as to what items can be changed.

DATE/TIME



Highlight **Date/Time** from the **System** menu. Press enter to select.

Date Format – Highlight and press enter to open a sub menu for selecting the preferred date format: YY/MM/DD, MM/DD/YY, DD/MM/YY, or YY/DD/MM.

Date – Highlight and press enter to use the numeric entry screen to set the correct date.

Time Format – Highlight and press enter to open a submenu to select the preferred time format from 12-hour or 24-hour.

Time – Highlight and press enter to use the numeric entry screen to set the correct time.

The date and time will need to be reset if a battery change takes longer than 2 minutes. When this occurs, the Date/Time menu will automatically appear upon power up and require you to set the date and time.

GLP

The GLP or 'Good Laboratory Practice' file saves detailed information about calibrations. It also includes diagnostic information about the sensors. Calibrations are logged into a file, the GLP, for later review as needed. A single GLP file is utilized to store all calibration records and is capable of storing 500 records. Once the GLP file is full, the instrument will begin to overwrite the oldest record with each new calibration record.

> ⓘ *In order to keep all of your GLP records, periodically download the GLP to Data Manager and export it to another program. Otherwise, the unit will overwrite the oldest record once the memory is full. Also, since Data Manager saves GLP files under the Unit ID, you must periodically export and rename the GLP file on your PC or it will be overwritten each time you upload the GLP file from the instrument.*

Several calibration parameters are saved for each calibration record including optional ones that can be enabled by the user. Standard parameters include date/time stamp, calibration method, and sensor information. Optional, user selectable parameters include User ID, Probe ID, and User Fields 1 and 2.

The sensor specific information that is saved with each calibration point is different for each sensor. The sensor specific values saved are:

Conductivity
Method (Spec Cond, Cond, Salinity)
Cal Value (value of calibration solution)
Sensor Value (Cell Constant)
Temperature Reference (User selected in Sensor Setup menu)
Temperature Compensation Coefficient %/°C (User selected in Sensor Setup menu)
TDS Constant (User selected in Sensor Setup menu)
Temperature
Cal Cell Constant
Calibrate Status

DO
Method (%, mg/L)
Cal Value
Sensor Value (Sensor Current)
Sensor Type (Polarographic/Galvanic)
Membrane Type (Teflon Black, PE Yellow, PE Blue)
Salinity Mode (user entered value if in Manual Salinity Mode)
Temperature
Barometer
Calibrate Status

pH (up to 6 calibration points)
Buffer Value
Sensor Value (mV)
Temperature
Slope (mV/pH)
Slope (% of ideal)
Calibrate Status

ORP
Cal Solution Value
Sensor Value
Temperature
Calibrate Status

Ammonium
Buffer Value
Sensor Value (mV)
Temperature
Calibrate Status

Chloride
Buffer Value
Sensor Value (mV)
Temperature
Calibrate Status

Nitrate
Buffer Value
Sensor Value (mV)
Temperature
Calibrate Status

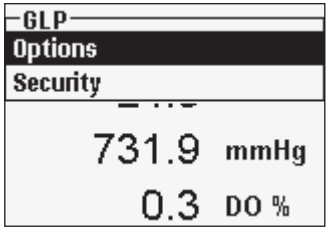
An example of a GLP record

(Operation performed is single point % DO Calibration)

*** Calibrate – DO% ***

Date	02/03/09 MM/DD/YY
Time	12:14:57PM 12-hour
User ID:	Tech 1
Probe ID	08D
Method	DO Air Calibrate
Cal Value:	100.00%
Sensor Value:	5.175155uA
Sensor Type	Polarographic
Membrane Type	1.25 PE Yellow
Salinity Mode	5.175165 Auto
Temperature	23.9 °C
Barometer	731.4 mmHg
Calibrate Status	Calibrated

GLP SETTINGS



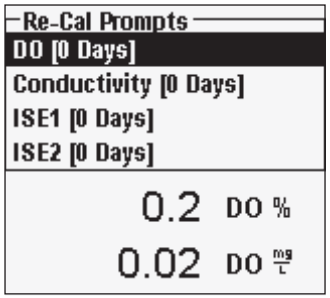
In the System menu, highlight **GLP** and press enter to view and modify the GLP settings.

Highlight Options and press enter to access **User ID**, **Probe ID**, **User Defined Fields**, and **Re-Cal Prompt**.

User ID may be used to identify the person calibrating the instrument. Highlight **User ID** and press enter to select, edit, or delete a User ID from a list of previously entered IDs. Or, highlight **Add New** and press enter to create a new User ID using the alpha/numeric entry screen. The User ID may also be changed in the **Calibration** menu during the calibration process. The selected User ID will be stored in the GLP file with each calibration record. A User ID could be a person's initials or badge number. The character limit is 16 characters.

Probe ID is stored with the calibration record and may be used to distinguish one cable/probe assembly from another, typically by serial number. Highlight **Include Probe ID** and press enter to turn this function on (☑) and off (☐). Highlight **Probe ID** and press enter to add, view, edit, delete, or select a Probe ID. The Probe ID may also be changed in the **Calibration** menu during the calibration process. The character limit is 16 characters.

User Fields 1 and 2 are stored with the calibration record and may be used to enter other parameters pertinent to the user, such as weather conditions, elevation, etc. Highlight **Include User Field 1** or **Include User Field 2** and press enter to turn this function on and off. Highlight **User Field 1** or **User Field 2** and press enter to add, delete, view, edit, or select a User Field. The character limit is 16 characters. When enabled, a prompt for selecting a User Defined Field will appear during the calibration process.



Re-Cal Prompt may be used to remind the user to perform a calibration. To set a time interval, highlight the parameter you wish to be reminded about and press enter to access the numeric entry screen. Enter a value in days and press enter to confirm the reminder time. To turn off the Re-cal prompt, set the reminder to zero (0) days (this is the default).

The **Security** section of the GLP menu is a password protected area. This area includes options to set a new password and to lock access to the calibration menu. When first viewing the security menu, you will be required to enter a password. Use the "shift" on the alpha/numeric screen to switch to lower case if necessary and enter "**ysi123**". This is the default password.

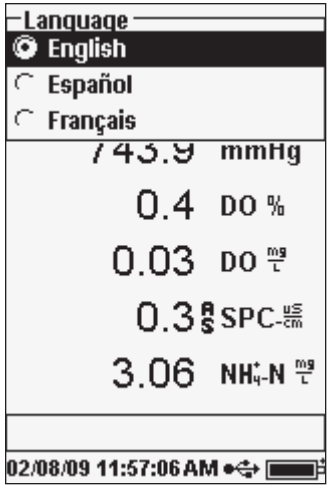
Protect Cal can be enabled (☑) or disabled (☐). When enabled, the user must know and enter the instrument's password to enter the calibration menu option. Highlight **Protect Cal** and press enter to enable or disable this feature.

Set Password allows a user to set the security password. Highlight **Set Password,** press enter, and use the alpha/numeric entry screen to set the new password. The password can have up to 16 characters.

Contact YSI Technical Support at environmental@ysi.com or +1 937 767-7241 if you forget or misplace your password.

> ⓘ *Once a password is set, and the GLP security screen exited, a password must be entered to make changes under GLP security. Keep passwords in a safe place.*

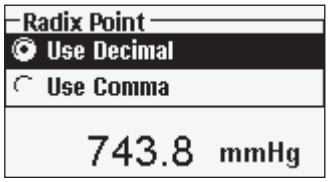
LANGUAGE



The Pro Plus can be configured to display all text in English, Spanish, French, German, Portuguese, Italian, Norwegian, Simplified Chinese, Traditional Chinese, or Japanese. From the factory, the instrument includes English, Spanish, and French language options. The other language options can be downloaded from www.ysi.com/support.

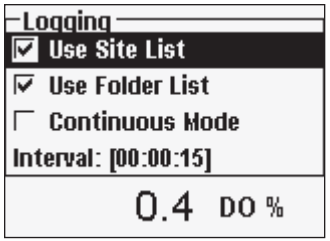
Once the appropriate language file is in the instrument, press System, highlight **Language,** and press enter. Highlight the desired language and press enter to confirm.

RADIX POINT



Radix Point allows the user the option to choose between a comma or a decimal in numeric displays. For example, 1.00 becomes 1,00 when **Use Comma** is selected. Highlight **Use Decimal** or **Use Comma** and press enter to make your selection.

LOGGING



From the System menu, highlight **Logging** and press enter to view or change the logging options. Logging options include **Use Site List**, **Use Folder List**, **Continuous Mode**, and **Interval**.

Use Site List and **Use Folder List** are optional ways of filing or 'tagging' your logged data points. If these settings are enabled, you will be prompted to select a Site and/or Folder to 'tag' to the logged data point. See the **File and Site Lists** section of this manual for information on creating Site and Folder Lists.

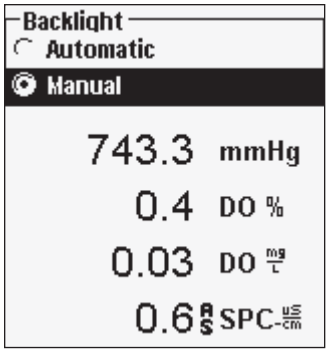
Check the box for **Continuous Mode** if you want to log samples continuously at a specific time interval. To set the length of time between logged samples, highlight **Interval** and press enter. Enter the interval as HH:MM:SS. This interval will display at the top of the screen when you select the **Start Logging** option in run mode.

To log one sample at a time, uncheck **Continuous Mode**. When Continuous Mode is unchecked, **Log One Sample** will appear at the top of the run screen.

AUTO SHUTOFF

Auto Shutoff powers the instrument off after a user specified time period. Highlight **Auto Shutoff** and press enter. Using the alpha/numeric entry screen, enter a value between 0 and 360 minutes. To disable auto shutoff, set the value to 0 (zero).

BACKLIGHT



Backlight can be set to **Automatic** or **Manual**. Automatic turns the backlight on when you turn the instrument on and when you press any key. Manual allows you to turn the backlight on or off with the backlight key. When in Automatic mode, the instrument will turn the backlight off 60 seconds after the last key press. The instrument will "reset" the 60 second time period every time a key is pressed. The lighted keypad will turn off after approximately 20 seconds.

SW VERSION (SOFTWARE VERSION)

SW Version shows the instrument's software version. The instrument's software can be updated via www.ysi.com/support. There you will find the new software files and instructions on how to update the instrument. There is no need to send the instrument back to the factory for upgrades.

SERIAL

Serial # shows the instrument's serial number and allows you to match it with the number engraved on the back of the instrument's case.

UNIT ID

Unit ID is used to identify instruments in the Data Manager software program that was included with your instrument. It is also used to identify GLP files, Site Lists, Configuration files, and Data files transferred from the instrument to the PC. The default Unit ID is the instrument's serial number. To modify the Unit ID, highlight **Unit ID**, press enter and then use the alpha/numeric entry screen. The character limit is 16 characters.

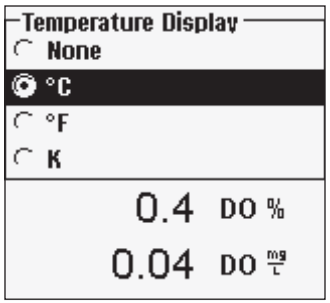
PARAMETERS: SETUP, DISPLAY, AUTO STABLE, AND CALIBRATION

The following section is separated by parameter and will discuss sensor setup, display options, auto stable features, and calibration procedures for each parameter. The sections are separated by parameter due to the versatility of the Pro Plus. You may focus solely on the parameters of your choice.

For the highest accuracy, calibrate or verify each sensor regularly. For your convenience, YSI offers 5580 Confidence Solution® which allows you to check the accuracy of pH, conductivity, and ORP readings to help determine if a sensor calibration is necessary.

If you receive an error message during a calibration that indicates questionable results, you have the option to either accept or decline the calibration. YSI recommends that you decline a questionable calibration since accepting it may result in erroneous data. After declining a questionable calibration, ensure the sensor is clean, the calibration solution is good, the calibration vessel is clean, and that you are entering the correct calibration value if entering manually. Then, try to recalibrate the sensor. If you continue to have problems, see the Troubleshooting section of this manual.

TEMPERATURE



All probe/cable assemblies, except the Quatro, have a built-in temperature sensor. The Quatro cable ships with a Conductivity/Temperature sensor that must be installed on the cable. Temperature calibration is not required nor is it available.

To set the units, press Sensor  , highlight **Display** and press enter. Highlight **Temperature** and press enter. Highlight the desired temperature units of **°F**, **°C**, or **K** and press enter to confirm the selection. Only one temperature unit may be displayed at a time. You may also choose not to display temperature. If you choose not to display temperature, other parameters that require a temperature reading will still be temperature compensated.

DISSOLVED OXYGEN (DO)

DO sensors can be used on 60520-X, 6051020-X, 6052030-X, and Quatro cables.

PREPARING THE DO SENSOR FOR THE FIRST TIME

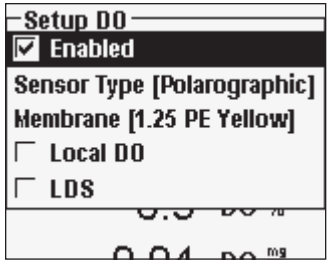
The dissolved oxygen sensor is shipped with a dry, protective red cap that will need to be removed before using. It is very important to put a new membrane with electrolyte solution on the sensor after removing the red cap.

Prepare the membrane solution according to the instructions on the bottle. After mixing, allow the solution to sit for 1 hour. This will help prevent air bubbles from later developing under the membrane. Ensure you are using the correct electrolyte solution for the correct sensor. Galvanic sensors utilize electrolyte with a light blue label and Polarographic sensors utilize electrolyte with a white label. The dissolved oxygen sensor is supplied with cap membranes specific to the sensor type ordered (Polarographic or Galvanic). 5912, 5913, and 5914 membrane kits are for Galvanic sensors and the 5906, 5908, and 5909 membrane kits are for Polarographic sensors. See the **Setup - Dissolved Oxygen** section of this manual for more information on the different types of membranes available from YSI.

Remove the red cap by pulling it straight off the sensor tip. Discard or save for later use during long term storage. Thoroughly rinse the sensor tip with distilled or deionized water. Fill the cap membrane 3⁄4 full of electrolyte solution, then tap the cap with a finger to release any trapped air. Be careful not to touch the membrane portion of the cap. Thread the membrane cap onto the sensor, moderately tight. Do not use a tool. It's typical for some of the electrolyte solution to spill over. For detailed instructions on changing a membrane cap, see the **Care, Maintenance, and Storage** section of this manual.

SETUP - DISSOLVED OXYGEN

Press Sensor, highlight **Setup** and press enter. Next, highlight **DO** and press enter.



Enabled allows you to enable or disable the Dissolved Oxygen function. Highlight **Enabled** and press enter to activate(☑) or deactivate(☐) dissolved oxygen. Disable dissolved oxygen if you do not have a dissolved oxygen sensor connected to the instrument.

> *If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable, false reading, ?????, or ----- next to the units.*

Sensor Type sets the type of oxygen sensor being used: either Polarographic (black) or Galvanic (grey). Highlight **Sensor Type** and press enter. Highlight the correct sensor type installed on the cable and press enter to confirm.

If using a ProBOD sensor/cable assembly, the sensor type should be set to polarographic.

The Pro Plus has two compatible sensors for use with a field cable:

Polarographic – This sensor has a black sensor body and is engraved with the model number 2003.

Galvanic – This sensor has a grey sensor body and is engraved with the model number 2002.

In terms of physical configuration, membrane material, and general performance, YSI Professional Series Galvanic dissolved oxygen sensors are exactly like the Professional Series Polarographic sensors. The advantage of using Galvanic sensors is convenience. Galvanic sensors provide for an instant-on sensor without the need for warm-up time but this affects the life of the sensor. Polarographic sensors last longer and have a longer warranty but require a 5-15 minute warm-up time before use or calibration.

> **IMPORTANT** – *The instrument default setting is Galvanic. Please change the **Sensor Type** to match the correct sensor. If you observe readings very close to 0 or extremely high readings (i.e. 600%), your **Sensor Type** setting (Polarographic or Galvanic) may be set incorrectly and you should immediately ensure it matches the sensor installed on your cable.*

Membrane sets the type of membrane used on the dissolved oxygen sensor. Highlight **Membrane** and press enter. Highlight the correct membrane type installed on the sensor and press enter to confirm. The DO sensor is supplied with membranes specific to the sensor type ordered and are color coded as described in the following tables.

Galvanic membrane kits:

Item	*Color*	*Material*	*Description*
5912	Black	1 mil Teflon®	Traditional membrane material
5913	Yellow	1.25 mil polyethylene	Improved response time and less flow dependence than Teflon® Ships standard with the sensor.
5914	Blue	2 mil polyethylene	Less flow dependence than 1.25 mil but somewhat slower response

Polarographic membrane kits:

Item	*Color*	*Material*	*Description*
5906	Black	1 mil Teflon®	Traditional membrane material
5908	Yellow	1.25 mil polyethylene	Improved response time and less flow dependence than Teflon® Ships standard with the sensor.
5909	Blue	2 mil polyethylene	Less flow dependence than 1.25 mil but somewhat slower response

Selecting a Dissolved Oxygen Membrane:

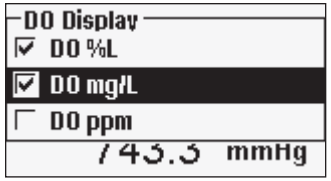
Membrane Type	*Flow Dependence After 4 Minutes*	*Typical Response Time - 95%*
5912, 5906 - Black	60%	18 seconds
5913, 5908 - Yellow	25%	8 seconds
5914, 5909 - Blue	18%	17 seconds

Local DO allows for localized DO% measurements. This sets the calibration value to 100% regardless of the altitude or barometric pressure. Highlight **Local DO** and press enter to enable (☑) or disable (☐) this function. Local DO is a method for the Pro Plus to factor in the barometric pressure on each DO measurement. In essence, if the barometric pressure changes you wouldn't notice the difference in the DO% readings in air-saturated water or water-saturated air. Local DO is ideal for EU compliance. When Local DO is enabled, an L will appear next to DO% on the run screen. DO mg/L readings are unaffected by the selection of DO Local.

LDS (Last Digit Suppression) rounds the DO value to the nearest tenth; i.e. 8.27 mg/L becomes 8.3 mg/L. Highlight **LDS** and press enter to enable (☑) or disable (☐) this function.

DISPLAY - DISSOLVED OXYGEN

Press Sensor , highlight **Display** and press enter. Highlight **DO** and press enter. All DO units can be displayed simultaneously. Highlight the unit(s) and press enter to activate (☑) or deactivate (☐) units from the run screen. Note - You will not be able to display dissolved oxygen unless it is **Enabled** in the Sensor Setup menu first, see previous section.



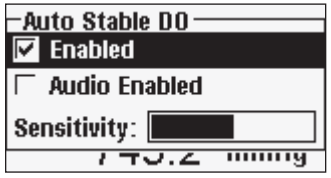
DO % will show DO readings in a percent scale from 0 to 500%.

DO mg/L will show DO readings in milligrams per liter (equivalent to ppm) on a scale from 0 to 50 mg/L.

DO ppm will show DO readings in parts per million (equivalent to mg/L) on a scale from 0 to 50 ppm.

AUTO STABLE - DISSOLVED OXYGEN

Auto Stable indicates when a reading is stable.When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.



To enable Auto Stable, press Sensor , highlight **Auto Stable** and press enter. Highlight **DO** and press enter.

Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter to confirm. The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.05%
75	0.62525%
50	1.275%
25	1.8875%
0 - Least Sensitive, Sensitivity bar is set to the far left	2.5%

Example:

The instrument obtained the following data:

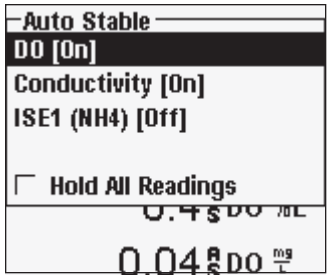
Reading #1 95.5 DO%
Reading #2 95.7 DO%
Reading #3 95.8 DO%
Reading #4 96.1 DO%
Reading #5 95.3 DO%

The instrument is programmed to determine the minimum and maximum data value over the previous 5 samples, and to compute the percent difference between those values. In this example, that gives a percent change of:

% Change = 100 * ((96.1 – 95.3) / 95.3)
% Change = 0.83%

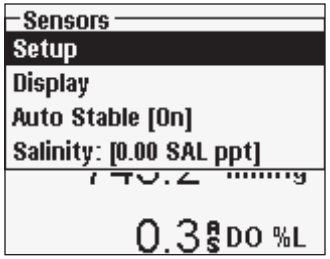
In this example, if the Sensitivity bar is set to the far right, the Auto Stable requirement would not be met and AS would continue to blink. However, if the sensitivity bar is set to the median threshold (1.275%), the Auto Stable requirement would be met and AS would display steadily on the display.

Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if DO and pH have



Auto Stable and Hold All Readings enabled, then the display will hold the readings once DO and pH have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings **Hold All Readings** must be reactivated after each use!

SALINITY CORRECTION



The last feature in the **Sensor** menu is the **Salinity** correction value which is used to calculate the dissolved oxygen mg/L and ammonia readings when a conductivity sensor is not in use. Press Sensor, highlight **Salinity**, and press enter. Then, use the numeric entry screen to enter the Salinity value of the water you will be testing from 0 to 70 ppt.

If using a cable with a conductivity sensor, the salinity measured by the conductivity sensor will be used in the DO and ammonia mg/L calculations and 'As Measured' will be displayed next to **Salinity** in the Sensor menu.

As the salinity of water increases, its ability to dissolve oxygen decreases. For example, fully oxygenated 20 °C water at sea level with zero salinity will hold 9.092 mg/L of dissolved oxygen. If that same sample had a salinity value of 9 ppt, then it would hold 8.621 mg/L of dissolved oxygen. Therefore, to obtain accurate mg/L readings, it is important to know the salinity of the water you will be testing and to input that value into the instrument. The salinity of fresh water is typically 0-0.5 ppt and seawater is typically 35 ppt. You will also have the opportunity to enter or modify the Salinity correction value during DO calibration.

CALIBRATION - DISSOLVED OXYGEN

The Pro Plus offers several options for calibrating dissolved oxygen: DO% in water saturated air, DO mg/L and DO ppm in a solution of known dissolved oxygen determined by a Winkler Titration, and a Zero point. If performing a zero point calibration, you must also perform a %, mg/L, or ppm calibration following the zero calibration. For both ease of use and accuracy, YSI recommends performing the following 1-point DO % water saturated air calibration:

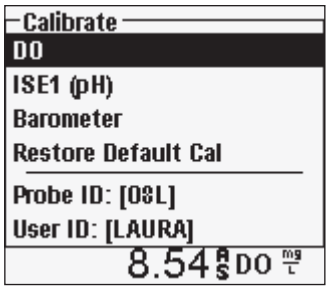
> *It is not necessary to calibrate in both % and mg/L or ppm. Calibrating in % will simultaneously calibrate mg/L and ppm and vice versa.*

Calibrating DO % in Water Saturated Air: **1-Point Calibration**

The supplied sensor storage container (a grey sleeve for a single port cable or a screw on plastic cup for the dual-port and Quatro cables) can be used for DO calibration purposes.

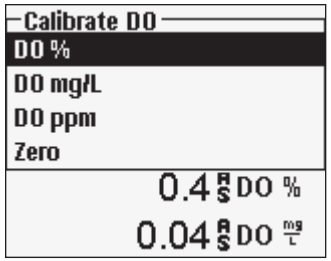
Moisten the sponge in the storage sleeve or plastic cup with a small amount of clean water. The sponge should be clean since bacterial growth may consume oxygen and interfere with the calibration. If using the cup and you no longer have the sponge, place a small amount of clean water (1/8 inch) in the plastic storage cup instead.

Make sure there are no water droplets on the DO membrane or temperature sensor. Then install the storage sleeve or cup over the sensors. The storage sleeve ensures venting to the atmosphere. If using the cup, screw it on the cable and then disengage one or two threads to ensure atmospheric venting. Make sure the DO and temperature sensors are not immersed in water. Turn the instrument on and wait approximately 5 to 15 minutes for the storage container to become completely saturated and to allow the sensors to stabilize.



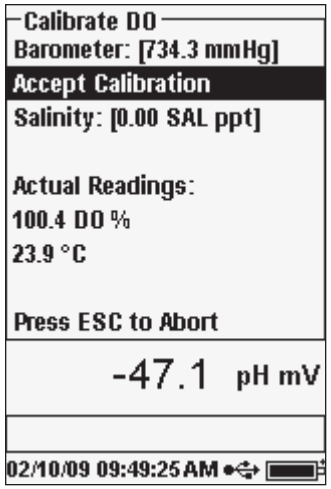
Press Cal . Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting your User ID and/or Probe ID if appropriate, highlight DO and press enter.



Highlight **DO %** and press enter to confirm.

The instrument will use the internal barometer during calibration and will display this value in brackets at the top of the display. Highlight **Barometer** and press enter to adjust it if needed. If the barometer reading is incorrect, it is recommended that you calibrate the barometer. Note - the barometer should be reading "true" barometric pressure (see Barometer section for more information on "true" barometric pressure). If the value is acceptable, there is no need to change it or perform a barometer calibration.



The Salinity value displayed near the top of the screen is either the salinity correction value entered in the Sensor menu or the Salinity value as measured by the conductivity sensor in use and enabled. If you are not using a conductivity sensor, the Salinity correction value should be the salinity of the water you will be testing. Highlight **Salinity** and press enter to modify this setting if necessary. See the **Salinity Correction** section of this manual for more information.

Wait for the temperature and DO% values under "Actual Readings" to stabilize, then highlight **Accept Calibration** and press enter to calibrate. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled in the GLP menu, you will be prompted to select these inputs and then press Cal to complete the calibration. The message line at the bottom of the screen will display "Calibrating Channel..." and then "Saving Configuration...".

Calibrating DO% in Water Saturated Air: **2-Point Calibration with Zero Solution**

Place the sensor in a solution of zero DO.

A zero DO solution can be made by dissolving approximately 8 - 10 grams of sodium sulfite (Na_2SO_3) into 500 mL tap water or DI water. Mix the solution thoroughly. It may take the solution 60 minutes to be oxygen-free.

Press Cal. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **Zero** and press enter. Wait for the temperature and DO% values under "Actual Readings" to stabilize, then press enter to **Accept Calibration**. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal to complete the calibration. The screen will then prompt for a follow-up second point calibration.

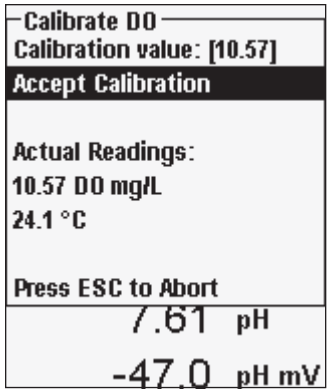
Highlight **DO%** and press enter to continue with the next calibration point. Rinse the sensor of any zero oxygen solution using clean water. Then follow the steps under Calibrating DO % in Water Saturated Air to complete the second point.

Calibrating in mg/L or ppm as a Titration: **1-Point Calibration**

Place the sensor into an adequately stirred sample that has been titrated to determine the dissolved oxygen concentration. Allow the sensor to stabilize.

Press Cal. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **DO mg/L or ppm** and press enter.



Highlight **Calibration value** and press enter to manually input the sample's dissolved oxygen value. Highlight **Accept Calibration** and press enter once the temperature and Dissolved Oxygen readings stabilize. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled in the GLP menu, you will be prompted to select the fields after selecting **Accept Calibration**. After making your selection, press Cal to complete the calibration. After completing the calibration, the message line will display "Calibrating Channel..." and then "Saving Configuration...".

Calibrating in mg/L or ppm as a Titration: **2-Point Calibration with Zero Solution**

Place the sensor in a solution of zero DO.

A zero DO solution can be made by dissolving approximately 8 - 10 grams of sodium sulfite (Na_2SO_3) into 500 mL tap water. Mix the solution thoroughly. It may take the solution 60 minutes to be oxygen-free.

Press Cal. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **Zero** and press enter. Wait for the temperature and DO% values under "Actual Readings" to stabilize, then press enter to **Accept Calibration**. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then Press Cal to complete the calibration. The screen will then prompt for a follow-up second point calibration.

Highlight the desired calibration units (mg/L or ppm) and press enter to continue with the next point. Rinse the sensor of any zero oxygen solution using clean water. To complete the second calibration point, follow the steps under Calibrating in mg/L or ppm as a Titration: **1-Point Calibration**.

BAROMETER

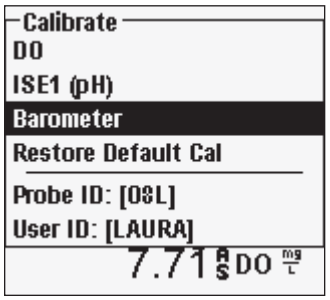
All Professional Plus instruments contain an internal barometer.

DISPLAY - BAROMETER

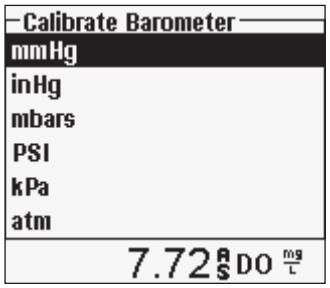
Press Sensor, highlight **Display** and press enter. Highlight **Barometer** and press enter. The measurement unit options are: mmHg, inHg, mBar, PSI, kPa, or Atm. Only one unit can be displayed at a time. Select **None** if you do not want to display a barometric pressure reading.

Whether or not you choose to display the barometer reading, the barometric pressure will still be used for calibrating DO% and for compensating for pressure changes if **Local DO** is enabled.

CALIBRATION - BAROMETER

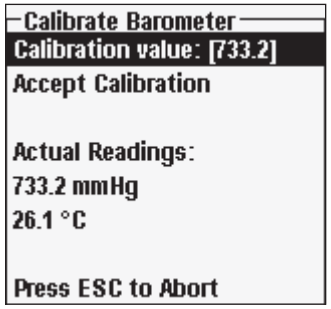


The barometer in the instrument is calibrated at the factory. If the barometer requires calibration, press **Cal**. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. When enabled, these IDs are stored with each calibration record in the GLP file.



After selecting the Probe ID and/or User ID if appropriate, highlight **Barometer** and press enter.

Highlight the desired unit and press enter.



Highlight **Calibration Value** and press enter to manually enter the correct "true" barometric pressure. Next, highlight **Accept Calibration**, and press enter. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal to complete the calibration or press Esc to cancel the calibration.

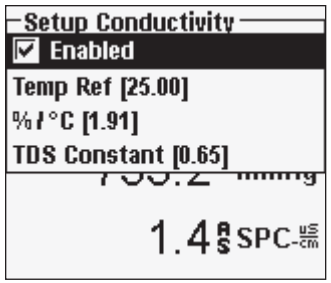
> *Laboratory barometer readings are usually "true" (uncorrected) values of air pressure and can be used "as is" for barometer calibration. Weather service readings are usually not "true", i.e., they are corrected to sea level, and therefore cannot be used until they are "uncorrected". An approximate formula for this "uncorrection" is below:*

True BP = [Corrected BP] – [2.5 * (Local Altitude in ft. above sea level/100)]

CONDUCTIVITY

Conductivity sensors are supplied with 60530-X, 6051030-X, 6052030-X , and Quatro cables. Conductivity sensors are built into the 60530-X, 6051030-X, and 6052030-X cables and are not replaceable. Conductivity/Temperature sensors are shipped with the Quatro cable, must be installed, and are replaceable.

SETUP - CONDUCTIVITY



Press Sensor , highlight **Setup,** and press enter. Highlight **Conductivity**, press enter.

Enabled allows you to enable or disable the conductivity measurement. Highlight **Enabled** and press enter to activate (☑) or deactivate (☐) conductivity. Disable conductivity if you do not have a conductivity sensor connected to the instrument.

> *If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable, false reading next to the units.*

Temp Ref (Temperature Reference) is the reference temperature used for calculating temperature compensated Specific Conductance. This will be the temperature all Specific Conductance values are compensated to. The default is 25 °C. To change the Reference Temperature, highlight **Temp Ref** and press enter. Use the numeric entry screen to enter a new value between 15.00 and 25.00 °C. Next, highlight <<<ENTER>>> at the bottom of the screen and press enter on the keypad to confirm.

%/°C (Percent per Degree Celsius) is the temperature coefficient used to calculate temperature compensated Specific Conductance. The default is 1.91% which is based on KCl standards. To change the temperature coefficient, highlight %/°C and press enter. Use the numeric entry screen to enter a new value between 0 and 4%. Next, highlight <<<ENTER>>> at the bottom of the screen and press **Enter** on the keypad to confirm.

TDS Constant is a multiplier used to calculate an estimated TDS (Total Dissolved Solids) value from conductivity. The multiplier is used to convert Specific Conductance in mS/cm to TDS in g/L. The default value is 0.65. This multiplier is highly dependent on the nature of the ionic species present in the water sample. To be assured of moderate accuracy for the conversion, you must determine a multiplier for the water at your sampling site. Use the following procedure to determine the multiplier for a specific sample:

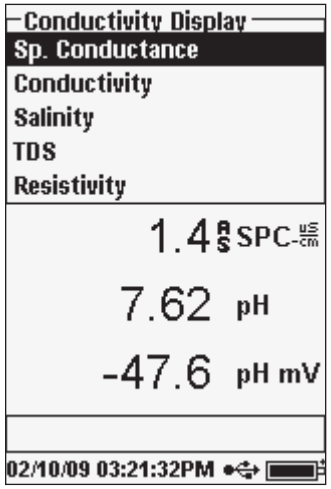
1. Determine the specific conductance of a water sample from the site;
2. Filter a portion of water from the site;
3. Completely evaporate the water from a carefully measured volume of the filtered sample to yield a dry solid;
4. Accurately weigh the remaining solid;
5. Divide the weight of the solid (in grams) by the volume of water used (in liters) to yield the TDS value in g/L for this site; Divide the TDS value in g/L by the specific conductance of the water in mS/cm to yield the conversion multiplier. Be certain to use the correct units.

> *If the nature of the ionic species at the site changes between sampling studies, the TDS values will be in error. TDS cannot be calculated accurately from specific conductance unless the make-up of the chemical species in the water remains constant.*

To change the multiplier, highlight **TDS Constant** and press enter. Use the numeric entry screen to enter a new value between 0 and 0.99. Highlight <<<ENTER>>> at the bottom of the screen and press **Enter** on the keypad to confirm.

DISPLAY - CONDUCTIVITY

Press Sensor, highlight **Display** and press enter. Highlight **Conductivity** and press enter. Highlight **Sp. Conductance** (Specific Conductance), **Conductivity**, **Salinity**, **TDS**, or **Resistivity**, and press enter to select the reporting units for each parameter. One reporting unit per parameter may be enabled. To disable a parameter, select **None**. You will not be able to display any of these parameters unless the Conductivity sensor is **Enabled** in the Sensor Setup menu first.



Sp. Conductance can be displayed in us/cm or ms/cm. Specific conductance is temperature compensated conductivity.

Conductivity can be displayed in uS/cm or mS/cm. Conductivity is the measure of a solution's ability to conduct an electrical current. Unlike specific conductance, conductivity is a direct reading without any temperature compensation.

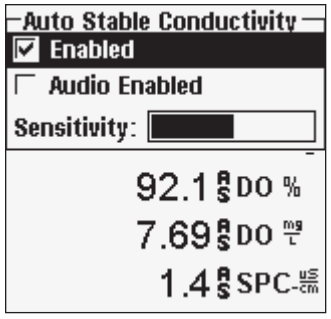
Salinity can be displayed in ppt (parts per thousand) or PSU (practical salinity units). The units are equivalent as both use the Practical Salinity Scale for calculation.

TDS can be displayed in mg/L (milligrams per liter), g/L (grams per liter), or kg/L (kilograms per liter).

Resistivity can be displayed in ohm-cm (ohms per centimeter), kohm-cm (kilo ohms per centimeter), or Mohm-cm (mega ohms per centimeter).

AUTO STABLE - CONDUCTIVITY

Press Sensor, highlight **Auto Stable** and press enter. Highlight **Conductivity** and press enter.

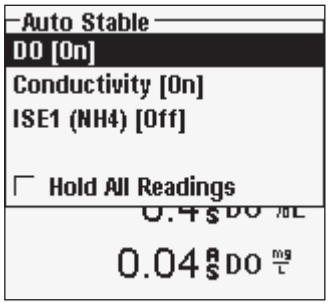


Auto Stable indicates when a reading is stable. Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter enable (☑) or disable (☐). When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

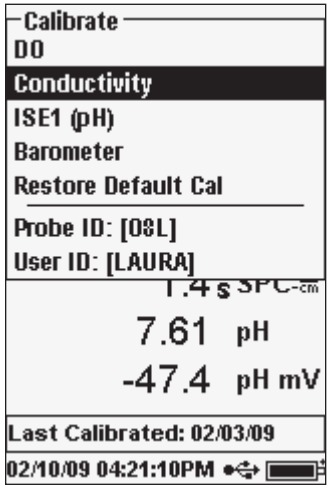
The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.025%
75	0.39375%
50	0.7625%
25	1.13125%
0 - Least Sensitive, Sensitivity bar is set to the far left	1.5%



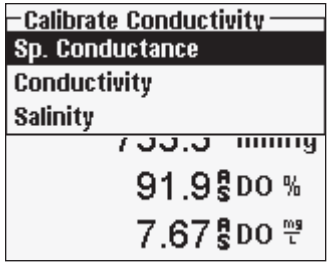
Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if conductivity and DO have Auto Stable and Hold All Readings enabled, then the display will hold the readings once conductivity and DO have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings. **Hold All Readings** must be reactivated after each use!

> *The 6051030 ISE/conductivity cable has a specialized calibration container that resembles a large test tube. This calibration chamber can be used to calibrate the conductivity sensor with an ISE sensor installed. A ring-stand should be used to support this chamber.*



Press Cal . Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.

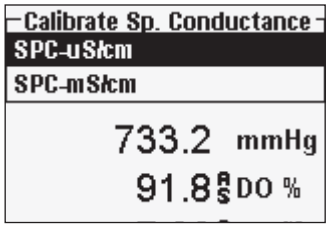
After selecting the User ID and/or Probe ID if appropriate, highlight **Conductivity** and press enter.



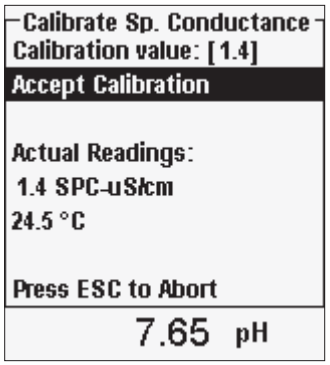
Highlight the desired calibration method; **Sp. Conductance**, **Conductivity**, or **Salinity** and press enter. YSI recommends calibrating in specific conductance for greatest ease.

Calibrating in Specific (Sp.) Conductance or Conductivity

Place the sensor into a fresh, traceable conductivity calibration solution. The solution must cover the holes of the conductivity sensor that are closest to the cable. Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately of half the expected value!



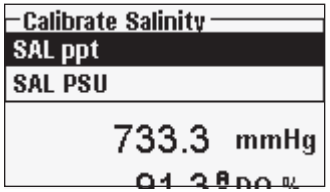
Choose the units in either **SPC-us/cm**, **C-us/cm** or **SPC-ms/cm**, **C-ms/cm** and press enter.



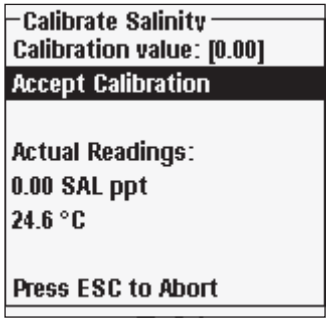
Highlight **Calibration value** and press enter to input the value of the calibration standard. Then, once the temperature and conductivity readings stabilize, highlight **Accept Calibration** and press enter. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled in the GLP menu, you will be prompted to select the fields and then press Cal to complete the calibration. After completing the calibration, the message line at the bottom of the screen will display "Calibrating Channel..." and then "Saving Configuration...".

Calibrating in Salinity

Place the sensor into a salinity calibration solution. The solution must cover the holes of the conductivity sensor that are closest to the cable. Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately of half the expected value!



Select **SAL ppt** or **SAL PSU** and press enter.



Highlight **Calibration value** and press enter to input the value of the calibration standard. Then, once the temperature and conductivity readings stabilize, highlight **Accept Calibration** and press enter. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal to complete the calibration.

pH

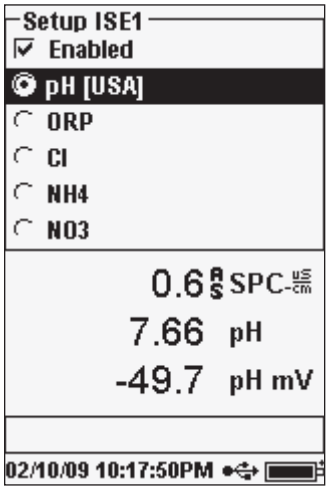
pH sensors can be used on 60510-X, 6051020-X, 6051030-X, 6051010-X, and Quatro cables.

If using a 605103 pH/ORP combination sensor on a 6051020 or 6051030 cable you can report both pH and ORP by configuring ISE1 as pH and ISE2 as ORP in the Sensor Setup menu.

The 605103 pH/ORP combination sensor is not recommended for use on a 6051010 or Quatro cable. If used on one of these cable, only pH will be reported and ORP will not be measured.

SETUP - pH

Press Sensor, highlight **Setup**, press enter. Highlight **ISE1** if using a 60510, 6051020, or 6051030 cable. If using a 6051010 or Quatro cable, highlight **ISE1** if the pH sensor is installed in port 1 or highlight **ISE2** if the pH sensor is installed in port 2(a sensor must be installed in port 1 for port 2 to operate). Press enter.



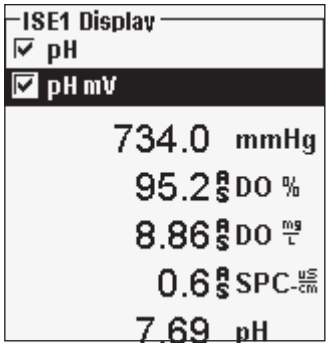
Enabled allows you to enable or disable the ISE function and select which ISE sensor is installed on the cable. Highlight **Enabled** and press enter to enable (☑) or disable (☐) the ISE you selected previously (either ISE1 or ISE2). Disable the ISE function(s) if you do not have a ISE sensor connected to the instrument.

After enabling the ISE function, ensure that it is set to pH as shown in the left screen shot. If necessary, highlight pH and press enter to set the ISE to pH.

Highlighting **pH[USA]** and pressing enter will also allow you to select the values for auto buffer recognition which are used during calibration. The buffer options are **USA** (4, 7, 10), **NIST** (4.01, 6.86, 9.18), and **User-Defined**. The selected option will be displayed in [brackets].

> *If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable false reading, ?????, or ----- next to the units.*

DISPLAY - pH



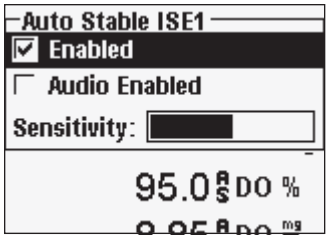
Press Sensor, highlight **Display** and press enter.

Highlight **ISE (pH)** and press enter. You will not be able to **Display** the sensor unless it is **Enabled** in the Sensor Setup menu.

Highlight **pH** and/or **pH mV**, press enter to enable (☑) or disable (☐). Both can be reported at the same time.

AUTO STABLE - pH

Press Sensor, highlight **Auto Stable** and press enter. Highlight **ISE (pH)** and press enter.

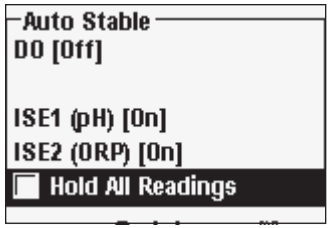


Auto Stable indicates when a reading is stable. Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter enable (☑) or disable (☐). When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

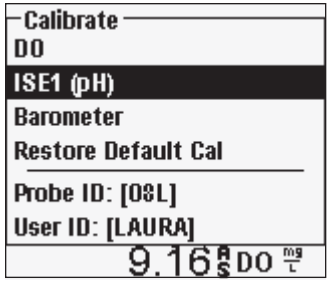
Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.025%
75	0.39375%
50	1.5%
25	1.13125%
0 - Least Sensitive, Sensitivity bar is set to the far left	0.15%



Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if ORP and pH have Auto Stable enabled and Hold All Readings is enabled, then the display will hold the readings once ORP and pH have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings. **Hold All Readings** must be reactivated after each use!

CALIBRATION - pH

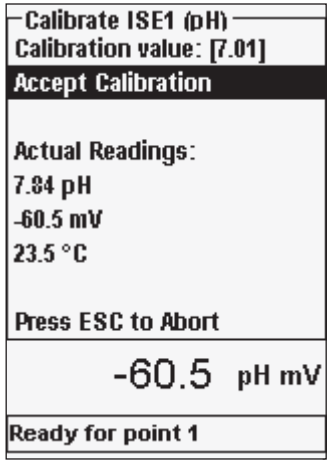
> *Calibration can be accomplished in any buffer order. pH 7 buffer should be used regardless of how many calibration points you use but it does not have to be used first.*

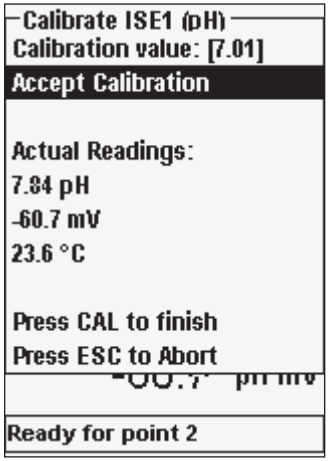


Press Cal . Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting your User ID and/or Probe ID if appropriate, highlight **ISE (pH)** and press enter. The message line will show the instrument is "Ready for point 1". The pH calibration allows up to six calibration points.

Place the sensor in a traceable pH buffer solution. The instrument should automatically recognize the buffer value and display it at the top of the calibration screen. If the calibration value is incorrect, the auto buffer recognition setting





in the Sensor Setup menu may be incorrect. If necessary, highlight the **Calibration Value** and press enter to input the correct buffer value.

Once the pH and temperature readings stabilize, highlight **Accept Calibration** and press enter to accept the first calibration point. The message line will then display "Ready for point 2".

If you do not wish to perform a second point, press Cal to finalize the calibration. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal to finalize the calibration.

To continue with the 2nd point, place the sensor in the second buffer solution. The instrument should automatically recognize the second buffer value and display it at the top of the screen. If necessary, highlight the **Calibration Value** and press enter to input the correct buffer value. Once the pH and temperature readings stabilize, highlight **Accept Calibration** and press enter to confirm the second calibration point. The message line will then display 'Ready for point 3" and you can continue with the 3rd calibration point if desired.

If you do not wish to perform a 3rd calibration point, press Cal to complete the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal to finalize the calibration.

Continue in this fashion until the desired number of calibration points is achieved (up to six).

> *Once you've achieved the desired number of cal points you must press* Cal *to finalize the calibration and to allow the instrument to update the pH offset and slope. The instrument will not take these cal values into account until Cal has been pressed.*

The actual readings displayed during the calibration will NOT reflect the updated calibration information. These values will not change until Cal is pressed to finalize the calibration and to update the instrument.

ORP

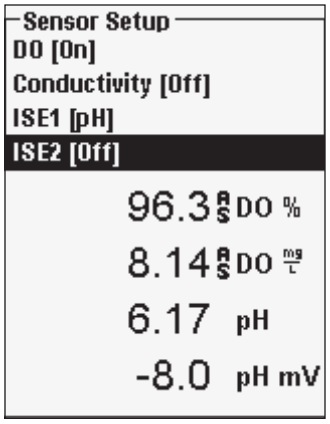
ORP sensors can be used on 60510-X, 6051020-X, 6051030-X, 6051010-X, and Quatro cables.

If using a 605103 pH/ORP combination sensor on a 6051020 or 6051030 cable you can report both pH and ORP by configuring ISE1 as pH and ISE2 as ORP in the Sensor Setup menu.

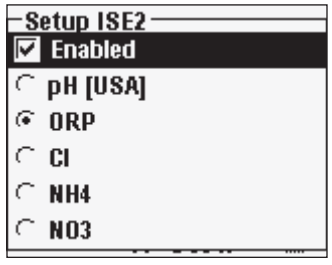
The 605103 pH/ORP combination sensor is not recommended for use on a 6051010 or Quatro cable. If used on one of these cable, only pH will be reported and ORP will not be measured.

SETUP - ORP

Press Sensor, highlight **Setup**, press enter.



Highlight **ISE1** if using a 605102 (ORP sensor) on a 60510, 6051020, or 6051030 cable. Highlight **ISE2** is using a 605103 (pH/ORP sensor) on a 60510, 6051020, or 6051030 cable. If using a 6051010 or Quatro cable, highlight **ISE1** if the ORP sensor is installed in port 1 or highlight **ISE2** if the ORP sensor is installed in port 2 (a sensor must be installed in port 1 for port 2 to operate). Press enter.

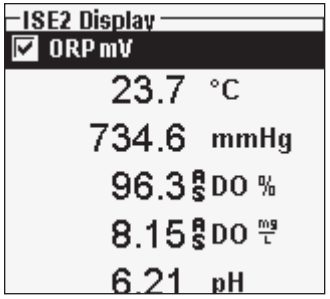


Enabled allows you to enable or disable the ISE function and select which ISE sensor is installed on the cable. Highlight **Enabled** and press enter to enable (☑) or disable (☐) the ISE you selected previously (either ISE1 or ISE2).

After enabling the ISE function, ensure ORP is selected as the ISE sensor as shown in screen shot to the left. If necessary, highlight ORP and press enter to set the selected ISE to ORP.

If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable false reading, ?????, or ----- next to the units.

DISPLAY - ORP

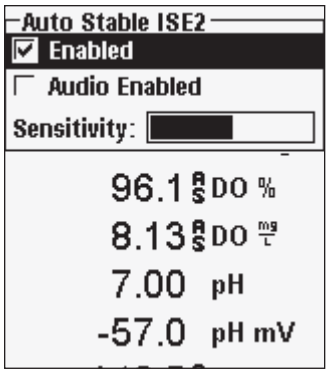


Press Sensor, highlight **Display** and press enter.

Highlight **ISE (ORP)** and press enter. You will not be able to **Display** the sensor unless it is **Enabled** in the Sensor Setup menu.

Press enter to enable (☑) or disable (☐) **ORP mV.**

AUTO STABLE - ORP



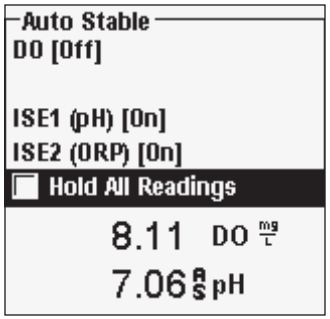
Press Sensor, highlight **Auto Stable** and press enter. Highlight **ISE (ORP)** and press enter.

Auto Stable indicates when a reading is stable. Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter enable (☑) or disable (☐). When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

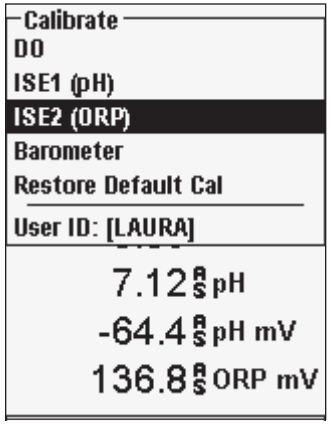
The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.05%
75	0.62525%
50	1.275%
25	1.8875%
0 - Least Sensitive, Sensitivity bar is set to the far left	2.5%



Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if ORP and pH have Auto Stable enabled and Hold All Readings is enabled, then the display will hold the readings once ORP and pH have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings. **Hold All Readings** must be reactivated after each use!

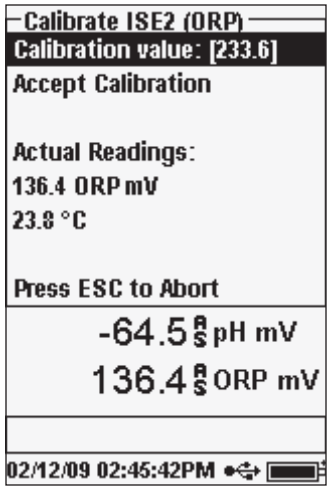
CALIBRATION - ORP



Press Cal . Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting your User ID and/or Probe ID if appropriate, highlight **ISE (ORP)** and press enter. The message line will show the instrument is "Ready for point".

Place the sensor in a solution of known ORP and wait for the readings to stabilize.



Highlight **Calibration value** and press enter to input the value of the ORP calibration standard. If using the YSI Zobell calibration solution, the Pro Plus will automatically determine the calibration value. However, the calibration value should be verified against the chart on the side of the Zobell bottle. Next, once the temperature and ORP readings stabilize, highlight **Accept Calibration** and press enter to calibrate. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal to complete the calibration.

AMMONIUM, NITRATE, CHLORIDE

Ammonium, Nitrate, and Chloride sensors can be used on 60510-X, 6051020-X, 6051030-X, 6051010-X, and Quatro cables. These cables also accommodate pH and ORP sensors so instrument setup is important.

WARNING: *Ammonium, Nitrate, and Chloride sensors should only be used at DEPTHS OF LESS THAN 55 FEET (17 METERS). Use of the sensors at greater depths is likely to permanently damage the sensor membrane.*

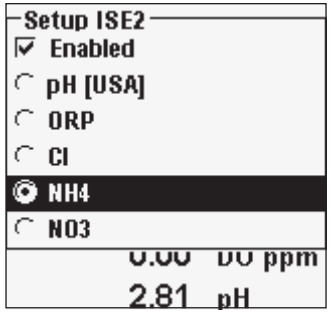
WARNING: *Ammonium, Nitrate, and Chloride sensors should only be used in FRESHWATER.*

SETUP - AMMONIUM, NITRATE, CHLORIDE

Install the Ammonium, Nitrate, or Chloride sensor in Port 2 if using in conjunction with pH or ORP sensor on a 6051010 or Quatro cable. See the **Getting Started Setup** section of this manual for a complete list of cable/sensor configurations.

Press Sensor , highlight **Setup**, press enter. Highlight **ISE1** if using an ammonium, nitrate, or chloride sensor on a 60510, 6051020, or 6051030 cable.

If using a 6051010 or Quatro cable highlight **ISE1** if the sensor is installed in Port 1 or highlight **ISE2** if the sensor is installed in Port 2. Press enter.



Enabled allows you to enable or disable the ISE function and select which ISE sensor is installed on the cable.

Highlight **Enabled** and press enter to enable (☑) or disable (☐) the ISE you selected previously (either ISE1 or ISE2).

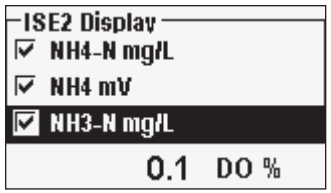
After enabling the ISE function, choose the parameter you want enabled for that ISE. In this example, NH4 is selected.

Cl - Chloride
NH4 - Ammonium
NO3 - Nitrate

> ⓘ *If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable, false reading next to the units.*

DISPLAY - AMMONIUM, NITRATE, CHLORIDE

Press Sensor, highlight **Display**, press enter. Highlight **ISE2(NH4)**, press enter. You will not be able to **Display** the sensor unless it is **Enabled**.



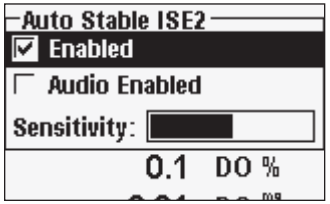
Highlight the value you wish to display and press enter to enable (☑) . Ammonium can be displayed as **NH4-N mg/L** (Ammonium), **NH3-N** (Ammonia) and/or **NH4 mV** (sensor signal).

The same steps would be followed to display nitrate or chloride.

Ammonia is calculated from the pH, salinity, and temperature readings. If a pH sensor is not in use, the instrument will assume the sample is neutral (pH 7) for the calculation. If a conductivity sensor (Salinity) is not in use, the instrument will use the salinity correction value entered in the Sensor Menu for the calculation (see Salinity Correction within the Dissolved Oxygen Setup section of this manual for more information).

AUTO STABLE - AMMONIUM, NITRATE, CHLORIDE

Auto Stable indicates when a reading is stable. When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

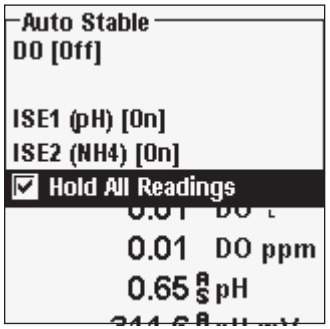


To enable Auto Stable, press Sensor, highlight **Auto Stable** and press enter. Highlight **ISE1** or **ISE2** and press enter.

Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter to confirm. The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.05%
75	0.62525%
50	1.275%
25	1.8875%
0 - Least Sensitive, Sensitivity bar is set to the far left	2.5%



Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if pH and Ammonium have Auto Stable enabled and Hold All Readings is also enabled, then the display will hold the readings once pH and Ammonium have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings. **Hold All Readings** must be reactivated after each use!

CALIBRATION - AMMONIUM, NITRATE, CHLORIDE

The 6051030 ISE/conductivity cable has a specialized calibration container that resembles a large test tube. This calibration chamber can be used to calibrate the ISE sensors with the conductivity sensor. A ring-stand should be used to support this chamber.

> *The ISE sensors can be calibrated at 1, 2, or 3-points.*
> **A 2-point calibration without chilling a third calibration solution is extremely accurate and is the preferred method.**
> *Greatest accuracy is achieved if the actual samples to be measured are within 10 ˚C of the calibration solutions.*

CALIBRATION TIP: Exposure to the high ionic content of pH buffers can cause a significant, but temporary, drift in the ammonium, nitrate, and chloride ISE sensors. Therefore, when calibrating the pH sensor, YSI recommends that you use one of the following methods to minimize errors in the subsequent readings:

- When calibrating pH, remove ISE sensors from the cable bulkhead and plug the ports. After pH calibration is complete, replace the ISE sensors and proceed with their calibration with no stabilization delay.

- Calibrate pH first, immersing all of the sensors in the pH buffers. After calibrating pH, place the sensors in 100 mg/L nitrate or ammonium standard or 1000 mg/L chloride standard depending on the sensor in use and monitor the reading. Usually, the reading starts low and may take awhile to reach a stable value. When it does, proceed with the calibration. This may take several hours.

Preparing Chloride Standards

The following recipes are provided for preparation of 10 and 1000 mg/L chloride reagents. Nitrate and Ammonium standards can be purchased from YSI or other laboratory supply companies.

It is important to note that some of the chemicals required for these solutions could be hazardous under some conditions. It is the responsibility of the user to obtain and study the MSDS for each chemical and to follow the required instructions with regard to handling and disposal of these chemicals.

You will need: Solid sodium chloride or a certified 1000 mg/L chloride solution from a supplier, magnesium sulfate, high purity water, a good quality analytical balance, 1000 mL volumetric flask, an accurate 10 mL measuring devices, and 1000 mL glass or plastic storage vessels.

1000 mg/L Standard: Accurately weigh 1.655 grams of anhydrous sodium chloride and transfer into a 1000 mL volumetric flask. Add 0.5 grams of anhydrous magnesium sulfate to the flask. Add 500 mL of water to the flask, swirl to dissolve all of the reagents , and then dilute to the volumetric mark with water. Mix well by repeated inversion and then transfer the 1000 mg/L standard to a storage bottle. Rinse the flask extensively with water prior to its use in the preparation of the 10 mg/L standard. Alternatively, simply add 0.5 grams of magnesium sulfate to a liter of a 1000 mg/L chloride standard from a certified supplier.

10 mg/L Standard: Accurately measure 10 mL of the above 1000 mg/L standard solution into a 1000 mL volumetric flask. Add 0.5 grams of anhydrous magnesium sulfate to the flask. Add 500 mL of water, swirl to dissolve the solid reagents, and then dilute to the volumetric mark with water. Mix well by repeated inversion and then transfer the 10 mg/L standard to a storage bottle.

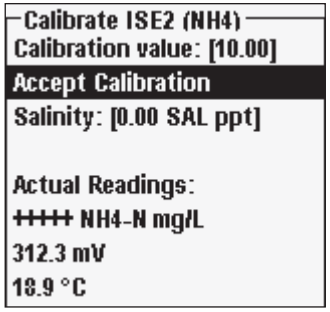
AMMONIUM (NH4+) , NITRATE (NO3-), AND CHLORIDE CL- 2-POINT

The calibration procedures for ammonium, nitrate, or chloride are similar to pH. The only differences are the calibration solutions. Recommended values for calibration solutions and the order of calibration are as follows:

Sensor	*1st Point*	*2nd Point*
Ammonium-nitrogen (NH4-N)	1 mg/L	100 mg/L
Nitrate-nitrogen (NO3-N)	1 mg/L	100 mg/L
Chloride (Cl-)	10 mg/L	1000 mg/L

Place the proper amount of 1 mg/L standard for Ammonium or Nitrate (10 mg/l for Chloride) into a clean, dry or pre-rinsed calibration cup. Carefully immerse the sensor into the solution. Allow at least 1 minute for temperature equilibration before proceeding.

Press Cal  . Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.



After selecting your User ID and/or Probe ID if appropriate, highlight **Ammonium**, **Nitrate**, or **Chloride** to access the appropriate calibration, and press enter. The parameter you want to calibrate may appear under ISE1 or ISE2 depending on your cable type and setup. The message line will show the instrument is ready for the 1st calibration point.

The instrument will display the calibration value at the top of the screen. If necessary, highlight the **Calibration value** and press enter to input the correct value.

Once the readings stabilize, highlight **Accept Calibration** and press enter to accept the first calibration point. The message line will then display "Ready for point 2".

If you do not wish to perform a second point, press Cal (Cal) to finalize the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal (Cal) to finalize the calibration. Alternatively, you may press Esc (Esc) to cancel the calibration.

To continue with the 2nd point, rinse the sensor with clean water, then dry it before placing it in the second calibration standard. Allow at least 1 minute for temperature equilibration before proceeding. The instrument will display the second calibration value at the top of the screen. If necessary, highlight the **Calibration value** and press enter to input the correct buffer value. Once the readings stabilize, highlight **Accept Calibration** and press enter to confirm the second calibration point. The message line will then display "Ready for point 3" and you can continue with the 3rd calibration point if desired.

If you do not wish to perform a 3rd calibration point, press Cal (Cal) to complete the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal (Cal) to finalize the calibration. Alternatively, you may press Esc (Esc) to cancel the calibration.

AMMONIUM (NH4+) , NITRATE (NO3-), AND CHLORIDE CL- 3-POINT

A 2-point calibration without chilling a third calibration solution is extremely accurate and is the preferred method. If you must perform a 3-point calibration, the following procedure requires one portion of the high concentration calibration solution and two portions of the low concentration calibration solution. The

high concentration solution and one of the low concentration solutions should be at ambient temperature. The other low concentration solution should be chilled to less than 10 °C prior to calibration.

> ⚠ **WARNING**: *The chilled calibration solution MUST BE CHILLED TO AT LEAST 5 °C COOLER THAN THE 1ST CALIBRATION POINT, otherwise the 1st point will be OVERRIDDEN.*

Follow the procedure for a 2-point cal. After the second calibration point is complete, the message line with state 'Ready for point 3". Place the proper amount of chilled 1 mg/L standard (10 mg/L for the chloride) into a clean, dry or pre-rinsed calibration cup. Carefully immerse the sensor into the solution. Allow for temperature equilibration. If necessary, highlight **Calibration value** and press enter to manually enter the 3rd buffer value. Once the readings are stable, highlight **Accept Calibration** and press enter to confirm. Press Cal (Cal) to complete the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal (Cal) to finalize the calibration. Alternatively, press Esc (Esc) to cancel the calibration.

TAKING MEASUREMENTS

To obtain the most accurate readings, be sure the instrument is calibrated before taking measurements.

DISSOLVED OXYGEN

Turn the instrument on and wait 5-15 minutes if using a polarographic sensor. If using a field cable/sensor, install the sensor guard to protect the sensor and membrane. Place the probe in the sample to be measured and give the probe a quick shake to release any air bubbles. Allow the temperature readings to stabilize. Next, stir the probe in the sample to overcome the stirring dependence of the dissolved oxygen sensor. You must provide at least 3 inches per second for 2.0 PE membranes, 6 inches per second for 1.25 PE membranes, and 12 inches per second for Teflon® membranes. Once the values plateau and stabilize, you may record the measurement and/or log the data set. The dissolved oxygen reading will drop over time if stirring is ceased.

If placing the DO sensor into a stream or fast flowing waters it is best to place it perpendicular to the flow and NOT facing into the flow.

If using the DO sensor in an aeration tank/basin, it is helpful to make sure bubbles do not burst on the membrane since this may cause unstable readings. You should be able to prevent this by pointing the sensor upwards so it's facing

the sky and then twist tying, zip tying, or rubber banding the bulkhead to the cable. Making a simple curve to the cable without bending or breaking the cable will allow you to lower the sensor into the aeration tank while the sensor points skyward so the bubbles are no longer bursting on the membrane surface.

CONDUCTIVITY

The conductivity sensor will provide quick readings as long as the entire sensor is submerged and no air bubbles are trapped in the sensor area. Immerse the probe into the sample so the sensors are completely submerged and then shake the probe to release any air bubbles. Occasional cleaning of the sensor may be necessary to maintain accuracy and increase the responsiveness. To clean the sensor, use the conductivity cleaning brush with a mild detergent.

pH/ORP

pH and ORP readings are typically quick and accurate. However, it may take the sensors a little longer to stabilize if they become coated or fouled. To improve the response time of a sensor, follow the cleaning steps in the Maintenance section of this manual.

AMMONIUM, NITRATE, AND CHLORIDE

These sensors may take a little longer to stabilize if the tips are dirty or fouled. If installed with a pH sensor, always maintain a clean pH sensor for a more rapid sensor stabilization.

These sensors can only be used in freshwater.

LOGGING DATA

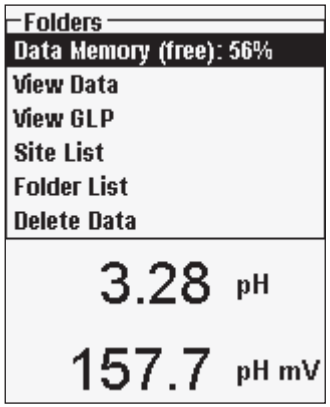
Log One Sample is already highlighted in Run mode. Press enter to open a submenu. If **Use Site List** and or **Use Folder List** are enabled in the Logging Setup menu, you will have to option to select these two items before the data point is logged. If necessary, use the keypad to create a new Site or Folder name. If Site List and Folder List are disabled in the **System** menu, you will not see these options when logging a sample. Once the Site and/or Folder name is selected, highlight **Log Now** and press Enter. The instrument will confirm that the data point was successfully logged.

If you would like to log at a specific interval vs. logging one sample at a time or vice versa, press **System**, then highlight **Logging** and press enter. Select **Continuous Mode** and adjust the time Interval if necessary. On the Run screen, the option to log will change from **Log One Sample** to **Start Logging** based on the time interval entered in the Logging Menu.

During a continuous log, the Start Logging dialog box on the Run screen will change to Stop Logging. Press Enter to stop continuous logging.

FILES AND SITE LISTS

FILE MEMORY

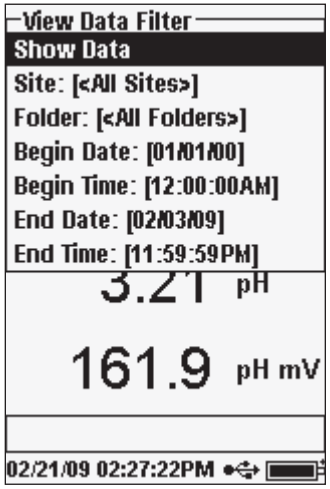


To view the file memory, press **File**.

The **Data Memory** shows a percentage indicating the amount of memory available. If the file memory is near 0%, files should be downloaded to a PC and/or deleted to free up memory.

VIEWING SAVED DATA

Press **File**, highlight **View Data** and press enter.

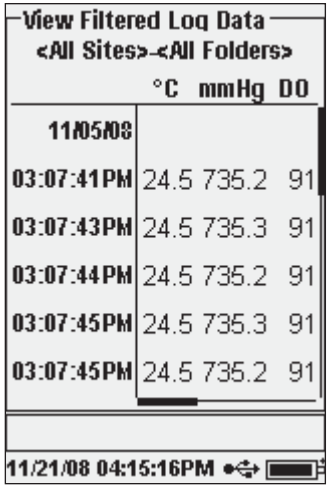


Configuring your data view:

Site: will allow you to view data from one particular site or all sites. Highlight **Site**, press enter, and select the site you wish to view data from or select **All Sites** to view data from all sites.

Folder: will allow you to view data from one particular folder or all folders. Highlight **Folder**, press enter, and select the file you wish to view data from or select **All Folders** to view data from all folders.

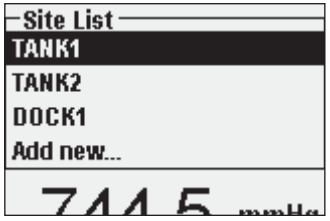
Begin Date, Begin Time, End Date, and **End Time:** will allow you to view data collected between a specific time period. Highlight the



time qualifier you would like to set, press enter, and use the numeric entry screen to select the date/time you wish to view.

After making your selections in the Data Filter, highlight **Show Data** and press enter. The data will have date and time stamps. You will likely have to scroll up and down and side to side using the arrow keys to completely view the data file. No more than 100 data records can be viewed at one time.

SITE LIST



To modify the **Site List**, press **File**, highlight **Site List**, and press enter. Enter new site names or edit existing sites with the alpha/numeric entry screen. Site lists can also be created and edited on your PC with Data Manager and then downloaded to the instrument.

FOLDER

To modify the **Folder List**, press **File**, highlight **Folder List**, and press enter. Enter new Folder names or edit existing folders with the alpha/numeric entry screen.

DELETE DATA

Press **File**, highlight **Delete Data**, and press enter. Enter the criteria for the data you wish to delete in the Delete Data Filter, then highlight **Delete Data** and press enter.

DATA MANAGER DESKTOP SOFTWARE

Data Manager is provided with the purchase of a Pro Plus Instrument. Data Manager is a powerful Windows® based software that will allow you to easily manage logged data, set up instruments, and conduct real time studies.

Minimum PC system requirements for Data Manager are Windows® 2000 with SP4 (minimum) or Windows® XP with SP2 (minimum) Operating System, 300 MHz or higher Pentium®-compatible CPU, 128 MB of RAM or higher, 80 MB or more of free hard-disk space, USB 2.0, and Microsoft® .NET.

Data Manager needs to be installed on a PC before use and before you try to connect a Pro Plus to your PC. First install Data Manger, then connect the communications saddle to the PC and, lastly, connect the saddle to your Pro Plus. Data Manager will identify the connected instruments by their Unit ID.Refer to the Data Manager Readme file for detailed installation instructions. Data Manager will then recognize the attached instruments.

From the 'home' screen of Data Manager, see below, you can select one of the following functions: Retrieve Instrument Data, Real Time Instrument Data, Instrument Configuration, or View Saved File/Data.

USING THE COMMUNICATIONS SADDLE

> ⚠ **WARNING**: *DO NOT connect the Communications Saddle to your PC before installing Data Manager. The Communication Saddle drivers MUST be installed prior to connecting it to your PC. The drivers will install automatically during the Data Manager installation. The first time the saddle is connected to the PC, you may have to walk through a couple of installation wizards. For detailed instruction, please refer to the Readme file located on the CD that was included with your instrument.*

A PC will recognize the Communications Saddle (saddle) as a YSI water quality instrument with or without the Pro Plus installed in the saddle.

To connect the saddle to a Pro Plus, simply align the saddle to the oval section on top of the instrument and push it down to snap it in place (Figure 6).

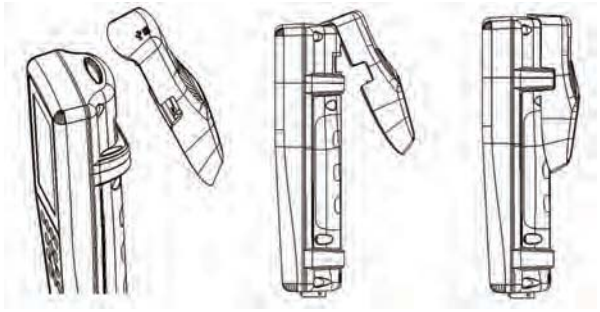


Figure 6. Locate the oval alignment groove at the top of the instrument and inside the saddle. Insert the saddle into this oval groove. Press the saddle towards the back of the instrument until it snaps into place.

Connect the USB cable to the top of the saddle and to a USB port on the PC. Once Data Manager is launched, the program will recognize all saddles with instruments connected to the PC.

The instrument will be powered through the saddle and USB connection when connected to the PC. However, the instrument must still have batteries installed in order to keep the date and time correct when powering the PC off at night. Make sure the instrument is turned off first, then turn off the PC to keep the instrument from running all night on the batteries. If you power it off and power off the PC the instrument will keep the correct date and time if it has batteries installed. If batteries are not installed, the instrument's date and time will not remain correct and will need to be reset each morning.

MANAGE LOGGED DATA

Data that has been logged to the Professional Plus can easily be uploaded to the PC via the provided USB saddle. You can upload sensor data, GLP files, site lists, and instrument configuration files individually or all at once. After connecting the instrument to the PC via the USB saddle and cable and launching Data Manager, click the **Retrieve Instrument Data** tab. Click on the Instrument's Unit ID you would like to retrieve data from, then select the files you would like to retrieve and click Start.

Once the sensor data is uploaded to the PC, you can graph and view tabular data by instrument Unit ID, date/time, site name, and/or folder name. This allows you to configure the report according to your needs. You can choose to view all data from all instruments, or select a certain date/time range for only a few specific instruments, there are multiple ways to view the data. Once the report has been defined, you will be able to print the graph and/or export the table.

Data Manager takes information management one step further and allows you to delete specific points instead of entire files. This allows you to clean up data that is no longer needed or that may have been collected erroneously, for example, when the sensor was out of the water. If you can not delete data due to regulation and compliance purposes, Data Manager has the solution. While viewing logged data or real time data, you have the ability to 'tag' individual data points with comments.

In addition to sensor data, you will be able to view GLP files, site lists, and configuration files that have been uploaded from the instrument. These can be printed and exported as well.

REAL TIME STUDIES

Data Manager allows you to view real time data on the PC.

After selecting your instrument, click the **Real Time Instrument Data** tab. Next, input your sample interval, site/folder name, select the parameters you wish to view and click **OK**. You must click **Start** on the next screen to begin your real time study. Choose to hide the table or graph by unchecking the box next to these options. Click **Stop**, then **Edit Setup** to change the Y-scale min/max of the graph, to select different colors, or to name your graph. Add a comment to a data point by clicking in the comment field of the table next to the data point. You may also **Print** the graph and **Export** the data for viewing in another program.

CONFIGURE INSTRUMENTS

Data Manager allows for easy and quick configuration of single or multiple instruments. Once you have uploaded a site list or configuration file, you can edit it as needed, save it, and download it to other instruments. You no longer need to configure each instrument individually. By using the same configuration file for all instruments, you can rest assured that all instruments will have identical settings.

New site lists and configuration files can be created in Data Manager as well. These lists and files can be downloaded to one or multiple instruments. Save time by creating these files on your PC and downloading them to the instrument as opposed to creating them on the instrument.

CARE, MAINTENANCE, AND STORAGE

This section describes the proper procedures for care, maintenance and storage of the sensors. The goal is to maximize their lifetime and minimize down-time associated with improper sensor usage.

UPDATING INSTRUMENT FIRMWARE

The instrument's firmware can be updated via www.ysi.com. There you will find the new firmware file and instructions on how to update the instrument. There is no need to send the instrument back to the factory for upgrades.

GENERAL MAINTENANCE

GENERAL MAINTENANCE - O-RINGS

The instrument utilizes o-rings as seals to prevent water from entering the battery compartment and sensor ports. Following the recommended procedures will help keep your instrument functioning properly.

If the o-rings and sealing surfaces are not maintained properly, it is possible that water can enter the battery compartment and/or sensor ports of the instrument. If water enters these areas, it can severely damage the battery terminals or sensor ports causing loss of battery power, false readings, and corrosion to the sensors or battery terminals. Therefore, when the battery compartment lid is removed, the o-ring that provides the seal should be carefully inspected for contamination (e.g. debris, grit, etc.) and cleaned if necessary.

The same inspection should be made of the o-rings associated with the sensor connectors when they are removed. If no dirt or damage to the o-rings is evident, then they should be lightly greased without removal from their groove. However, if there is any indication of damage, the o-ring should be replaced with an identical o-ring. At the time of o-ring replacement, the entire o-ring assembly should be cleaned.

To remove the o-rings:
Use a small, flat-bladed screwdriver or similar blunt-tipped tool to remove the o-ring from its groove. Check the o-ring and the groove for any excess grease or contamination. If contamination is evident, clean the o-ring and nearby plastic parts with lens cleaning tissue or equivalent lint-free cloth. Alcohol can be used to clean the plastic parts, but use only water and mild detergent on the o-ring itself. Also, inspect the o-rings for nicks and imperfections.

> ⚠ *Using alcohol on o-rings may cause a loss of elasticity and may promote cracking. Do not use a sharp object to remove the o-rings. Damage to the o-ring or the groove may result.*

Before re-installing the o-rings, make sure to use a clean workspace, clean hands, and avoid contact with anything that may leave fibers on the o-ring or grooves. Even a very small amount of contamination (hair, grit, etc.) may cause a leak.

To re-install the o-rings:
Place a small amount of o-ring grease between your thumb and index finger. (More grease is NOT BETTER!)

Draw the o-ring through the grease while pressing the fingers together to place a very light covering of grease to the o-ring. Place the o-ring into its groove making sure that it does not twist or roll.

Use your grease-coated finger to once again lightly go over the mating surface of the o-ring.

> ⚠ *Do not over-grease the o-rings. The excess grease may collect grit particles that can compromise the seal. Excess grease can also cause the waterproofing capabilities of the o-ring to diminish, potentially causing leaks. If excess grease is present, remove it using a lens cloth or lint-free cloth.*

GENERAL MAINTENANCE - SENSOR PORTS

It is important that the entire sensor connector end be dry when installing, removing or replacing. This will prevent water from entering the port. Once a sensor is removed, examine the connector inside the port. If any moisture is present, use compressed air to completely dry the connector or place directly in front of a steady flow of fresh air. If the connector is corroded, return the cable to your dealer or directly to an YSI Repair Center.

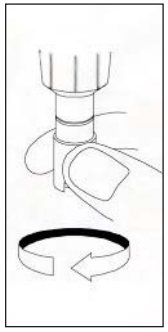
> *Remove sensors upside down (facing the ground) to help prevent water from entering the port upon removal.*

SENSOR MAINTENANCE

SENSOR MAINTENANCE - DISSOLVED OXYGEN

Membrane Cap Installation

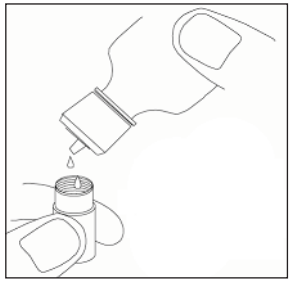
The DO sensor (Polarographic and Galvanic) is shipped with a dry, protective red cap that will need to be removed before using. Remove the protective cap or used membrane cap and replace it with a new membrane cap following these instructions:



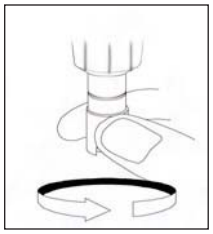
Remove the sensor guard to access the sensor tip.

Unscrew and remove any old membrane cap by holding the sensor when unscrewing the membrane cap and discard.

Thoroughly rinse the sensor tip with distilled or DI water.



Fill a new membrane cap with O2 sensor electrolyte solution that has been prepared according to the directions on the bottle. Be very careful not to touch the membrane surface. Lightly tap the side of the membrane cap to release bubbles that may be trapped.



Thread the membrane cap onto the sensor. It is normal for a small amount of electrolyte to overflow.

Polarographic Sensors - Model # 605203

The KCl (potassium chloride) solution and the membrane cap should be changed at least once every 30 days during regular use. In addition, the KCl solution and membrane should be changed if (a) bubbles are visible under the membrane; (b) significant deposits of dried electrolyte are visible on the membrane; and (c) if the sensor shows unstable readings or other sensor-related symptoms.

During membrane changes, examine the gold cathode at the tip of the sensor and the silver anode along the shaft of the sensor. If either the silver anode is black in color or the gold cathode is dull, the sensor may need resurfaced using the fine sanding disks included in the membrane kit. Do not sand the electrode every membrane change as this is not routine maintenance. In fact, visually, the anode may appear tarnished and operate just fine. YSI recommends using the 400 grit wet/dry sanding disks to resurface the electrodes if the sensor has difficulty stabilizing or calibrating after a membrane change.

To resurface the sensor using the fine sanding disk, follow the instructions below.

Gold Cathode:

For correct sensor operation, the gold cathode must be textured properly. It can become tarnished or plated with silver after extended use. Never use chemicals or abrasives not recommended or supplied by YSI.

First dry the sensor tip completely with lens cleaning tissue. Wet a sanding disk with a small amount of clean water and place it face up in the palm of your hand. Next, with your free hand, hold the sensor in a vertical position, tip down. Place the sensor tip directly down on the sanding disk and twist it in a circular motion to sand the gold cathode. The goal is to sand off any build-up and to lightly scratch the cathode to provide a larger surface area for the O2 solution under the membrane. Usually, 3 to 4 twists of the sanding disk are sufficient to remove deposits and for the gold to appear to have a matte finish. Rinse thoroughly and wipe the gold cathode with a wet paper towel before putting on a new membrane

cap. If the cathode remains tarnished, contact YSI Technical Support or the Authorized dealer where you purchased the instrument.

Silver Anode

After extended use, a thick layer of Silver Chloride (AgCl) builds up on the silver anode reducing the sensitivity of the sensor. The anode must be cleaned to remove this layer and restore proper performance. The cleaning can be chemical or mechanical:

Chemical cleaning: Remove the membrane cap and rinse the electrodes with deionized or distilled water. Soak the sensing anode section of the sensor in a 14% ammonium hydroxide solution for 2 to 3 minutes or in a 3% ammonia solution overnight for 8-12 hours (most household ammonia cleaners are typically around 3%). Rinse heavily in cool tap water followed by a thorough rinsing with distilled or deionized water. The anode should then be thoroughly wiped with a wet paper towel to remove the residual layer from the anode. You can smell the tip of the sensor to help ensure all the ammonia has been rinsed off. Trapping residual ammonia under the new membrane cap can quickly tarnish the electrode and/or give false readings.

Chemical cleaning should be performed as infrequently as possible. First attempt a membrane change and recalibrate. If a new membrane does not resolve the problem, then proceed with cleaning.

Mechanical cleaning: In order to sand the silver anode along the shaft of the sensor, simply hold the sensor in a vertical position. Wet the sanding disk with a small amount of clean water then gently wrap it around the sensor shaft and twist it a few times to lightly sand the anode (the goal is to simply sand off any build-up without scratching or removing layers of the anode itself). Usually, 3 to 4 twists of the sanding disk are sufficient to remove deposits. However, in extreme cases, more sanding may be required to regenerate the original silver surface.

After completing the sanding procedure, repeatedly rinse the electrode with clean water and wipe with lens cleaning tissue to remove any grit left by the sanding disk. Thoroughly rinse the entire tip of the sensor with distilled or deionized water and install a new membrane.

IMPORTANT: *Be sure to: (1) Use only the fine sanding disks provided and (2) Sand as mentioned in the above procedures. Not adhering to either of these instructions can damage the electrodes. If this procedure is unsuccessful, as indicated by improper electrode performance, contact YSI Technical Support or the Authorized dealer where you purchased the instrument.*

Galvanic Sensors – Model # 605202

We recommend that the Sodium Chloride (NaCl) solution and the membrane cap be changed at least once every 60 days during regular use. In addition, the NaCl solution and membrane should be changed if (a) bubbles are visible under the membrane; (b) significant deposits of dried electrolyte are visible around the membrane; and (c) if the sensor shows unstable readings or other sensor-related symptoms.

The Galvanic dissolved oxygen sensor is continuously reducing oxygen even when the display of the instrument is not active. This factor allows the sensor to be used with no warm-up period as soon as the instrument is powered on (instant on DO). However, because the sensor is "on" all the time, some solid from the oxidation of the zinc anode will form in the electrolyte within 1-2 weeks of activation. Small amounts of the solid will generally cause no performance problems, but excessive amounts may result in jumpy dissolved oxygen readings. The rate of solid formation is dependent on the type of membrane installed. The formation of solids based on membrane type typically form more rapidly with the 5912 (1 mil Teflon), less rapid with 5913 (1.25 mil PE), and least rapid with 5914 (2 mil PE).

The Galvanic DO sensor solution will appear milky white after use but will NOT affect the accuracy of the sensor unless there is excessive build up. The color change is acceptable and normal as long as DO readings remain stable.

At the time the membrane cap is changed, YSI recommends that you rinse the anode (silver shaft of the sensor) with purified water and wipe with a clean paper towel. If white deposits are evident on the anode after cleaning, YSI recommends that you remove this material by sanding the anode with the sandpaper disk enclosed in your membrane kit. Follow the "Mechanical Cleaning" instructions under the Polarographic Silver Anode section.

IMPORTANT: *Be sure to: (1) Use only the fine sanding disks provided and (2) Sand as mentioned in the above procedures. Not adhering to either of these instructions can damage the electrodes.*
WARNING: *DO NOT PERFORM THE POLAROGRAPHIC CHEMICAL CLEANING ON A GALVANIC SENSOR. If this procedure is unsuccessful, as indicated by improper electrode performance, contact YSI Technical Support or the Authorized dealer where you purchased the instrument.*

SENSOR MAINTENANCE - CONDUCTIVITY

The openings that allow sample access to the conductivity electrodes should be cleaned regularly. The small cleaning brush included in the Maintenance Kit is ideal for this purpose. Dip the brush in clean water and insert it into each hole 10 to 12 times. In the event that deposits have formed on the electrodes, it may be necessary to use a mild detergent (laboratory grade soap or bathroom foaming tile cleaner) with the brush. Rinse thoroughly with clean water, then check the response and accuracy of the conductivity cell with a calibration standard.

> ⓘ *If this procedure is unsuccessful, as indicated by improper electrode performance, contact YSI Technical Support or the Authorized dealer where you purchased the instrument.*

SENSOR MAINTENANCE - TEMPERATURE

You must keep the temperature portion of the sensor free of build up. Other than that, the sensor requires no maintenance. The conductivity cleaning brush can be used to scrub the temperature sensor if needed. Alternatively, you can use a toothbrush to clean the sensor.

SENSOR MAINTENANCE - pH, ORP AND COMBINATION pH/ORP

> ⓘ *Typical working life for pH and ORP sensors is approximately 12-24 months depending on usage, storage, and maintenance. Proper storage and maintenance generally extends the sensor's working life.*

Cleaning is required whenever deposits or contaminants appear on the glass and/or platinum surfaces or when the sensor's response slows. The cleaning can be chemical and/or mechanical.

Removing the sensor from the cable may make cleaning easier. Initially, use clean water and a soft clean cloth, lens cleaning tissue, or cotton swab to remove all foreign material from the glass bulb and/or platinum button. Then use a moistened cotton swab to carefully remove any material that may be blocking the reference electrode junction of the sensor.

> ⚠ **CAUTION**: *When using a cotton swab, be careful NOT to wedge the swab between the guard and the glass sensor. If necessary, remove cotton from the swab tip, so that the cotton can reach all parts of the sensor tip without stress. You can also use a pipe cleaner for this operation if more convenient.*

If good pH and/or ORP response is not restored, perform the following additional procedure:

1. Soak the sensor for 10-15 minutes in clean water containing a few drops of commercial dishwashing liquid.
2. GENTLY clean the glass bulb and platinum button by rubbing with a cotton swab soaked in the cleaning solution.
3. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water, and then rerinse with clean water.

If good pH and/or ORP response is still not restored, perform the following additional procedure:

1. Soak the sensor for 30-60 minutes in one molar (1 M) hydrochloric acid (HCl). This reagent can be purchased from most lab supply distributors. Be sure to follow the safety instructions included with the acid.
2. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water (not DI water), and then rerinse with clean water. To be certain that all traces of the acid are removed from the sensor crevices, soak the sensor in clean water for about an hour with occasional stirring.

If biological contamination of the reference junction is suspected or if good response is not restored by the above procedures, perform the following additional cleaning step:

1. Soak the sensor for approximately 1 hour in a 1:1 dilution of commercially-available chlorine bleach.
2. Rinse the sensor with clean water and then soak for at least 1 hour in clean water with occasional stirring to remove residual bleach from the junction. (If possible, soak the sensor for a period of time longer than 1 hour in order to be certain that all traces of chlorine bleach are removed.) Then rerinse the sensor with clean water and retest.

> ⓘ *Dry the port and sensor connector with compressed air and apply a very thin coat of o-ring lubricant to all o-rings before reinstallation.*

SENSOR MAINTENANCE - CHLORIDE

> ⓘ *Typical working life for chloride sensors is approximately 3-6 months depending on usage, storage, and maintenance. Proper storage and maintenance generally extends the sensor's working life.*

The chloride sensor is considered a pellet membrane ISE. As always, when handling sensors, care should be taken to avoid damaging the membrane. This

sensor can be regenerated by washing with alcohol and/or gently polishing with fine emery paper in a circular motion to remove any deposits or discoloration, then thoroughly washing with deionized water to remove any debris. The sensor may require soaking in the high standard chloride calibration solution to recover its performance.

SENSOR MAINTENANCE - AMMONIUM AND NITRATE

> *Typical working life for ammonium and nitrate sensors is approximately 3-6 months depending on usage, storage and maintenance. Proper storage and maintenance generally extends the sensor's working life.*

The ammonium and nitrate sensors are PVC membranes. As always, when handling a sensor, care should be taken to avoid damaging the membrane. After extensive use the membranes may become coated with a deposit or scoured with fine scratches which may cause a slow or reduced response (low slope) or unstable readings. Deposits may be removed with a fine jet of deionized water or rinsing in alcohol followed by soaking in the high standard calibration solution. Gently dab dry with a lint-free tissue before taking measurements.

SENSOR STORAGE

SHORT-TERM STORAGE

The cable assembly is supplied with a sensor storage container, or sleeve, that attaches to the cable. The container is used for short-term storage (less than 30 days). Be sure to keep a small amount of moisture (tap water) in the container during storage. This is done to maintain a 100% saturated air environment which is ideal for short-term sensor storage. The sensors should not be submersed in water. The intent is to create a humid air storage environment.

LONG-TERM STORAGE

Long-term Storage - Temperature

No special storage is required. The temperature sensor can be stored dry or wet as long as solutions in contact with the thermistor are not corrosive (for example, chlorine bleach).

Long-term Storage Temperature: -5 to 70°C (23 to 158°F)

Long-term Storage - Conductivity

No special storage is required. Sensors can be stored dry or wet as long as solutions in contact with conductivity electrodes are not corrosive (for example, chlorine bleach). However, it is recommended that the sensor be cleaned with the provided brush prior to and after long term storage.

Long-term Storage Temperature: -5 to 70°C (23 to 158°F)

Long-term Storage - Dissolved Oxygen

Dissolved oxygen sensors (Polarographic and Galvanic) should be stored in a dry state for long term storage First, remove the membrane cap and thoroughly rinse the sensor with clean water. Next, either blow it dry with compressed air or allow to air dry completely. Install a clean, dry new membrane cap over the sensor to keep it dry and to protect the electrodes.

After storing the sensor for a long period of time, it is necessary to "condition" the sensor by putting a new membrane with electrolyte solution on the sensor and then turning the instrument on to allow the sensor sufficient time to stabilize.

Long-term Storage Temperature: -5 to 70°C (23 to 158°F)

Long-term Storage - pH

The key to pH sensor storage, short or long-term, is to make certain that the sensor does not dry out. Sensors which have been allowed to dry out due to improper storage procedures may be irreparably damaged by the dehydration and will require replacement. You can try to rehydrate the sensor by soaking it (preferably overnight) in a potassium chloride solution or a pH 4 buffer before attempting to calibrate.

To store the sensor, remove it from the cable and seal the vacant port with a port plug. Fill the original shipping/storage vessel (plastic boot or bottle) with buffer 4 solution and then submerge the sensor into the solution. The sensor should remain submerged in the solution during the storage period; therefore, make certain that the vessel is sealed to prevent evaporation and periodically check the vessel to ensure the sensor does not dry out.

Long-term Storage Temperature: 0 to 30°C (32 to 86°F)

> *It is important not to store the pH sensor in distilled or deionized water as the glass sensor may be damaged by exposure to this medium.*

Long-term Storage - ORP

To store, remove the sensor from the cable and seal the vacant port with the provided plug. Fill the original shipping/storage vessel (plastic boot or bottle) with buffer 4 solution and then submerge the sensor into the solution. The sensor should remain submerged in the solution during the storage period; therefore, make certain that the vessel is sealed to prevent evaporation and periodically check the vessel to ensure the sensor does not dry out.

Long-term Storage Temperature: 0 to 30°C (32 to 86°F)

Long-term Storage - Ammonium, Nitrate, and Chloride

The key to ISE sensor storage, short or long-term, is to make certain that the sensor does not dry out. Sensor junctions that have been allowed to dry out due to improper storage procedures may be irreparably damaged by the dehydration and will require replacement. You can attempt to rehydrate the sensor by soaking it (preferably overnight) in the sensor's high calibration solution before attempting to calibrate.

The recommended storage of these sensors is in moist air. Remove the sensor from the cable and seal the vacant port with the provided plug. Place the sensor in its original shipping storage vessel (plastic boot or bottle) with a small amount of tap water or its high calibration standard. The vessel should remain a saturated air environment. The sensor only needs to be kept in moist air, not submerged. Make certain that the vessel is sealed to prevent evaporation.

Long-term Storage Temperature: 0 to 30°C (32 to 86°F)

TROUBLESHOOTING

Illegal Value may appear during alpha/numeric entry on the message line. This only appears if the values entered do not match the formatting. This will also appear in GLP security area if the password is incorrect.

If you forget the GLP Security Password please contact YSI Tech Support at environmental@ysi.com, 800-897-4151, or +1 937 767-7241.

HELP

During use of the Professional Plus instrument, press **Question** ? from any screen to view help messages directly on the display.

ERROR MESSAGES

If readings for a certain parameter are over range you will see a series of +++++ and if the readings are under range you will see a series of ----- plus the error message along the bottom of the screen. If you see a series of ????? that will indicate that a certain parameter can not be calculated. The following are potential error messages:

Probe Temp over range
Probe Temp under range
Case Temp over range
Case Temp under range
pH over range
pH under range
ORP over range
ORP under range
Cl over range
Cl under range
NH4 over range
NH4 under range
NO3 over range
NO3 under range
DO over range
DO under range
Conductivity over range
Conductivity under range
Barometer over range
Barometer under range

Error messages for the sensors typically indicate a need to properly clean the sensor. First verify the sensor is properly setup in the Sensor menu, then conduct the recommended cleaning and attempt to calibrate the sensor. If this does not work, it may indicate the useful life of the sensor has been reached and may need to be replaced. You may also contact Technical Support to help determine the next step.

DISSOLVED OXYGEN

The dissolved oxygen sensors will use Probe Current (DO uA) and Probe Slope (%/uA) as part of their GLP file records. The following information indicates the acceptable values for each of these readings:

Polarographic DO at 25 °C, 100% saturated air environment at 760 mmHg

Probe Current

1.25 mil PE membrane

Average 6.15 uA (min. 4.31 uA, max. 8.00 uA)

2.0 mil PE membrane

Average 3.38 uA (min. 2.37 uA, max. 4.40 uA)

1 mil Teflon® membrane

Average 16.29 uA (min. 11.40 uA, max. 21.18 uA)

Probe Slope

1.25 mil PE membrane

Average 16.26 % sat/uA (min. 12.51 uA, max. 23.23 uA)

2.0 mil PE membrane

Average 29.56 % sat/uA (min. 22.74 uA, max. 42.23 uA)

1 mil Teflon® membrane

Average 6.14 % sat/uA (min. 4.72 uA, max. 8.77 uA)

RESTORE DEFAULT CALIBRATION VALUES

Occasionally, the instrument may need to have the factory calibration default values restored. In order to accomplish this press Calibrate (Cal), highlight **Restore Default Cal** and press enter. Highlight the parameter you wish to restore to default and press enter. Next you will be asked to confirm the operation. Highlight **Yes** and press enter to confirm.

ACCESSORIES / PART NUMBERS

*Cable Part Number**	*Description*
6050000	Professional Plus Instrument
60510-1, -4, -10, -20, or -30	1, 4, 10, 20, or 30-meter cable for ISE/temp
60520-1, -4, -10, -20, or -30**	1, 4, 10, 20, or 30-meter cable for DO/temp
60530-1, 4, -10, -20, or -30	1, 4, 10, 20 or 30-meter cable for Cond/temp
6051010-1, 4, -10, -20, or -30	1, 4, 10, 20, or 30-meter cable for ISE/ISE/temp
6051020-1, -4, -10, -20, or -30	1, 4, 10, 20, or 30-meter cable for ISE/DO/temp
6051030-1, 4, -10, -20, or -30	1, 4, 10, 20, or 30-meter cable for ISE/Cond/temp
6052030-1, -4, -10, -20, or -30	1, 4, 10, 20 or 30-meter cable for DO/Cond/temp
605790-1, -4, -10, -20, or -30	1, 4, 10, 20 or 30-meter Quatro cable for DO/Cond/temp/ISE/ISE
605107	1-meter pH/temp single junction lab-grade combo electrode
605177	4-meter pH/temp single junction lab-grade combo electrode
605108	1-meter ORP/temp single junction lab-grade combo electrode
605178	4-meter ORP/temp single junction lab-grade combo electrode
605109	1-meter pH/ORP/temp single junction lab-grade combo electrode
605179	4-meter pH/ORP/temp single junction lab-grade combo electrode

Sensor Part Number	*Description*
605202	Galvanic DO sensor
605203	Polarographic DO sensor
605101	pH (ISE)
605102	ORP (ISE)
605103***	pH/ORP Combination (ISE)
605104****	Ammonium (ISE)

Sensor Part Number	*Description*
605105****	Chloride (ISE)
605106****	Nitrate (ISE)
605780	Self-Stirring BOD sensor
005560	Conductivity/Temperature sensor for Quatro cable

* All cables include temperature.
Cables with conductivity include sensor
(no need to order separate conductivity sensor).
** Special order cables up to 100-meters are available with 60520 cables.
*** Not compatible with 6051010-X or Quatro cables.
**** Freshwater only

Accessory Part Number	*Description*
603059	Flow cell, standard, 203 mL (for two-port sensors) 
603077	Flow cell kit, 1 or 2 port sensor (includes 603059 flow cell for two-port sensors with the 603078 adapter for one-port sensors) 
603078	Flow cell adapter, single port (use with 603059 flow cell to accommodate one-port sensors)

Accessory Part Number	*Description*
605990	Flow cell kit for Quatro cable assemblies.
603056	Flow cell mounting spike 
605604	Communications saddle kit 
605515	Data Manager desktop software
603075	Carrying case, soft-sided 
603074	Carrying case, hard-sided 
605745	Maintenance kit
038213	Brush, tube cleaner
601205	Grease, o-ring

Accessory Part Number	*Description*
603069	Belt clip 
063517	Ultra clamp 
063507	Tripod clamp 
603062	Cable management kit 
605978	Weight, sensor/cable, 4.9 oz. 
063019	Weight, sensor/cable, 24 oz., 3”
063020	Weight, sensor/cable, 51 oz., 6”
603070	Shoulder strap

Solutions Part Number	*Description*
3161	1,000 us/cm conductivity solution (quart)
3163	10,000 us/cm conductivity solution (quart)
3169	50,000 us/cm conductivity solution (8 pints)
3682	Zobell ORP solution (125 mL)
3824	pH 4, 7, 10 buffers (2 pints of each)
3841	1 mg/L ammonium solution (500 mL)
3842	10 mg/L ammonium solution (500 mL)
3843	100 mg/L ammonium solution (500 mL)
3885	1 mg/L nitrate solution (500 mL)
3886	10 mg/L nitrate solution (500 mL)
3887	100 mg/L nitrate solution (500 mL)
5580	Confidence Solution (verifies pH, ORP, conductivity sensor performance)

DECLARATION OF CONFORMITY

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for the listed European Council Directive(s) and carries the CE mark accordingly.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	Professional Plus Water Quality Instrument
Model Numbers	
Instrument/Accessory:	Professional Plus (6050000) / ProComm (605604)
Probe/Cable Assemblies:	605107, 605177, 605108, 605178, 605109, 605179, 605780, 60510, 60520, 60530, 6051010, 6051020, 6051030, 6052030, 605790
Sensors:	605202, 605203, 605780, 605101, 605102, 605103, 605104, 605105, 605106, 005560
Conforms to the following:	
Directives:	EMC 2004/108/EC RoHS 2002/95/EC WEEE 2002/96/EC

Harmonized Standards:	• EN61326-1:2006, Electrical equipment for measurement, control, and laboratory use – EMC requirements – Part 1: General Requirements • EN61326-2-3:2006, Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular Requirements – Test configuration, operational conditions, and performance criteria for transducers with integrated or remote signal conditioning. • EN61000-3-2:2006, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current < 16A per phase). • EN61000-3-3:1995 +A1:2001 +A2:2005, Electromagnetic compatibility (EMC) – Part 3: Limits – Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current < 16A.
Supplementary Information:	All performance met the continuous unmonitored operation criteria as follows: 1. ESD, EN61000-4-2, Performance Criterion B 2. Radiated Immunity, EN61000-4-3, Performance Criterion A 3. EFT, EN61000-4-4, (EFT) Performance Criterion B 4. Surge, EN61000-4-5, Performance Criterion B 5. Conducted Immunity, EN61000-4-6, Performance Criterion A 6. Voltage Interrupts, EN61000-4-11, Performance Criterion B 7. RF Emissions, EN55011:1998, A1:1999 Class B equipment
Authorized EU Representative	YSI Hydrodata Ltd Unit 8, Business Centre West, Avenue 1 Letchworth, Hertfordshire, SG6 2HB UK

Signed: Lisa M. Abel Date: 22 February 2008
Title: Director of Quality

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for electrical equipment under US FCC Part 15 and ICES-003 for unintentional radiators.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	
Model Numbers	
Instrument/Accessory:	Professional Plus (6050000) / ProComm (605604)
Probe/Cable Assemblies:	605107, 605177, 605108, 605178, 605109, 605179, 605780, 60510, 60520, 60530, 6051010, 6051020, 6051030, 6052030, 605790
Sensors:	605202, 605203, 605780, 605101, 605102, 605103, 605104, 605105, 605106, 005560
Conforms to the following:	
Standards:	• FCC 47 CFR Part 15-2008, Subpart B, Class B, Radio Frequency Devices • ICES-003:2004, Digital Apparatus
Supplementary Information:	Tested using ANSI C63.4-2003 (excluding sections 4.1, 5.2, 5.7, 9, and 14)

Signed: Lisa M. Abel Date: 22 February 2008
Title: Director of Quality

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms with the Australian and New Zealand Electromagnetic Compatibility (EMC) requirements for generic products to be used in residential, commercial, and light industrial environments.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	Professional Plus Water Quality Instrument
Model Numbers	
Instrument/Accessory:	Professional Plus (6050000) / ProComm (605604)
Probe/Cable Assemblies:	605107, 605177, 605108, 605178, 605109, 605179, 605780, 60510, 60520, 60530, 6051010, 6051020, 6051030, 6052030, 605790
Sensors:	605202, 605203, 605780, 605101, 605102, 605103, 605104, 605105, 605106, 005560
Conforms to the following:	
Standards:	• AS/NZS 4251.1:1999, Electromagnetic Compatibility (EMC) – Generic emission standard – Part 1: Residential, commercial, and light industry.

Signed: Lisa M. Abel Date: 22 February 2008
Title: Director of Quality

RECYCLING

YSI is committed to reducing the environmental footprint in the course of doing business. Even though materials reduction is the ultimate goal, we know there must be a concerted effort to responsibly deal with materials after they've served a long, productive life-cycle. YSI's recycling program ensures that old equipment is processed in an environmentally friendly way, reducing the amount of materials going to landfills.

- Printed Circuit Boards are sent to facilities that process and reclaim as much material for recycling as possible.
- Plastics enter a material recycling process and are not incinerated or sent to landfills.

- Batteries are removed and sent to battery recyclers for dedicated metals.

When the time comes for you to recycle, follow the easy steps outlined at www.ysi.com.

CONTACT INFORMATION

ORDERING AND TECHNICAL SUPPORT

Telephone: 800 897 4151 (US)
+1 937 767 7241 (Globally)
Monday through Friday, 8:00 AM to 5:00 ET

Fax: +1 937 767 9353 (orders)
+1 937 767 1058 (technical support)

Email: environmental@ysi.com or proseries@ysi.com

Mail: YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387 USA

Internet: www.ysi.com

When placing an order please have the following available:
1.) YSI account number (if available)
2.) Name and phone number
3.) Purchase Order or Credit Card
4.) Model Number or brief description
5.) Billing and shipping addresses
6.) Quantity Telephone: 800 897 4151 (US)

SERVICE INFORMATION

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click 'Support' or contact YSI Technical Support directly at 800-897-4151.

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from www.ysi.com by clicking on the 'Support" tab, then the Product Return Form button.

Item # 605596
Rev D
Drawing # A605596
March 2009

APPENDIX B

Hach® DR/890 Colorimeter Procedures Manual

Appendix B-1

Hach® DR890 General Procedures

Appendix B-2

Hach® DR890 Nitrite Analysis Procedures

Appendix B-3

Hach® DR890 Nitrate Analysis Procedures

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DR/890
COLORIMETER
PROCEDURES MANUAL

te/dk 03/13 10ed

INTRODUCTION

This manual is divided into five sections:

Section 1 Chemical Analysis Information

This section applies to all the procedures. It provides background information and reference/review material for the technician or chemist. Commonly used techniques are explained in detail.

Section 2 Sample Pretreatment

This section provides a brief overview of sample pretreatment and two USEPA digestions. A brief discussion of the Hach Digesdahl Digestion Apparatus and the Hach Distillation Apparatus is included.

Section 3 Waste Management and Safety

Section 3 includes information on waste management, regulations, waste disposal and resources on waste management. The Safety portion covers reading an MSDS and general safety guidelines.

Section 4 Procedures

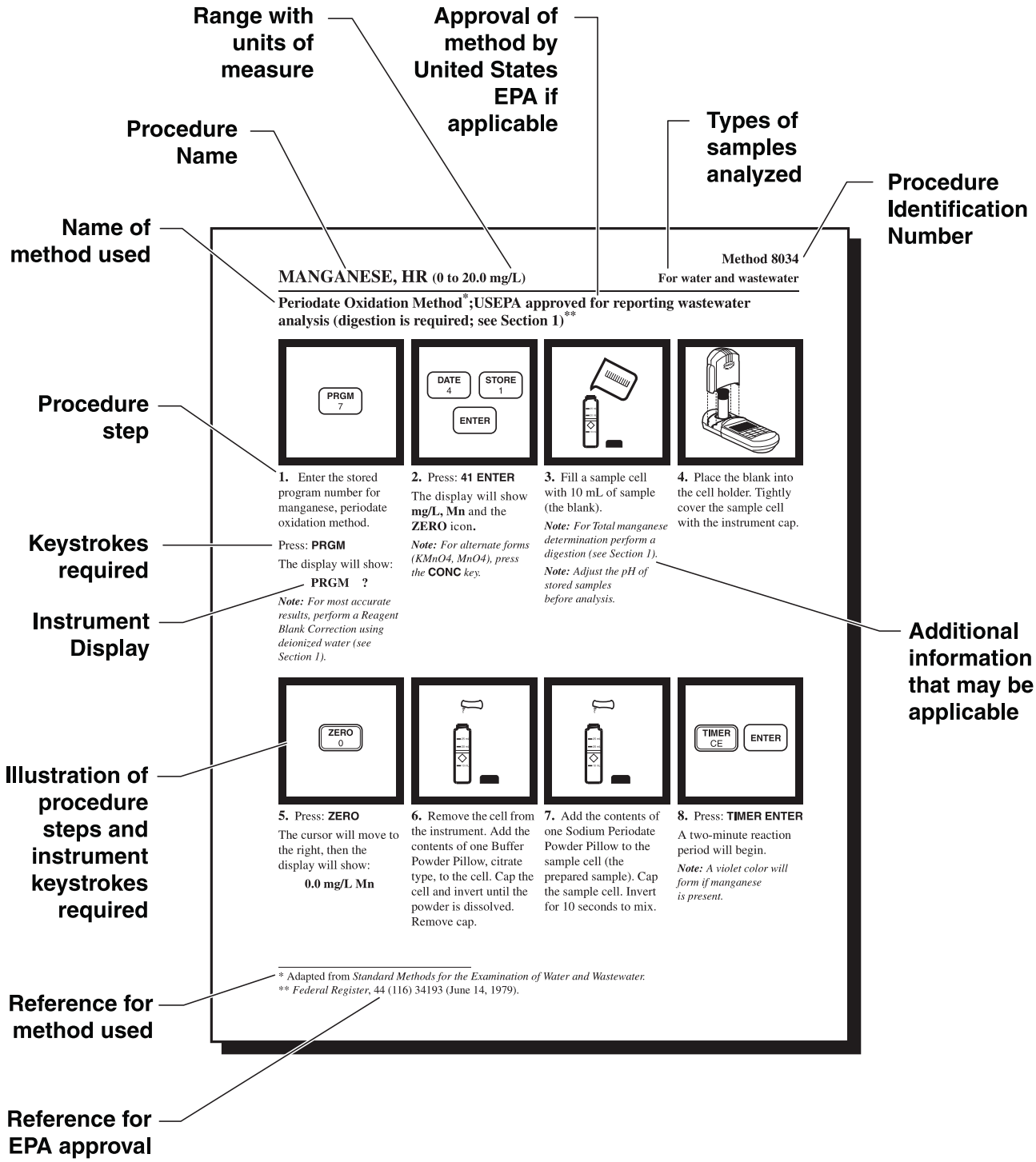
Section 4 contains step-by-step illustrated instructions for measuring parameters. The steps also include helpful notes. Each procedure contains information on sample collection, storage and preservation, accuracy checks, possible interferences, summary of method and a list of the reagents and apparatus necessary to run the test.

Section 5 Ordering Information

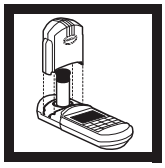
This section provides information needed for ordering, shipping, return of items and Hach trademarks.

Before attempting the analysis procedures the analyst should read the instrument manual to learn about the colorimeter's features and operation.

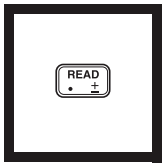
Sample Procedure Explained



MANGANESE, HR, continued



9. Place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.



10. Press: **READ**

The cursor will move to the right, then the result in mg/L manganese will be displayed.

Note: *Standard Adjust may be performed using a prepared standard (see Section 1).*

Specific sampling and storage information for this test

Sampling and Storage

Collect samples in acid-washed plastic bottles. Manganese may be lost by adsorption to glass container walls. Adjust the pH to less than 2 with nitric acid (about 2 mL per liter). Preserved samples may be stored up to six months at room temperature. Adjust the pH to 4 to 5 with 5.0 N sodium hydroxide before analysis. Do not exceed pH 5, as manganese may be lost as a precipitate. Correct the test result for volume additions; see *Correction for Volume Additions* in *Section 1* for more information. If only dissolved Mn is to be determined, filter before acid addition.

Confirm accuracy with these steps (in addition, may also be used to troubleshoot a test, improve technique, check reagents and to assure cleanliness of glassware)

Accuracy Check

Standard Additions Method

a) Snap the neck off a Manganese Voluette Ampule Standard Solution, 250 mg/L Mn.

b) Use the TenSette Pipet to add 0.1, 0.2 and 0.3 mL of standard, respectively, to the three 25-mL water samples. Swirl to mix.

c) Transfer only 10 mL of each solution to the 10-mL sample cells.

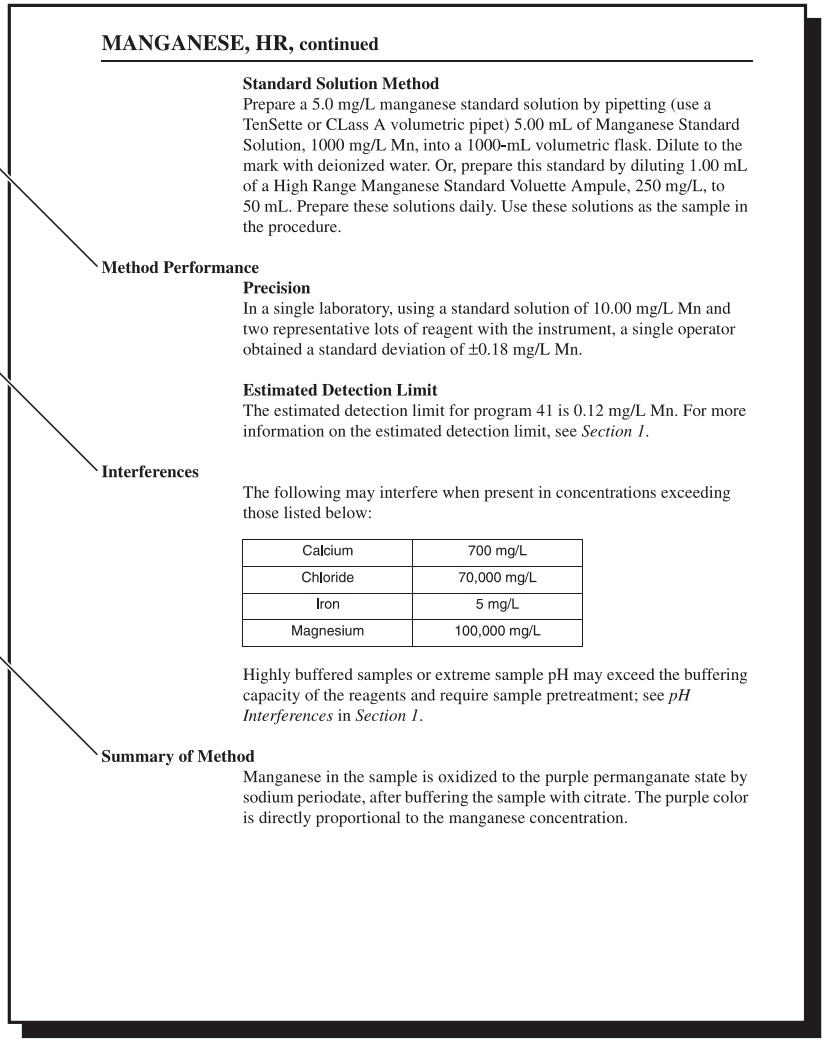
d) Analyze each standard addition sample as described in the procedure. The manganese concentration should increase 1.0 mg/L for each 0.1 mL of standard added.

e) If these increases do not occur, see *Standard Additions* in *Section 1* for troubleshooting information.

Expected repeatability and estimated detection limit of the procedure

Levels of common sample substances or conditions that will cause inaccurate results

Concise explanation of method



MANGANESE, HR, continued

Standard Solution Method

Prepare a 5.0 mg/L manganese standard solution by pipetting (use a TenSette or CLass A volumetric pipet) 5.00 mL of Manganese Standard Solution, 1000 mg/L Mn, into a 1000-mL volumetric flask. Dilute to the mark with deionized water. Or, prepare this standard by diluting 1.00 mL of a High Range Manganese Standard Voluette Ampule, 250 mg/L, to 50 mL. Prepare these solutions daily. Use these solutions as the sample in the procedure.

Method Performance

Precision

In a single laboratory, using a standard solution of 10.00 mg/L Mn and two representative lots of reagent with the instrument, a single operator obtained a standard deviation of ±0.18 mg/L Mn.

Estimated Detection Limit

The estimated detection limit for program 41 is 0.12 mg/L Mn. For more information on the estimated detection limit, see *Section 1*.

Interferences

The following may interfere when present in concentrations exceeding those listed below:

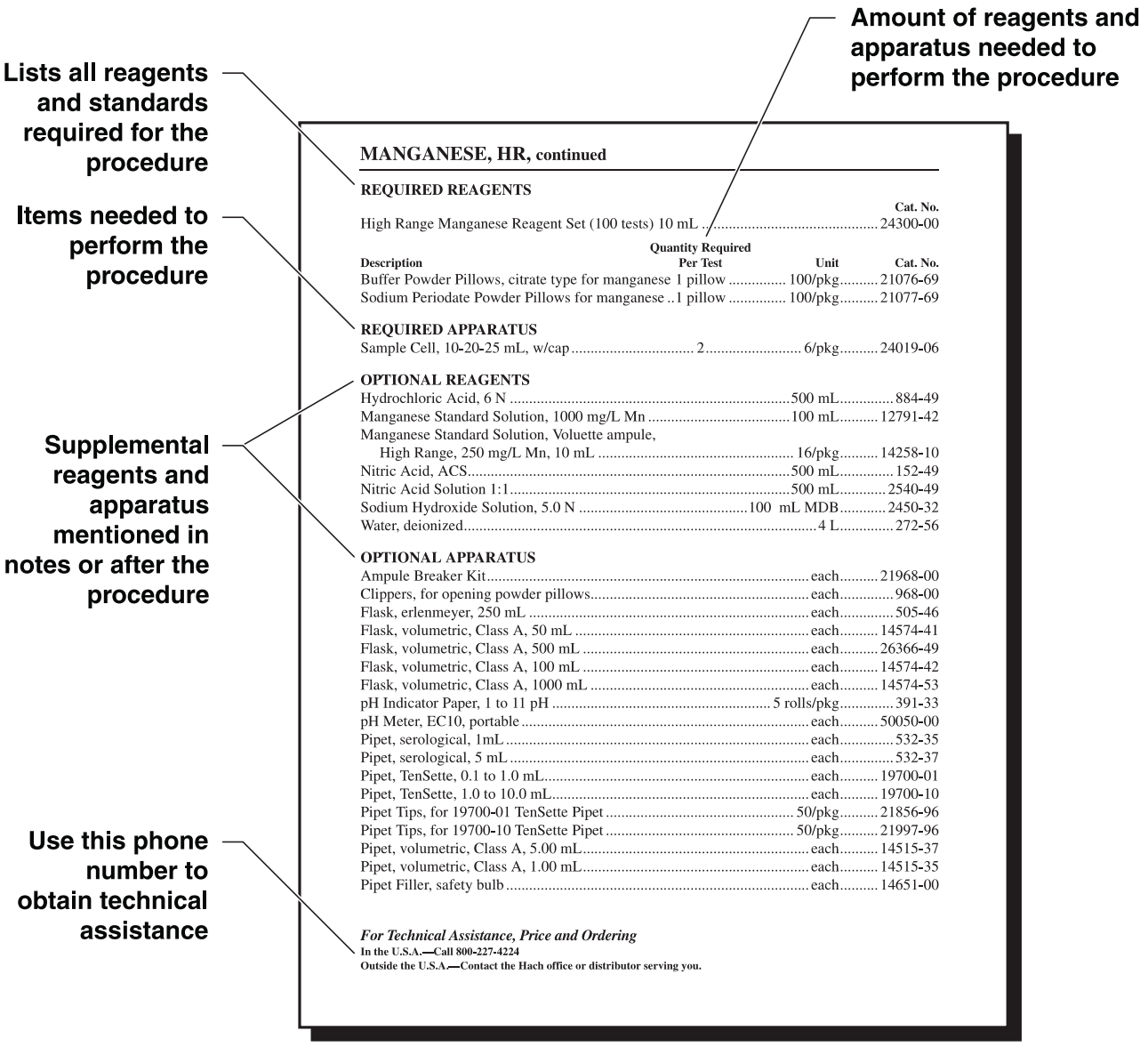
Calcium	700 mg/L
Chloride	70,000 mg/L
Iron	5 mg/L
Magnesium	100,000 mg/L

Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagents and require sample pretreatment; see *pH Interferences* in *Section 1*.

Summary of Method

Manganese in the sample is oxidized to the purple permanganate state by sodium periodate, after buffering the sample with citrate. The purple color is directly proportional to the manganese concentration.

Sample Procedure Explained, continued



Abbreviations

The following abbreviations are used throughout the text of the procedure section:

Abbrev-iation	Definition	Abbrev-iation	Definition
°C	degree(s) Celsius (Centigrade)	MDL	Method detection limit
°F	degree(s) Fahrenheit	MDB	marked dropping bottle
ACS	American Chemical Society reagent grade purity	mg/L	milligrams per liter (ppm)
APHA Standard Methods	*Standard Methods for the Examination of Water and Wastewater.*[1]	µg/L	micrograms per liter (ppb)
AV	AccuVac	mL	(milliliter)-approximately the same as a cubic centimeter (cc) or 1/1000 of a liter. Also known as a "cc".
conc	concentrated	MR	medium range
CFR	Code of Federal Regulations	NIPDWR	National Interim Primary Drinking Water Regulations
DB	dropping bottle	NPDES	National Pollutant Discharge Elimination System
EDL	Estimated detection limit	PCB	Poly chlorinated biphenyl
FAU	Formazin Attenuation Units. Turbidity unit of measure based on a Formazin stock suspension.	SCDB	self-contained dropping bottle
g	grams	TNT	Test 'N Tube™
gr/gal	grains per gallon (1 gr/gal = 17.12 mg/L)	TPH	Total petroleum hydrocarbons
HR	high range	TPTZ	(2,4,6-Tri-(2-Pyridyl)-1,3,5-Triazine)
L	Liter. Volume equal to one cubic decimeter (dm^3)	ULR	Ultra low range
LR	low range	USEPA	United States Environmental Protection Agency

[1] Published jointly by the American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF). Order from Hach requesting Cat. No. 22708-00 or from the Publication Office of the American Public Health Association. This book is the standard reference work for water analysis. Many procedures contained in this manual are based on *Standard Methods.*

Converting Chemical Species

Species conversion factors for many commonly used substances are pre-programmed into the instrument (see *Table 1*). Conversions are method specific and are viewable after taking the reading by pressing **CONC**.

Table 1 Conversion Factors

To Convert From...	To...	Multiply By...
mg/L Al	mg/L Al_2O_3	1.8895
mg/L Ca-$CaCO_3$	mg/L Ca	0.4004
mg/L $CaCO_3$	mg/L Ca	0.4004
mg/L $CaCO_3$	mg/L Mg	0.2428
µg/L Carbohydrazide	µg/L Hydroquinone	1.92
µg/L Carbohydrazide	µg/L ISA	2.69
µg/L Carbohydrazide	µg/L MEKO	3.15
mg/L Cr^{6+}	mg/L CrO_4^{2-}	2.231
mg/L Cr^{6+}	mg/L Na_2CrO_4	3.115
mg/L Mg-$CaCO_3$	mg/L Mg	0.2428
mg/L Mn	mg/L $KMnO_4$	2.876
mg/L Mn	mg/L MnO_4^-	2.165
mg/L Mo^{6+}	mg/L MoO_4^{2-}	1.667
mg/L Mo^{6+}	mg/L Na_2MoO_4	2.146
mg/L N	mg/L NH_3	1.216
mg/L N	mg/L NO_3^-	4.427
mg/L Na_2CrO_4	mg/L Cr^{6+}	0.321
mg/L Na_2CrO_4	mg/L CrO_4^{2-}	0.72
mg/L NH_2Cl-N	mg/L Cl_2	5.0623
mg/L NH_2Cl-N	mg/L NH_2Cl	3.6750
mg/L NH_3-N	mg/L NH_3	1.216
mg/L NH_3-N	mg/L NH_4^+	1.288
mg/L NO_2^-	mg/L $NaNO_2$	1.5
mg/L NO_2^-	mg/L NO_2^--N	0.3045
mg/L NO_2^--N	mg/L $NaNO_2$	4.926
µg/L NO_2^--N	µg/L $NaNO_2$	4.926
mg/L NO_2^--N	mg/L NO_2^-	3.284
µg/L NO_2^--N	µg/L NO_2^-	3.284
mg/L NO_3^--N	mg/L NO_3^-	4.427
mg/L PO_4^{3-}	mg/L P	0.3261
µg/L PO_4^{3-}	µg/L P	0.3261
mg/L PO_4^{3-}	mg/L P_2O_5	0.7473
µg/L PO_4^{3-}	µg/L P_2O_5	0.7473
mg/L SiO_2	mg/L Si	0.4674
µg/L SiO_2	µg/L Si	0.4674

Hardness Conversion

Table 2 lists the factors for converting one unit of measure for hardness to another unit of measure. For example, to convert mg/L $CaCO_3$ to German parts/100,000 CaO, multiply the value in mg/L x 0.056.

Table 2 Hardness Conversion Factors

Units of Measure	mg/L $CaCO_3$	British gr/gal (Imperial) $CaCO_3$	American gr/gal (US) $CaCO_3$	French parts/ 100,000 $CaCO_3$	German Parts/ 100,000 CaO	meq/L[1]	g/L CaO	lbs./cu ft $CaCO_3$
mg/L $CaCO_3$	1.0	0.07	0.058	0.1	0.056	0.02	$5.6x10^{-4}$	$6.23x10^{-5}$
English gr/gal $CaCO_3$	14.3	1.0	0.83	1.43	0.83	0.286	$8.0x10^{-3}$	$8.9x10^{-4}$
US gr/gal $CaCO_3$	17.1	1.2	1.0	1.72	0.96	0.343	$9.66x10^{-3}$	$1.07x10^{-3}$
Fr. p/ 100,000 $CaCO_3$	10.0	0.7	0.58	1.0	0.56	0.2	$5.6x10^{-3}$	$6.23x10^{-4}$
Ger. p/ 100,000 CaO	17.9	1.25	1.04	1.79	1.0	0.358	$1x10^{-2}$	$1.12x10^{-3}$
meq/L	50.0	3.5	2.9	5.0	2.8	1.0	$2.8x10^{-2}$	$3.11x10^{-2}$
g/L CaO	1790.0	125.0	104.2	179.0	100.0	35.8	1.0	0.112
lbs./cu ft $CaCO_3$	16,100.0	1,123.0	935.0	1,610.0	900.0	321.0	9.0	1.0

[1] 'epm/L, or 'mval/L'
Note: 1 meq/L = 1N/1000

Dissolved Oxygen

Table 3 lists the mg/L dissolved oxygen in water at saturation for various temperatures and atmospheric pressures. The table was formulated in a laboratory using pure water. The values given are only approximations for estimating the oxygen content of a particular body of surface water.

Table 3 Dissolved Oxygen Saturation In Water

		Pressure in Millimeters and Inches Hg							
		mm							
		775	760	750	725	700	675	650	625
Temp		inches							
°F	°C	30.51	29.92	29.53	28.45	27.56	26.57	25.59	24.61
32.0	0	14.9	14.6	14.4	13.9	13.5	12.9	12.5	12.0
33.8	1	14.5	14.2	14.1	13.6	13.1	12.6	12.2	11.7
35.6	2	14.1	13.9	13.7	13.2	12.9	12.3	11.8	11.4
37.4	3	13.8	13.5	13.3	12.9	12.4	12.0	11.5	11.1
39.2	4	13.4	13.2	13.0	12.5	12.1	11.7	11.2	10.8
41.0	5	13.1	12.8	12.6	12.2	11.8	11.4	10.9	10.5
42.8	6	12.7	12.5	12.3	11.9	11.5	11.1	10.7	10.3
44.6	7	12.4	12.2	12.0	11.6	11.2	10.8	10.4	10.0
46.4	8	12.1	11.9	11.7	11.3	10.9	10.5	10.1	9.8
48.2	9	11.8	11.6	11.5	11.1	10.7	10.3	9.9	9.5
50.0	10	11.6	11.3	11.2	10.8	10.4	10.1	9.7	9.3
51.8	11	11.3	11.1	10.9	10.6	10.2	9.8	9.5	9.1
53.6	12	11.1	10.8	10.7	10.3	10.0	9.6	9.2	8.9
55.4	13	10.8	10.6	10.5	10.1	9.8	9.4	9.1	8.7
57.2	14	10.6	10.4	10.2	9.9	9.5	9.2	8.9	8.5
59.0	15	10.4	10.2	10.0	9.7	9.3	9.0	8.7	8.3
60.8	16	10.1	9.9	9.8	9.5	9.1	8.8	8.5	8.1
62.6	17	9.9	9.7	9.6	9.3	9.0	8.6	8.3	8.0
64.4	18	9.7	9.5	9.4	9.1	8.8	8.4	8.1	7.8
66.2	19	9.5	9.3	9.2	8.9	8.6	8.3	8.0	7.6
68.0	20	9.3	9.2	9.1	8.7	8.4	8.1	7.8	7.5
69.8	21	9.2	9.0	8.9	8.6	8.3	8.0	7.7	7.4
71.6	22	9.0	8.8	8.7	8.4	8.1	7.8	7.5	7.2
73.4	23	8.8	8.7	8.5	8.2	8.0	7.7	7.4	7.1

Table 3 Dissolved Oxygen Saturation In Water (continued)

		Pressure in Millimeters and Inches Hg							
		mm							
		775	760	750	725	700	675	650	625
Temp		inches							
°F	°C	30.51	29.92	29.53	28.45	27.56	26.57	25.59	24.61
75.2	24	8.7	8.5	8.4	8.1	7.8	7.5	7.2	7.0
77.0	25	8.5	8.4	8.3	8.0	7.7	7.4	7.1	6.8
78.8	26	8.4	8.2	8.1	7.8	7.6	7.3	7.0	6.7
80.6	27	8.2	8.1	8.0	7.7	7.4	7.1	6.9	6.6
82.4	28	8.1	7.9	7.8	7.6	7.3	7.0	6.7	6.5
84.2	29	7.9	7.8	7.7	7.4	7.2	6.9	6.6	6.4
86.0	30	7.8	7.7	7.6	7.3	7.0	6.8	6.5	6.2
87.8	31	7.7	7.5	7.4	7.2	6.9	6.7	6.4	6.1
89.6	32	7.6	7.4	7.3	7.0	6.8	6.6	6.3	6.0
91.4	33	7.4	7.3	7.2	6.9	6.7	6.4	6.2	5.9
93.2	34	7.3	7.2	7.1	6.8	6.6	6.3	6.1	5.8
95.0	35	7.2	7.1	7.0	6.7	6.5	6.2	6.0	5.7
96.8	36	7.1	7.0	6.9	6.6	6.4	6.1	5.9	5.6
98.6	37	7.0	6.8	6.7	6.5	6.3	6.0	5.8	5.6
100.4	38	6.9	6.7	6.6	6.4	6.2	5.9	5.7	5.5
102.2	39	6.8	6.6	6.5	6.3	6.1	5.8	5.6	5.4
104.0	40	6.7	6.5	6.4	6.2	6.0	5.7	5.5	5.3
105.8	41	6.6	6.4	6.3	6.1	5.9	5.6	5.4	5.2
107.6	42	6.5	6.3	6.2	6.0	5.8	5.6	5.3	5.1
109.4	43	6.4	6.2	6.1	5.9	5.7	5.5	5.2	5.0
111.2	44	6.3	6.1	6.0	5.8	5.6	5.4	5.2	4.9
113.0	45	6.2	6.0	5.9	5.7	5.5	5.3	5.1	4.8
114.8	46	6.1	5.9	5.9	5.6	5.4	5.2	5.4	4.8
116.6	47	6.0	5.9	5.8	5.6	5.3	5.1	4.8	4.7
118.4	48	5.9	5.8	5.7	5.5	5.3	5.0	4.8	4.6
120.2	49	5.8	5.7	5.6	5.4	5.2	5.0	4.7	4.5
122.0	50	5.7	5.6	5.5	5.3	5.1	4.9	4.7	4.4

Sample Collection, Preservation and Storage

Correct sampling and storage are critical for accurate testing. For greatest accuracy, thoroughly clean sampling devices and containers to prevent carryover from previous samples. Preserve the sample properly; each procedure has information about sample preservation.

- The least expensive containers are polypropylene or polyethylene.
- The best and most expensive containers are quartz or PTFE (polytetrafluoroethylene, Teflon).
- Avoid soft glass containers for metals in the microgram-per-liter range.
- Store samples for silver determination in light-absorbing containers, such as amber bottles.

Avoid contaminating the sample with metals from containers, deionized water or membrane filters. Thoroughly clean sample containers as described under Acid Washing Bottles.

Preservation slows the chemical and biological changes that continue after collection. These processes may change the amount of a chemical species available for analysis. Normally, analyze the samples as soon as possible after collection, especially when the analyte concentration is expected to be low. This also reduces the chance for error and minimizes labor.

Preservation methods include pH control, chemical addition, refrigeration and freezing. *Table 4* gives the recommended preservation for various substances. It also includes suggested types of containers and the maximum recommended holding times for properly preserved samples.

Preserve aluminum, cadmium, chromium, cobalt, copper, iron, lead, nickel, potassium, silver and zinc samples for at least 24 hours by adding one Nitric Acid Solution Pillow 1:1 (Cat. No. 2540-98) per liter of sample. Check the pH with pH indicator paper or a pH meter to assure the pH is 2 or less. Add additional pillows if necessary. Adjust the sample pH prior to analysis by adding an equal number of Sodium Carbonate Anhydrous Powder Pillows (Cat. No. 179-98). Or raise the pH to 4.5 with Sodium Hydroxide Standard Solution, 1 N or 5 N. Correct for the added volume of the preservatives; see *Correcting For Volume Additions*.

Table 4 Required Containers, Preservation Techniques and Holding Times[1]

Parameter No./Name	Container[2]	Preservation[3,4]	Maximum Holding Time[5]
Table 1A - Bacterial Tests:			
1-4. Coliform, fecal and total	P,G	Cool, 4°C, 0.008%, $Na_2S_2O_3$[6]	6 hours
5. Fecal streptococci	P,G	Cool, 4°C, 0.008%, $Na_2S_2O_3$	6 hours
Table 1B - Inorganic Tests:			
1. Acidity	P, G	Cool, 4°C	14 days
2. Alkalinity	P, G	Cool, 4°C	14 days
4. Ammonia	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
9. Biochemical oxygen demand (BOD)	P, G	Cool, 4°C	48 hours
11. Bromide	P, G	None required	28 days
14. Biochemical oxygen demand, carbonaceous	P, G	Cool, 4°C	48 hours
15. Chemical oxygen demand	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
16. Chloride	P, G	None required	28 days
17. Chlorine, total residual	P, G	None required	Analyze immediately
21. Color	P, G	Cool, 4°C	48 hours
23-24. Cyanide, total and amenable to chlorination	P, G	Cool, 4°C, NaOH to pH>12, 0.6 g ascorbic acid[6]	14 days[7]
25. Fluoride	P	None required	28 days
27. Hardness	P, G	HNO_3 to pH<2, H_2SO_4 to pH<2	6 months
28. Hydrogen ion (pH)	P, G	None required	Analyze immediately
31, 43. Kjeldahl and organic nitrogen	P, G	Cool 4°C, H_2SO_4 to pH<2	28 days
Metals:[8]			
18. Chromium VI	P, G	Cool, 4°C	24 hours
35. Mercury	P, G	HNO_3 to pH<2	6 months
3, 5-8, 12, 13, 19, 20, 22, 26, 29, 30, 32-34, 36, 37, 45, 47, 51, 52, 58-60, 62, 63, 70-72, 74, 75.[9] Metals, except boron, chromium VI and mercury	P, G	do	6 months
38. Nitrate	P, G	Cool, 4°C	48 hours
39. Nitrate-nitrite	P, G	Cool 4°C, H_2SO_4 to pH<2	28 days
40. Nitrite	P, G	Cool, 4°C	48 hours
41. Oil and grease	G	Cool, 4°C, HCl or H_2SO_4 to pH<2	28 days
42. Organic Carbon	P, G	Cool, 4°C, HCl or H_2SO4 or H_3PO_4 to pH<2	28 days
44. Orthophosphate	P, G	Filter immediately; Cool, 4°C	48 hours
46. Oxygen, dissolved probe	G Bottle and top	None required	Analyze immediately
47. Winkler	G Bottle and top	Fix on site and store in dark	8 hours

Table 4 Required Containers, Preservation Techniques and Holding Times[1] (continued)

Parameter No./Name	Container[2]	Preservation[3,4]	Maximum Holding Time[5]
48. Phenols	G only	Cool 4°C, H_2SO_4 to pH<2	28 days
49. Phosphorus, elemental	G	Cool, 4°C	48 hours
50. Phosphorus, total	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
53. Residue, total	P, G	Cool, 4°C	7 days
54. Residue, filterable	P, G	Cool, 4°C	7 days
55. Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
56. Residue, Settleable	P, G	Cool, 4°C	48 hours
57. Residue, volatile	P, G	Cool, 4°C	7 days
61. Silica	P, PFTE or quartz	Cool, 4°C	28 days
64. Specific conductance	P, G	Cool, 4°C	28 days
65. Sulfate	P, G	Cool, 4°C	28 days
66. Sulfide	P, G	Cool 4°C, add zinc acetate plus sodium hydroxide to pH>9	7 days
67. Sulfite	P, G	none required	Analyze immediately
68. Surfactants	P, G	Cool, 4°C	48 hours
69. Temperature	P, G	None required	Analyze immediately
73. Turbidity	P, G	Cool, 4°C	48 hours

1 This table was taken from Table II published in the Federal Register, July 1, 1995, 40 CFR, Part 136.3, pages 643-645. Organic tests are not included.

2 Polyethylene (P) or glass (G).

3 Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

4 When any sample is to be shipped by common carrier or sent through United States Mails, it must comply with the Department of Transportation Hazardous Material Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

5 Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permitee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administer under §136.3(e). Some samples may not be stable for the maximum time period given in the table. A permitee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability. See §136.3(e) for details. The term "analyze immediately" usually means within 15 minutes or less after sample collection.

6 Should only be used in the presence of residual chlorine.

7 Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

8 Samples should be filtered immediately on-site before adding preservative for dissolved metals.

9 Numbers refer to parameter numbers in 40 CFR Part 136.3, Table 1B.

Collecting Water Samples

Obtain the best sample by careful collection. In general, collect samples near the center of the vessel or duct and below the surface. Use only clean containers (bottles, beakers). Rinse the container several times first with the water to be sampled.

Take samples as close as possible to the source of the supply. This lessens the influences of the distribution system on the sample. Let the water run long enough to flush the system. Fill sample containers slowly with a gentle stream to avoid turbulence and air bubbles. Collect water samples from wells after the pump has run long enough to deliver water representative of the ground water feeding the well.

It is hard to obtain a truly representative sample when collecting surface water samples. Obtain best results by testing several samples. Use samples taken at different times from several locations and depths. The results can be used to establish patterns for that particular body of water.

Generally, as little time as possible should elapse between collecting the sample and analyzing it.

Depending on the test, special precautions in handling the sample may be necessary. This prevents natural interferences such as organic growth or loss or gain of dissolved gases. Each procedure describes sample preservatives and storage techniques for samples that are held for testing.

Acid Washing Bottles

If a procedure suggests acid-washing, use the following instructions:

a) Clean the glassware or plasticware with laboratory detergent (phosphate-free detergent is recommended).

b) Rinse well with tap water.

c) Rinse with a 1:1 Hydrochloric Acid Solution or 1:1 Nitric Acid Solution.

d) Rinse well with deionized water at least four times. Up to 12-15 rinses may be necessary if chromium is being determined.

e) Air dry.

Use chromic acid or chromium-free substitutes to remove organic deposits from glass containers. Rinse containers thoroughly with water to remove traces of chromium.

Wash glassware for phosphate determinations with phosphate-free detergents and acid-wash with 1:1 HCl. Thoroughly rinse the glassware with deionized water. For ammonia and Kjeldahl nitrogen, rinse with ammonia-free water.

Correcting for Volume Additions

If you use a large volume of preservative, correct for the volume of preservative added. This accounts for dilution due to the acid added to preserve the sample and the base used to adjust the pH to the range of the procedure. This correction is made as follows:

1. Determine the volume of initial sample, the volume of acid and base added, and the total or final volume of the sample.

2. Divide the total volume by the initial volume of sample.

3. Multiply the test result by this factor.

Example:
A one-liter sample was preserved with 2 mL of nitric acid. It was neutralized with 5 mL of 5 N sodium hydroxide. The result of the analysis procedure was 10.00 mg/L. What is the volume correction factor and correct result?

1. Total Volume = 1000 mL + 2 mL + 5 mL = 1007 mL

2. $\frac{1007}{1000} = 1.007 =$ volume correction factor

3. 10.0 mg/L × 1.007 = 10.07 mg/L = correct result

Hach 1:1 Nitric Acid Pillows contain 2.5 mL of acid; correct for this volume. The addition of a Sodium Carbonate Power Pillow (neutralizes the 1:1 Nitric Acid Solution Pillow) does not need to be corrected for.

Boiling Aids

Boiling is necessary in some procedures. Using a boiling aid such as boiling chips (Cat. No. 14835-31) helps reduce bumping. Bumping is caused by the sudden, almost explosive conversion of water to steam as it is heated. Avoid bumping; it may cause injury or sample loss.

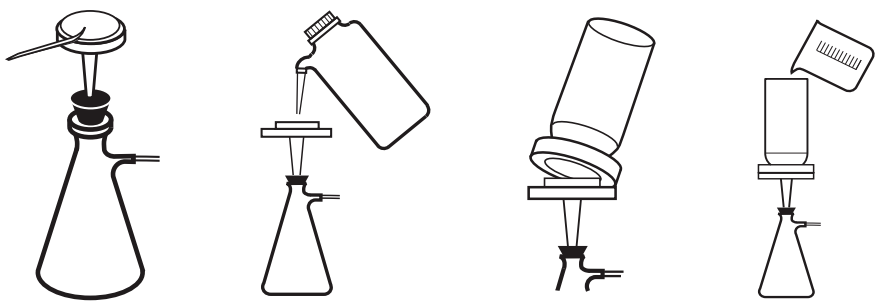
Make sure the boiling aids will not contaminate the sample. Do not use boiling aids (except glass beads) more than once. Loosely covering the sample during boiling will prevent splashing, reduce the chances of contamination and minimize sample loss.

Sample Filtration

Filtering separates particles from the aqueous sample. Filtration uses a medium, usually filter paper, to retain particles but pass solution. This is especially helpful when sample turbidity interferes with analysis. Two general methods of filtration are gravity and vacuum. Gravity filtration uses gravity to pull the sample though the filter paper. Vacuum filtration uses suction and gravity to move the sample through the filter. An aspirator or vacuum pump creates the suction. Vacuum filtration is faster than gravity filtration. Vacuum filter (see *Figure 1*) as follows:

1. Using tweezers, place a filter paper into the filter holder.
2. Place the filter holder assembly in the filtering flask. Wet the filter with deionized water to ensure adhesion to the holder. Empty the flask before filtering the sample.
3. Position the funnel housing on the filter holder assembly.
4. While applying a vacuum to the filtering flask, transfer the sample to the filtering apparatus.
5. Slowly release the vacuum from the filtering flask and transfer the solution from the filter flask to another container.

Figure 1 Vacuum Filtration



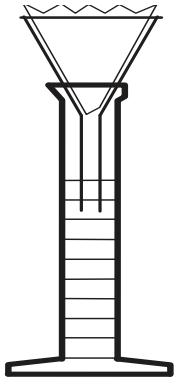
REQUIRED APPARATUS FOR VACUUM FILTRATION

Description	Unit	Cat. No.
Filter Discs, glass 47 mm, 1.5 µm	100/pkg	2530-00
Filter Holder, membrane	each	13529-00
Flask, filter, 500 mL	each	546-49
Pump, vacuum, hand operated	each	14283-00
OR		
Pump, vacuum, portable, 115 V	each	14697-00
Pump, vacuum, portable, 230 V	each	14697-02

Several procedures in this manual use gravity filtration. The only labware required is filter paper, a conical funnel and a receiving vessel. This labware is included under Optional Apparatus at the end of a procedure. Gravity filtration is better for retaining fine particles. For faster filtering, add solution until the filter paper cone is three-fourths filled. Never fill the cone completely. Gravity filter (see *Figure 2*) as follows:

1. Place a filter paper into the funnel.
2. Wet the filter with deionized water to ensure adhesion to the funnel. Allow all the deionized water to drain.
3. Place the funnel into an erlenmeyer flask or graduated cylinder.
4. Pour the sample into the funnel.

Figure 2 Gravity Filtration



REQUIRED APPARATUS FOR GRAVITY FILTRATION

Description	Unit	Cat No.
Cylinder, graduated, 100 mL	each	508-42
Funnel, poly, 65 mm	each	1083-67
Filter Paper, 12.5 cm	each	1894-57
Flask, erlenmeyer, 125 mL	each	505-43

Testing for metals requires acid and heat to pretreat the sample. Since these conditions destroy filter paper, vacuum filtration with glass fiber filter discs is recommended. Also, glass filter discs, unlike paper, do not retain colored species.

Temperature Considerations

For best results, perform most tests in this manual with sample temperatures between 20 °C (68 °F) and 25 °C (77 °F). If a test requires closer temperature control, notes in the procedure will indicate this.

Sample Dilution Techniques

Ten and 25 mL are the volumes used for most colorimetric tests. However, in some tests, the color developed in the sample may be too intense to be measured. Unexpected colors may develop in other tests. In both cases, dilute the sample to determine if interfering substances are present.

To dilute the sample easily, pipet the chosen sample portion into a clean graduated cylinder (or volumetric flask for more accurate work). Fill the cylinder (or flask) to the desired volume with deionized water. Mix well. Use the diluted sample when running the test.

To help with dilutions, *Table 5* shows the amount of sample used, the amount of deionized water used to bring the volume up to 25 mL and the multiplication factor.

The concentration of the sample is equal to the diluted sample reading multiplied by the multiplication factor.

More accurate dilutions can be done with a pipet and a 100-mL volumetric flask (see *Table 6* for more information). Pipet the sample and dilute to volume with deionized water. Swirl to mix.

Table 5 Sample Dilution Volumes

Sample Volume (mL)	mL Deionized Water Used to Bring the Volume to 25 mL	Multiplication Factor
25.0	0.0	1
12.5	12.5	2
10.0[1]	15.0	2.5
5.0[1]	20.0	5
2.5[1]	22.5	10
1.0[1]	24.0	25
0.250[1]	24.75	100

[1] For sample sizes of 10 mL or less, use a pipet to measure the sample into the graduated cylinder or volumetric flask.

Table 6 Multiplication Factors for Diluting to 100 mL

Sample Volume (mL)	Multiplication Factor
1	100
2	50
5	20
10	10
25	4
50	2

Sample Dilution and Interfering Substances

Sample dilution may influence the level at which a substance may interfere. The effect of the interferences decreases as the dilution increases. In other words, higher levels of an interfering substance can be present in the original sample if it is diluted before analysis.

An Example:

Copper does not interfere at or below 100 mg/L for a 25.00 mL sample in a procedure. If the sample volume is diluted with an equal volume of water, what is the level at which copper will not interfere?

$$\frac{\text{Total volume}}{\text{Sample volume}} = \text{Dilution factor}$$

$$\frac{25}{12.5} = 2$$

$$\text{Interference Level} \times \text{Dilution Factor} = \text{Interference level in sample}$$

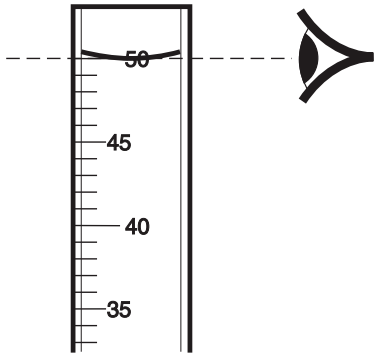
$$100 \times 2 = 200$$

The level at which copper will not interfere in the undiluted sample is at or below 200 mg/L.

Using Pipets and Graduated Cylinders

When small sample quantities are used, the accuracy of measurements is important. *Figure 3* illustrates the proper way of reading the sample level or the meniscus formed when the liquid wets the cylinder or pipet walls.

Figure 3 Reading the Meniscus



Rinse the pipet or cylinder two or three times with the sample to be tested before filling. Use a pipet filler or pipet bulb to draw the sample into the pipet. Never pipet chemical reagent solutions or samples by mouth. When filling a pipet, keep the tip of the pipet below the surface of the sample as the sample is drawn into the pipet.

Serological pipets have marks that indicate the volume of liquid delivered by the pipet. The marks may extend to the tip of the pipet or may be only on the straight portion of the tube. If the marks are only on the straight part of the tube, fill serological pipets to the zero mark and discharge the sample by draining the sample until the meniscus is level with the desired mark. If the serological pipet has marks extended to the tip of the pipet, fill the pipet to the desired volume and drain all the sample from the pipet. Then blow the sample out of the pipet tip for accurate measurements.

Volumetric (transfer) pipets have a bulb in the middle and a single ring above the bulb to indicate the volume of liquid when it is filled to the mark. To discharge a volumetric pipet, hold the pipet vertical until only a small amount of liquid remains (about ¾ inch), then hold the pipet at a slight angle against the container wall to drain. Do not attempt to discharge the solution remaining in the tip of the pipet after draining. Volumetric pipets are designed to retain a small amount of sample in the pipet tip.

If sample drops stay on the walls of the pipet, the pipet is dirty and is not delivering the correct amount of sample. Wash the pipet thoroughly with a laboratory detergent or cleaning solution and rinse several times with deionized water.

Using the TenSette Pipet

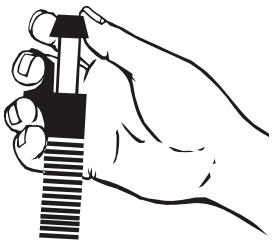
For best results use a new tip each time you pipet. After several uses, the pipet tip may retain some liquid, causing inaccurate delivery. Each pipet is supplied with 50 tips; order Hach replacement tips for best results.

Always use careful, even hand movements for best reproducibility. If the pipet does not operate smoothly, disassemble and coat the piston and retainer with high-quality stopcock grease. Also coat the metering turret lightly with grease. Refer to the TenSette Pipet manual.

For best pipetting accuracy, the solution and the room temperature should be between 20-25 °C.

Never lay the pipet down with the liquid in the tip. Solution could leak into the pipet and cause corrosion.

Operating the TenSette Pipet



1. Attach a clean tip by holding the pipet body in one hand and gently pressing the large end of the pipet tip onto the tapered end of the pipet. Be sure a good seal is obtained.

2. Turn the turret cap to align the desired volume with the mark on the pipet body.

3. Using a smooth motion, press down on the turret cap until it reaches the stop. Immerse the tip about 5 mm (¼ inch) below the solution surface to avoid drawing air into the pipet. Do not insert the tip any deeper or the delivery volume may be affected.

4. While maintaining a constant pressure, allow the turret to return slowly to the extended position. A rapid return may affect the delivery volume.

5. With the turret up, take the tip out of the solution and move it to the receiving vessel. Do not press on the turret cap while moving the pipet.

STEP 3

STEP 4

STEP 5

STEP 6

6. Use the thumb and forefinger to twist the turret cap to the next higher volume position to ensure quantitative transfer of the sample. The “F” position provides full blowout.

STEP 7

7. With the tip in contact with the side of the receiving vessel, slowly and smoothly press down on the turret cap until it reaches the stop and the solution is completely discharged.

Mixing Water Samples

The following two methods may be helpful in tests that require mixing sample with chemicals (usually indicated by "invert to mix" instructions).

1. When mixing sample in a round sample cell or mixing cylinder, invert the cell or cylinder; see *Figure 4*. Hold the cell in a vertical position with the cap on top. Invert the cell so the cap is on the bottom. Return the cell to the original position. Do the same with the mixing cylinder.

2. Swirling is recommended when mixing samples in a graduated cylinder or a titration flask. Grip the cylinder (or flask) firmly with the tips of three fingers; see *Figure 5*. Hold the cylinder at a 45-degree angle and twist the wrist. This should move the cylinder in an approximately 12-inch circle, creating enough rotation to complete the mixing in a few turns.

These mixing procedures are the most gentle. Both methods are simple but take a bit of practice to obtain the best results.

Figure 4 Inverting a Sample Cell

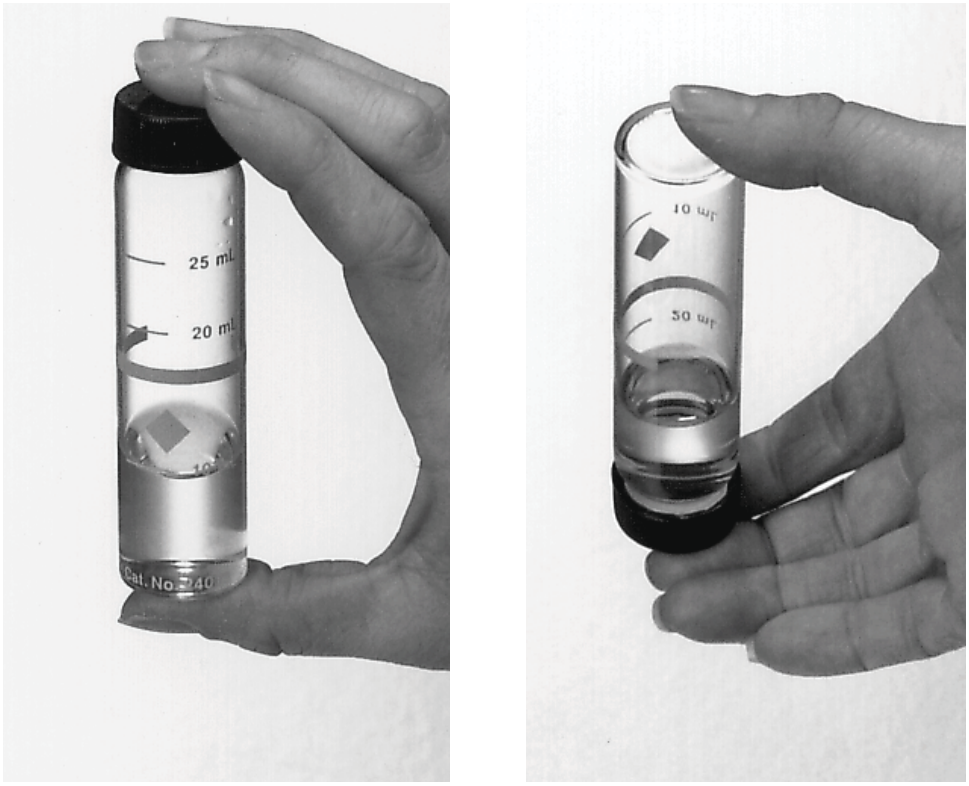
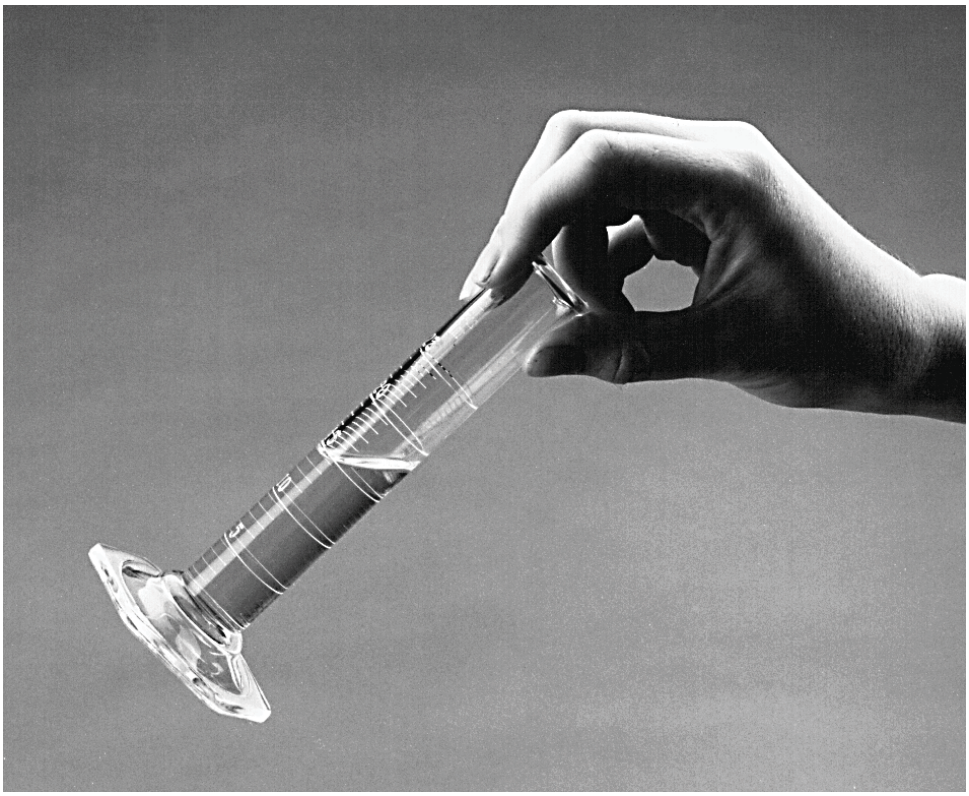


Figure 5 Swirling a Graduated Cylinder



Using Sample Cells

Orientation of Sample Cells

Two round sample cells are shipped with the DR/820, DR/850 and DR/890. They are marked with 10-, 20- and 25-mL fill lines which may be used to measure the sample volume unless the procedure instructs you to use other glassware to measure the sample volume.

To minimize variability of measurements using a particular cell, always place the cell into the cell holder with the same orientation. The cells are placed in the instrument with the fill marks facing the user.

In addition to proper orientation, the sides of the cells should be free of smudges, fingerprints, etc. to ensure accurate readings. Wipe the sides of the cells with a moist cloth followed by a dry soft cloth to clean the surface before taking measurements.

Care of Hach Sample Cells

Store sample cells in their boxes when not in use to protect them from scratching and breaking. It is good laboratory practice to empty and clean sample cells after analyses are complete--avoid leaving colored solutions in the cells for extended periods of time. Finish the cleaning procedure with a few rinses of deionized water and allow to dry. Individual procedures often recommend specific cleaning methods.

Cleaning Sample Cells

Most laboratory detergents can be used at recommended concentrations. Neutral detergents such as Neutracon are safer if regular cleaning is required, as in the case of protein residues.

If using a detergent, you can speed cleaning by increasing the temperature or using an ultrasonic bath.

Rinsing is more efficient when using deionized water.

Using the COD/TNT Adapter

Use care when seating a vial into the COD/ TNT adapter (for COD vials and Test ‘N Tubes). Place the vial into the adapter and press straight down on the top of the vial until it seats solidly. Do not move the vial from side to side; this can cause errors.

Volume Measurement Accuracy

The sample cells supplied with the instrument have fill marks to indicate 10, 20 or 25 mL. The fill marks are intended to measure the volume to be analyzed. Do not use these fill marks to perform sample dilutions.

If a sample must be diluted, use a pipet, graduated mixing cylinder and/or a volumetric flask for accurate measurement. When diluting, accuracy is important because a slight mistake in measuring a small sample will cause

a substantial error in the result. For instance, a 0.1-mL mistake in the dilution of a 1.0-mL final volume produces a 10% error in the test result.

Volumes for standard additions can be measured using the 25-mL mark, but it is not recommended for the 10-mL mark due to a potentially excessive relative error. An error of 0.5 mL in 25 mL is only 2%, while 0.5 mL error in 10 mL is 5%.

For 10 mL standard additions, follow this procedure:

1. Transfer 10.0 mL of sample into a clean, dry sample cell (the unspiked sample).

2. Add the standard (spike) to a 25 mL portion of sample in a 25-mL mixing cylinder. Stopper and mix thoroughly.

3. Transfer 10 mL to another sample cell (use fill mark) for analysis.

Using AccuVac Ampuls

AccuVac ampuls contain pre-measured powder or liquid in optical-quality glass ampuls.

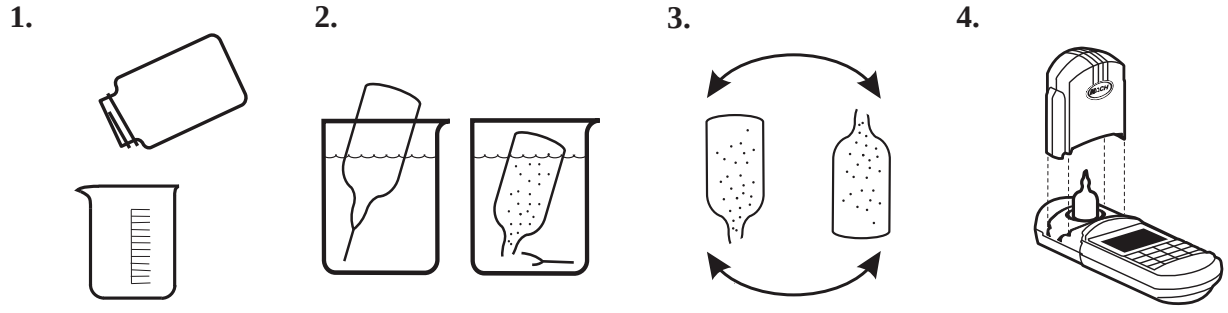
1. Collect the sample in a beaker or other open container.

2. Place the ampul tip well below the sample surface and break the tip off (see *Figure 6*) against the beaker wall. The break must be far enough below the surface to prevent air from being drawn in as the level of the sample lowers (the AccuVac Breaker may be used instead of breaking the ampul against the beaker side).

3. Invert the ampul several times to dissolve the reagent. Do not place your finger over the broken end; the liquid will stay in the ampul when inverted. Wipe the ampul with a towel to remove fingerprints, etc.

4. Insert the ampul into the instrument and read the results directly.

Figure 6 Using AccuVac Ampuls



Using Reagent Powder Pillows

Hach uses dry powdered reagents when possible. This minimizes leakage and deterioration problems. Some powders are packaged in individual, pre-measured, polyethylene "powder pillows" or foil pillows called PermaChem® pillows. Each pillow contains enough reagent for one test. Open the poly powder pillows with nail clippers or scissors; see *Figure 7*.

Figure 7 Opening Powder Pillows

Using PermaChem Pillows

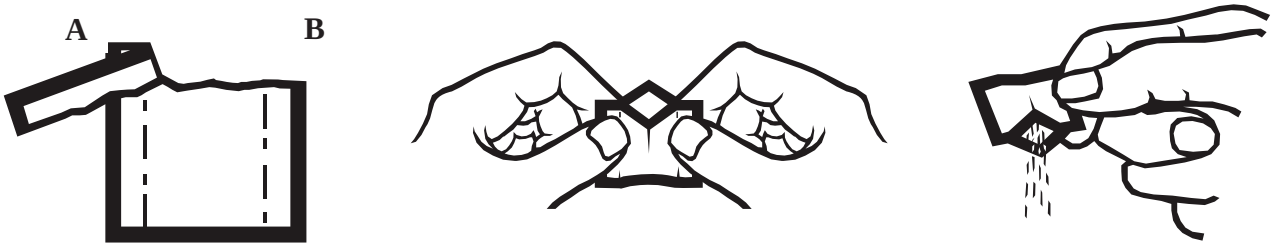
1. Tap the pillow on a hard surface to collect the powdered reagent in the bottom.

2. Tear (or cut) across the top of the pillow, from B to A, holding the pillow away from your face.

3. Using two hands, push both sides toward each other to form a spout.

4. Pour the pillow contents into the sample cell and continue the procedure according to the instructions. Tap the pillow to remove any powder from the corners.

1. Tear **2. Push** **3. Pour**



Reagent and Standard Stability

Hach always strives to make stable formulations and package them to provide maximum protection. Most chemicals and prepared reagents do not deteriorate after manufacture. However, the way they are stored and the packaging can affect how long the reagents are stable. Light, bacterial action, and absorption of moisture and gases from the atmosphere can affect shelf life. Some chemicals may react with the storage container or they may react with other chemicals.

Chemicals supplied with the colorimeter have an indefinite shelf life when stored under average room conditions, unless the packaging says something different. Product labels state any special storage conditions required. Otherwise, store reagents in a cool, dry, dark place for maximum life. It is always good practice to date chemicals when you receive them. Use older supplies first. If in doubt about the reagent shelf life, run a standard to check its effectiveness.

Interferences

Substances in the sample may interfere with a measurement. Hach mentions common interferences in the test procedures. The reagent formulations eliminate many interferences. You can remove others with sample pretreatments described in the procedure.

If you get an unusual answer, a color that you don't expect, or you notice an unusual odor or turbidity, the result may be wrong. Repeat the test on a sample diluted with deionized water; see *Sample Dilution Techniques*. Compare the result (corrected for the dilution) with the result of the original test. If these two are not close, the original result may be wrong and you should make an additional dilution to check the second test (first dilution). Repeat this process until you get the same corrected result twice in a row.

More information about interferences and methods to overcome them is contained in *Standard Additions* of this manual and the *General Introduction* section of APHA Standard Methods. Hach urges the analyst to obtain this book and refer to it when problems are encountered.

One of the greatest aids is knowing what is in the sample. You don't need to know exactly what is in each sample, but be aware of substances that are likely to interfere in the analysis method you use. When using a method, it may be helpful to determine if those interferences are present.

pH Interference

Many of the procedures in this manual only work within a certain pH range. Hach reagents contain buffers to adjust the pH of the typical sample to the correct pH range. However, the reagent buffer may not be strong enough for some samples. This occurs most often with highly buffered samples or samples with extreme sample pH.

The *Sampling and Storage* section of each procedure usually gives the proper pH range for the sample.

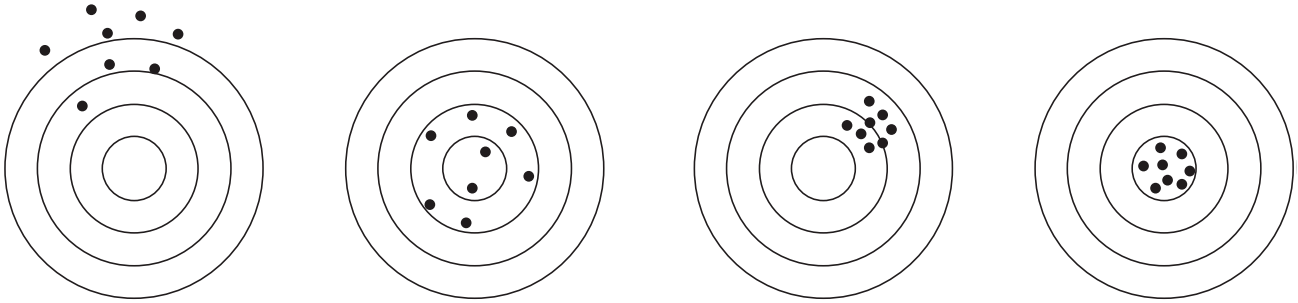
Adjust the sample to the proper pH range before testing. If this information is not given, follow these steps:

1. Measure the pH of your analyzed sample with a pH meter. For measuring Ag^+, K^+ or Cl^- , use pH paper.
2. Prepare a sample using deionized water. Add all reagents called for in the procedure. Timer sequences, etc., may be ignored. Mix well.
3. Measure the pH of the reagent blank with a pH meter.
4. Compare the pH values of your analyzed sample with the reagent blank.
5. If there is little difference in the values of your analyzed sample and the reagent blank, then pH interference is not the problem. Follow the *Accuracy Check* given in the procedure to help identify the problem.
6. If there is a large difference between the value of your analyzed sample and the reagent blank, adjust the sample pH to the value of the reagent blank. Adjust the sample pH to this same pH for all future samples from the same source before analysis. Use the appropriate acid, usually nitric acid, to lower the pH (do not use nitric acid for nitrate or nitrogen testing). Use the appropriate base, usually sodium hydroxide, to raise the pH. Adjust the final result for any dilution caused by adding acid or base; see *Correcting for Volume Additions*.
7. Analyze the sample as before.
8. Some purchased standards may be very acidic and will not work directly with Hach procedures. Adjust the pH of these standards as described above. Adjust the final concentration of the standard for the dilution. The Hach standard solutions suggested in the procedures are formulated so that no pH adjustment is necessary.

Accuracy and Precision

Accuracy is the nearness of a test result to the true value. Precision is how closely repeated measurements agree with each other. Although good precision suggests good accuracy, precise results can be inaccurate (see *Figure 8*). The following paragraphs describe how to improve accuracy and precision of analyses by using Standard Additions.

Figure 8 Precision and Accuracy Illustrated



Not accurate, not precise | **Accurate, not precise** | **Precise, not accurate** | **Accurate and precise**

Standard Additions

Standard Additions is a common technique for checking test results. Other names are "spiking" and "known additions." The standard additions technique can test for interferences, bad reagents, faulty instruments, and incorrect procedures.

Perform Standard Additions by following the Standard Additions Method section in the procedure under *Accuracy Check*. Follow the detailed instructions given.

If you get about 100% recovery for each addition, everything is working right and your results are correct.

If you don't get about 100% recovery for each addition, a problem exists. You can tell if you have an interference. Repeat the Standard Additions using deionized water as your sample. If you get about 100% recovery for each addition, you have an interference. If you didn't get good recoveries with the deionized water, the following checklist may help to find the problem quickly:

1. Check to see that you are following the procedure exactly:

a) Are you using the proper reagents in the proper order? Are you using 10-mL reagents with a 10-mL sample or 25-mL reagents with a 25-mL sample?

b) Are you waiting the necessary time for color to develop?

c) Are you using the correct glassware?

d) Is the glassware clean?

e) Does the test need a specific sample temperature?

f) Is the sample's pH in the correct range?

Hach's written procedure should help you to answer these questions.

2. Check your reagents. Repeat the Standard Additions using new, fresh reagents. If your results are good, the original reagents were bad.

3. If nothing else is wrong, the standard is almost certainly bad. Repeat the Standard Additions with a new standard.

If the check list does not determine the problem, use the decision tree (*Figure 9*) and explanation of each branch, below, to identify the problem.

Branch A

Suppose a single standard addition to the sample did not give the correct concentration increase. A possible cause could be interferences. Other causes include defective reagents, incorrect technique, a defective instrument/apparatus or defective standard used for the standard addition.

If interferences are known or assumed to be absent, proceed to Branch B. If interferences are known to be present, proceed to Branch C.

Branch B

Perform multiple standard additions on a sample of deionized water as in the following example using iron as the analyte of interest:

1. Pour 25 mL of deionized water into a 25-mL sample cell.

2. Add 0.1 mL of a 50-mg/L iron standard solution to a second 25 mL sample of deionized water.

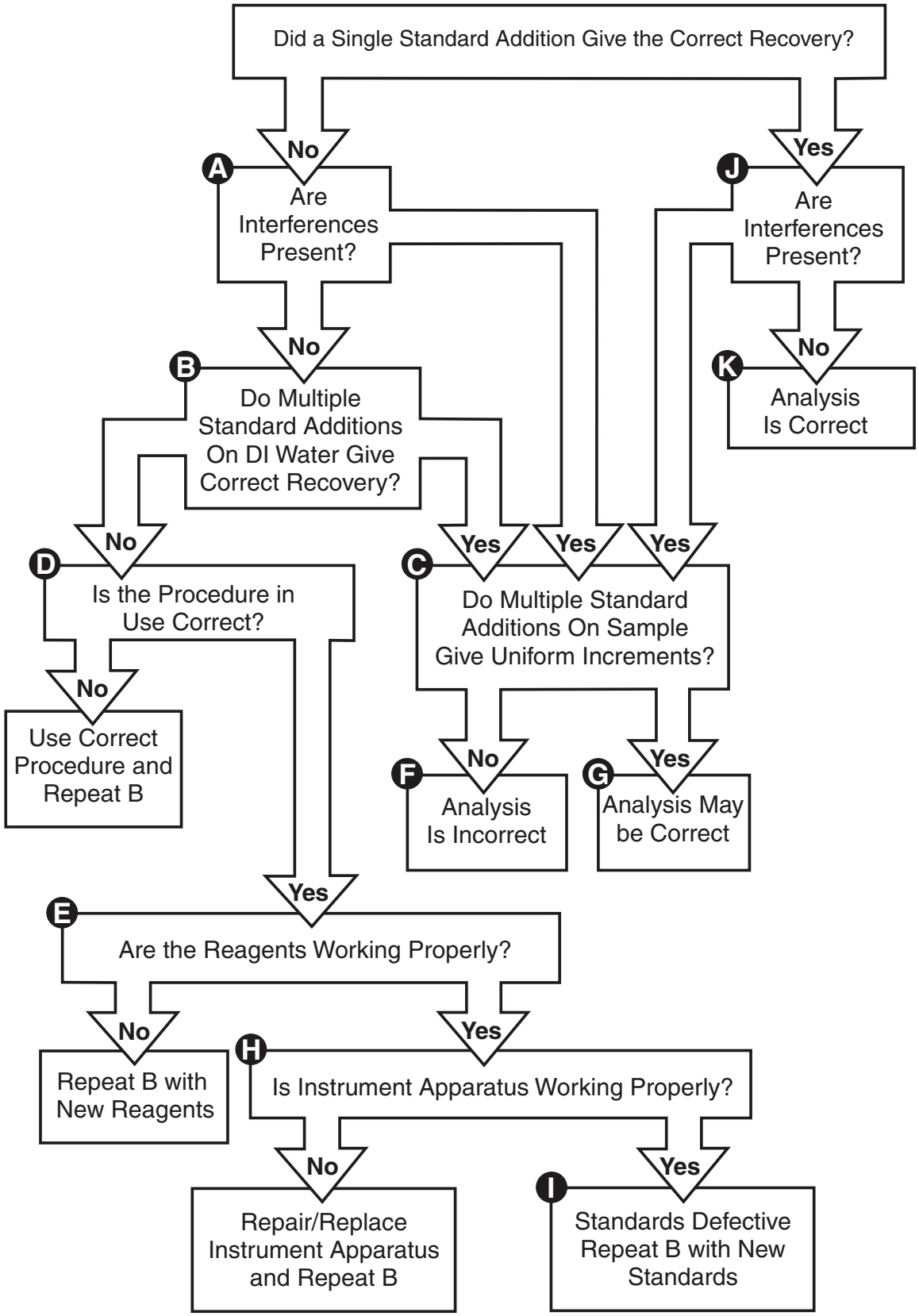
3. Add 0.2 mL of the same standard to a third 25 mL sample of deionized water.

4. Add 0.3 mL of the same standard to a fourth 25 mL sample of deionized water. Analyze all these samples for iron.

5. Tabulate the data as shown below:

mL of Standard Added	mg/L of Standard Added	mg/L of Iron Found
0	0	0
0.1	0.2	0.2
0.2	0.4	0.4
0.3	0.6	0.6

Figure 9 Standard Additions Decision Tree



The data show several points:

- The chemicals, instrument, procedure/technique and standards are working correctly because the iron added to the water sample was completely recovered in the same uniform steps that match the standard addition increments.
- Because iron added to the deionized water was recovered, but iron added to an actual sample was not recovered (Branch A), the sample contains an interference which prevents the test reagents from working properly.
- An iron analysis previously done on the actual sample using this method gave an inaccurate result.

If the results of multiple standard additions give the correct increment for each addition, proceed to Branch C.

If the results of multiple standard additions do not give the correct increment for each addition, go to Branch D.

Branch C

If interfering substances are present, the analysis may be incorrect. However, with multiple standard additions, it may be possible to arrive at an approximate result if the increases are uniform.

Suppose the sample result for iron was 1.0 mg/L. Because interferences may be present, a standard addition of 0.1 mL of a 50 mg/L iron standard to a 25 mL sample is made. The expected increase in the iron concentration is 0.2 mg/L, but the actual increase is 0.1 mg/L. Then 0.2 and 0.3 mL of the same standard are added to two more 25 mL samples and analyzed for iron.

If there is a uniform increase in concentration between each addition (i.e., 0.1 mg/L difference between each addition), use Branch G. If the increase in concentration is not uniform (i.e., 0.1, 0.08, 0.05), go to Branch F.

Branch D

Carefully check the instructions for the test. Make sure to use the correct reagents in the correct order. Be sure the glassware in use is what is required. Be sure time for color development and the sample temperature are as specified. If the procedure technique was incorrect, repeat Branch B. If the procedure was correctly followed, proceed to Branch E.

Branch E

Check the reagent performance. This may be done by obtaining a fresh lot of reagent or by using a known standard solution to run the test. Make sure the color development time given in the procedure is equal to the

time required for the reagent in question. If the reagent(s) is defective, repeat Branch B with new reagents. If the reagents are good, proceed with Branch H.

Branch F

Examples of non-uniform increments between standard additions are shown below.

Example A

mL of Standard Added	mg/L Standard Added	mg/L Found
0	0	1.0
0.1	0.2	1.10
0.2	0.4	1.18
0.3	0.6	1.23

Example B

mL of Standard Added	mg/L Standard Added	mg/L Found
0	0	0
0.1	0.2	0
0.2	0.4	0.2
0.3	0.6	0.4

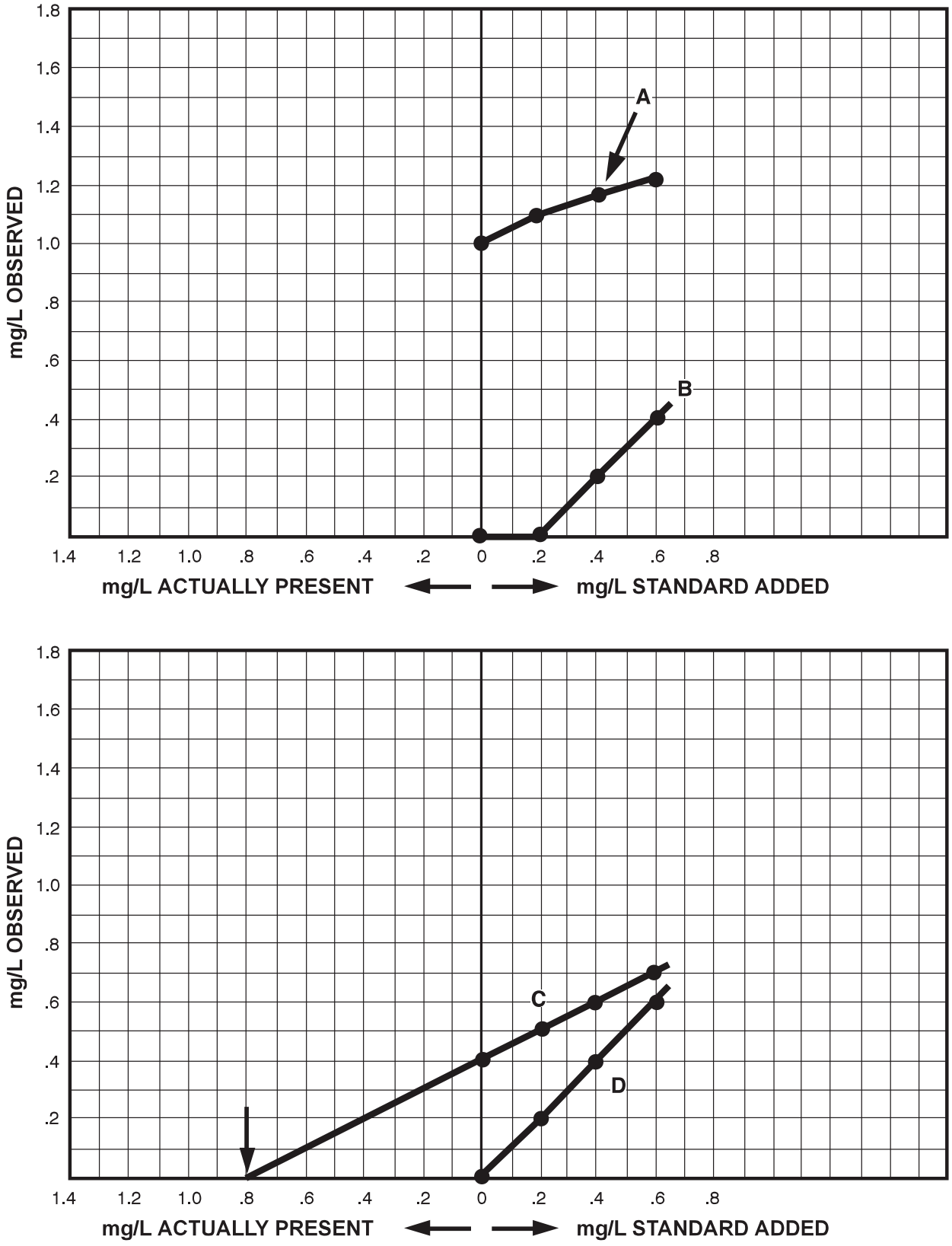
These examples show the effect of interferences on the standard addition. Data plotted on the graph in *Figure 10* for samples A and B show that the four data points do not lie on a straight line.

The plot for sample A illustrates an interference that becomes progressively worse as the concentration of the standard increases. This type of interference is uncommon and may be caused by an error or malfunction of the procedure, reagents or instrument. It is recommended Branch B be performed to verify the supposed interference.

The plot for sample B shows a common chemical interference which becomes less or even zero as the concentration of standard increases. The graph shows the first addition was consumed by the interference and the remaining additions gave the correct increment of 0.2 mg/L.

The apparent interference in Example B could be the result of an error made in the standard addition. Repeat the analysis to see if an error was made during standard addition. If not, the method is not appropriate for the sample matrix. When these two types of interferences occur, try to analyze the sample with a method which uses a different type of chemistry.

Figure 10 Multiple Standard Additions Graph



Branch G

Examples of uniform increments between standard additions are given below.

Example C

mL of Standard Added	mg/L Standard Added	mg/L Found
0	0	0.4
0.1	0.2	0.5
0.2	0.4	0.6
0.3	0.6	0.7

The plot for sample C illustrates a common interference with a uniform effect on the standard and the substances in the sample. The four data points form a straight line which may be extended back through the horizontal axis. The point where the line meets the axis can be used to determine the concentration of the substance you are measuring.

In this example, the first analysis gave 0.4 mg/L. After extrapolating the line to the horizontal axis, the graph shows the result should be much closer to the correct result: 0.8 mg/L.

Apparent interferences may also be caused by a defect in the instrument or standards. Before assuming the interference is chemical, check Branch B.

Example D

mL of Standard Added	mg/L Standard Added	mg/L Found
0	0	0
0.1	0.2	0.2
0.2	0.4	0.4
0.3	0.6	0.6

The plot for sample D illustrates a problem for the analyst. The increments are uniform and the recovery of the standard was complete. The result of the first analysis was 0 mg/L and the line extrapolates back through 0 mg/L. If interferences are known to be present, the interferences may be present in an amount equal to the substance in question, preventing the analyst from finding the substance. This would be an uncommon situation.

Branch H

Check operation of the instrument and/or apparatus used to perform the test. Check glassware used in the procedure and make sure it is extremely clean. Dirty pipets and graduated cylinders can cause contamination and will not deliver the correct volume. Check delivery of pipets by using deionized water and a balance; 0.2 mL = 0.2 grams.

If a defect is found in the instrument and/or apparatus, repeat Branch B after repair or replacement. If the instrument and apparatus are working, proceed with Branch I.

Branch I

After determining the procedure, reagents, instrument and/or apparatus are correct and working properly, you may conclude the only possible cause for standard additions not functioning correctly in deionized water is the standard used for performing standard additions. Obtain a new standard and repeat Branch B.

Branch J

If the standard additions gives the correct result, the analyst must then determine if an interfering substance(s) is present. If interfering substances are present, proceed to Branch C. If they are not present, the analysis is correct.

If you still cannot identify the problem, extra help is available. Please call our Technical Support Group at 800-227-4224 (U.S.A.) or 970-669-3050. A representative will be happy to help you.

Method Performance

Estimated Detection Limit

Ranges for chemical measurements have limits. The lower limit is important because it determines whether a measurement is different from zero. Many experts disagree about the definition of this detection limit, and determining it can be difficult. The Code of Federal Regulations (40 CFR, Part 136, Appendix B) provides a procedure to determine the "Method Detection Limit" or MDL. The MDL is the lowest concentration that is different from zero with a 99% level of confidence. A measurement below this MDL may be useful, but there is a greater chance that it is actually zero.

The MDL is not fixed; it varies for each reagent lot, instrument, analyst, sample type, etc. Therefore, a published MDL may be a useful guide, but is only accurate for a specific set of circumstances. Each analyst should determine a more accurate MDL for each specific sample matrix using the same equipment, reagents and standards that will routinely be used for measurements.

Hach provides a value called the Estimated Detection Limit (EDL) for all programs. It is the calculated lowest average concentration in a deionized water matrix that is different from zero with a 99% level of confidence. Specifically, it is the upper 99% confidence limit for zero concentration based on the calibration data used to prepare the pre-programmed calibration curve. **Do not use the EDL as the MDL**. The conditions for MDL determination must be exactly the same as the conditions used for analysis. The EDL may be useful to the analyst as a starting point in determining a MDL or as a way to compare methods. Measurements below the EDL may also be valuable because they can show a trend, indicate the presence of analyte and/or provide statistical data. However, these values have a large uncertainty.

Method Detection Limit (MDL)

This method is in accordance with the USEPA definition in 40 CFR, Part 136, Appendix B (see most current edition).

The USEPA defines the method detection limit (MDL) as the minimum concentration that can be determined with 99% confidence that the true concentration is greater than zero. Since the MDL will vary from analyst to analyst, it is important that analysts determine the MDL based on their unique operating conditions.

The procedure for determining MDL is based on replicate analyses at a concentration 1 to 5 times the estimated detection limit. The MDL value is calculated from the standard deviation of the replicate study results multiplied by the appropriate Student's *t* value for a 99% confidence interval. For this definition, the MDL does not account for variation in sample composition and can only be achieved under ideal conditions.

1. Estimate the detection limit. Use the Hach estimated detection limit (EDL) value stated in the *Method Performance* section of the analysis procedure.

2. Prepare a laboratory standard of the analyte in deionized water which is free of the analyte that is 1 to 5 times the estimated detection limit.

3. Analyze at least seven portions of the laboratory standard and record each result.

4. Calculate the average and standard deviation *(s)* of the results.

5. Compute the MDL using the appropriate Student's *t* value (see table below) and the standard deviation value:

MDL = Student's *t* x *s*

Number of Test Portions	Student's *t* Value
7	3.143
8	2.998
9	2.896
10	2.821

For example:
The EDL for measuring iron using the FerroZine method is 0.003 mg/L. An analyst accurately prepared 1 liter of a 0.010 mg/L (about 3x the EDL) laboratory standard by diluting a 10-mg/L iron standard in iron-free deionized water.

Eight portions of the standard were tested according to the FerroZine method with the following results:

Sample #	Result (mg/L)
1	0.009
2	0.010
3	0.009
4	0.010
5	0.008
6	0.011
7	0.010
8	0.009

Using a calculator program, the average concentration = 0.010 mg/L and the standard deviation (*s*) = 0.0009 mg/L

Based on the USEPA's definition, calculate the MDL as follows:

MDL for FerroZine method = 2.998 (Student's *t*) x 0.0009 (*s*)

MDL = 0.003 mg/L (agrees with initial estimate)

Note: *Occasionally, the calculated MDL may be very different than Hach's estimate of the detection limit. To test how reasonable the calculated MDL is, repeat the procedure using a standard near the calculated MDL. The average result calculated for the second MDL derivation should agree with the initial calculated MDL. Refer to 40 CFR, Part 136, Appendix B (7-1-94), pages 635-637 for detailed procedures to verify the MDL determination.*

Note: *Run a laboratory blank, containing deionized water without analyte, through the test procedure to confirm that the blank measurement is less than the calculated MDL. If the blank measurement is near the calculated MDL, repeat the MDL procedure using a separate blank for analysis for each standard solution portion analyzed. Subtract the average blank measurement from each standard and use the corrected standard values to calculate the average and standard deviation used in the MDL.*

Precision

Every measurement has some degree of uncertainty. Just as a ruler with markings of 0.1 mm leaves some doubt as to the exact length of a measurement, chemical measurements also have some degree of uncertainty. The quality of the entire chemical method determines the precision.

Uncertainty in chemical measurements may be due to systematic errors and/or random errors. A systematic error is a mistake that is always the same for every measurement made. For example, a blank can add to each measurement for a specific compound, giving consistently high results (a positive bias). Random errors are different for every test and add either positive or negative bias. Random errors may be caused by variation in analytical technique and cause response variation. Hach chemists work hard to eliminate systematic errors in Hach procedures using Hach reagents, but response variation occurs in all chemical measurements.

Estimating Precision

The method performance section in each procedure provides an estimate of the procedure's precision. The procedures use a "replicate analysis" estimate, based on real data.

In replicate analysis, a Hach chemist prepares a specific concentration of the analyte in a deionized water matrix. The standard is then analyzed seven individual times with the two reagent lots used in the calibration (14 total samples). A standard deviation of the two sets of seven values is calculated. The larger value is reported in the method. The reported value provides an estimate of the "scatter" of results at a particular point in the calibration curve.

It is important to stress that the estimates are based on a deionized water matrix. Precision on real samples with varying matrices can be quite different than these estimates.

Reagent Blank Correction

The Reagent Blank Correction subtracts the color absorbed when running the test with deionized water instead of sample. The blank value is subtracted from every result to correct for any background color due to reagents.

When using the Reagent Blank Correction feature, the blank correction should be entered before the Standard Adjust feature is used.

To enter a programmed correction for the reagent blank:

1. Run the test using deionized water with each new lot of reagents.
2. Press **READ** to obtain the blank value.
3. Press **SETUP**, scroll to **BLANK** and press **ENTER**. The display will show **BLANK?**.
4. Enter the blank value just read from the instrument.
5. Press **ENTER** to accept the value as the blank to be subtracted from each reading.
6. The display will show 0.00 mg/L (resolution and units vary) and the sample cell icon will be displayed, indicating that the reagent blank feature is enabled and the blank value will be subtracted from each reading. Repeat the reagent blank adjust for each new lot of reagents.

Note: *After entering a reagent blank adjust, the display may flash "limit" when zeroing if the sample used for zeroing has a lower absorbance value than the reagent blank.*

To disable the Reagent Blank adjust feature, press **SETUP**, scroll to **BLANK** and press **ENTER** twice. The concentration readings will be displayed without subtracting the blank. The sample cell icon will no longer appear in the display.

Do not use the Reagent Blank Adjust feature if the procedure uses a reagent blank for zeroing.

Standard Adjust (Adjusting the Standard Curve)

The colorimeter has Hach Programs permanently installed in memory. A program usually includes a pre-programmed calibration curve. Each curve is the result of an extensive calibration performed under ideal conditions and is normally adequate for most testing. Deviations from the curve can occur from using compromised testing reagents, defective sample cells, incorrect test procedure, incorrect technique, or other correctable causes. Interfering substances or other causes may be beyond the analyst's control.

In some situations, using the pre-programmed curve may not be convenient:

a) Running tests where frequent calibration curve checks are required.

b) Testing samples which give a consistent test interference.

Consider the following before adjusting the calibration curve:

1. Will future test results be improved by adjusting the curve?

2. Are interfering substances consistent in all the samples that you will test?

Any precision and test range information provided with the procedure may not apply to an adjusted curve calibration.

You can adjust many of the calibration curves by following the steps found in the test procedures. Working carefully is important. After the adjustment, it is wise to run standard solutions of several concentrations to make sure the adjusted curve is satisfactory. Perform standard additions on typical samples to help determine if the adjusted curve is acceptable.

Think of the standard adjust measurement as a two-step process. First, the instrument measures the sample using the pre-programmed calibration. Second, it multiplies this measurement by an adjustment factor. The factor is the same for all concentrations. The instrument will remember the factor indefinitely and will display the standard adjustment icon when it is used.

Adjust the calibration curve using the reading obtained with a Hach Standard Solution or carefully prepared standard made from a concentrated Hach Standard Solution. It is important to adjust the curve in the correct concentration range. For most purposes, Hach recommends adjusting the curve using a standard concentration that is 70 to 85% of the maximum concentration range of the test.

For example, the Hach pre-programmed method for fluoride has a range of 0-2.0 mg/L F. To adjust the calibration curve, use a standard with a concentration between 1.4-1.6 mg/L. Hach provides a 1.60 mg/L Fluoride Standard Solution (80% of the full range). This is a convenient standard to use for adjusting the calibration curve.

If the range of all your samples is known to be below a concentration that is less than 50% of the full range (50% of 2.0 is 1.0 mg/L), then adjust the standard curve with a standard that is within that range. For example, if all the samples contain 0.6-0.9 mg/L F, you may use a 1.00 mg/L fluoride standard to adjust the curve. You may use the 1.00 mg/L standard because it is closer to the sample range you are working with.

If you are using a Reagent Blank Correction, the blank correction should be entered before the standard curve is adjusted.

To adjust the standard curve:

1. Prepare the standard.
2. Use the standard as the sample in the procedure.
3. When the reading for the standard is obtained, press **SETUP**.
4. Use the arrow keys to scroll to the "**STD**" setup option.
5. Press **ENTER** to activate the standard adjust option.
6. Edit the standard concentration to match that of the standard used.
7. Press **ENTER**. A small plot of a line through a point will be displayed, indicating that the curve has been adjusted with the standard.

Note: *If the attempted correction is outside the allowable adjustment limit, the instrument will beep and flash Ø and the operation will not be allowed.*

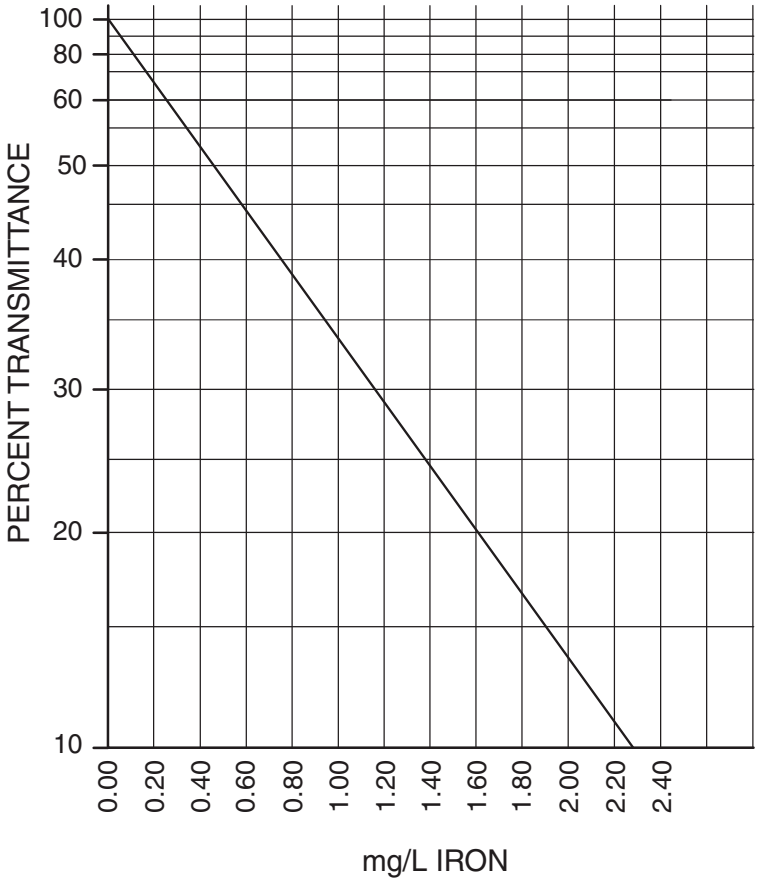
Preparing a User-Entered Calibration Curve

1. Prepare five or more standards of known concentration that cover the expected range of the test. Run tests as described in the procedure on each prepared standard. Pour the customary volume of each known solution into a separate clean sample cell of the type specified for your instrument.
2. Standardize (zero) the instrument using an untreated water sample or a reagent blank, whichever the procedure instructs you to use.
3. Measure and record the absorbance or %T of the known solutions. To use %T vs. concentration see *%T Versus Concentration Calibration*. To use absorbance vs. concentration, see *Absorbance Versus Concentration Calibration*. Or create a user-entered program by storing a custom calibration in the non-volatile memory of the instrument. Refer to the section on entering user-entered programs in the instrument manual.

%T Versus Concentration Calibration

If measuring %T, use semilogarithmic graph paper and plot %T (vertical scale) versus concentration (horizontal scale). In *Figure 11*, iron standard solutions of 0.1, 0.2, 0.4, 0.8, 1.2, 1.6, and 2.0 mg/L were measured on a spectrophotometer at 500 nm using half-inch test tubes. Results were plotted and the calibration table values were extrapolated from the curve (*Table 7*).

Figure 11 Logarithmic Calibration Curve



To convert %T readings to concentration, prepare a table such as *Table 7* and select the appropriate line from the "%T Tens" column and the appropriate column from the %T Units columns. The %T Ten value is the first number of the %T reading and the %T Units value is the second number of the %T reading. For example, if the instrument reading was 46%, the 40 line in the %T Tens column and the 6 column in the %T Units would be selected. The cell where these two intersect (0.78 mg/L) is the iron concentration of the sample.

Table 7 Calibration Table

%T Tens	%T Units									
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0										
10	2.30	2.21	2.12	2.04	1.97	1.90	1.83	1.77	1.72	1.66
20	1.61	1.56	1.51	1.47	1.43	1.39	1.35	1.31	1.27	1.24
30	1.20	1.17	1.14	1.11	1.08	1.04	1.02	.99	.97	.94
40	.92	.89	.87	.84	.82.	.80	.78	.76	.73	.71
50	.69	.67	.65	.64	.62	.60	.58	.56	.55	.53
60	.51	.49	.48	.46	.45	.43	.42	.40	.39	.37
70	.36	.34	.33	.32	.30	.29	.28	.26	.25	.24
80	.22	.21	.20	.19	.17	.16	.15	.14	.13	.12
90	.11	.09	.08	.07	.06	.05	.04	.03	.02	.01

Absorbance Versus Concentration Calibration

To read concentration values directly from the instrument, create a user-entered program. See the instrument manual for more information.

If absorbance values are measured, plot the results on linear graph paper. Plot the absorbance value on the vertical axis and the concentration on the horizontal axis.

Plot increasing absorbance values from bottom to top. Plot increasing concentration values from left to right. Values of 0.000 absorbance units and 0 concentration will begin at the bottom left corner of the graph. A calibration table can be extrapolated from the curve or the concentration values can be read directly from the graph for determining an equation for the line using the slope and the y-intercept.

USEPA Approved and Accepted Definitions

The United States Environmental Protection Agency (USEPA) establishes limits for maximum contamination levels of certain constituents in water. It also requires that specific methodology be used to analyze for these constituents. These methods originate from several sources. The USEPA has developed some of these methods. In other cases, the USEPA has evaluated and approved methods developed by manufacturers, professional groups and public agencies such as:

- American Public Health Association

- American Water Works Association
- Water Environmental Federation
- American Society for Testing and Materials
- United States Geological Survey
- Associates of Official Analytical Chemists

All USEPA approved methods are cited in the *Federal Register* and compiled in the Code of Federal Regulations. USEPA approved methods may be used for reporting results to the USEPA and other regulatory agencies.

USEPA Accepted

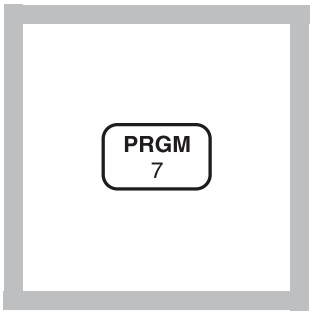
Hach has developed several procedures that are equivalent to USEPA approved methods. Even though minor modifications exist, the USEPA has reviewed and accepted certain procedures for reporting purposes. These methods are not published in the *Federal Register,* but are referenced to the equivalent USEPA method in the procedure.

NITRITE, Low Range (0 to 0.350 mg/L NO_2^--N)

For water, wastewater, seawater

Diazotization Method* (Powder Pillows or AccuVac Ampuls);

USEPA approved for reporting wastewater and drinking water analyses.



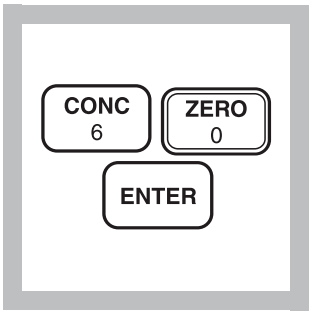
1. Enter the stored program number for nitrite nitrogen (NO_2^--N), powder pillows.

Press: **PRGM**

The display will show:

PRGM ?

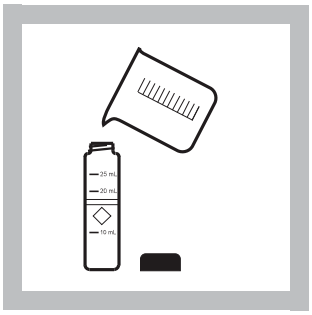
Note: *For most accurate results, perform a Reagent Blank Correction using deionized water (see Section 1).*



2. Press: **60 ENTER**

The display will show **mg/L, NO2-N** and the **ZERO** icon.

Note: *For alternate forms (NO_2^-, $NaNO_2$), press the* **CONC** *key.*

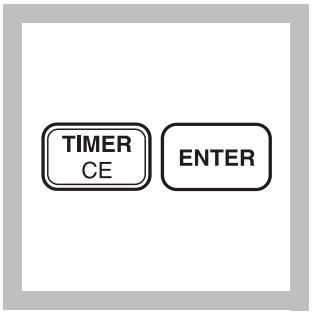


3. Fill a sample cell with 10 mL of sample.

4. Add the contents of one NitriVer 3 Nitrite Reagent Powder Pillow to the sample cell. Cap the cell and shake to dissolve.

Note: *Accuracy is not affected by undissolved powder.*

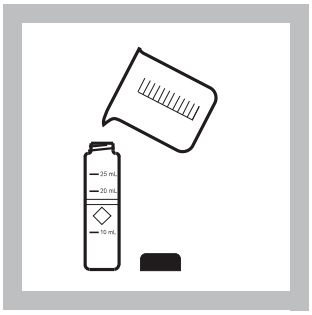
* *Federal Register*, 44(85) 25505 (May 1, 1979)



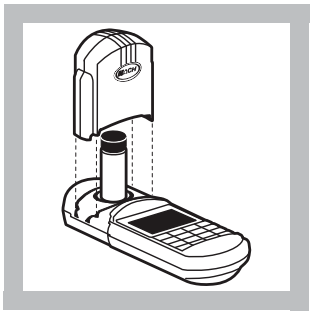
5. Press:
TIMER ENTER

A 15-minute reaction period will begin.

Note: *A pink color will develop if nitrite is present.*

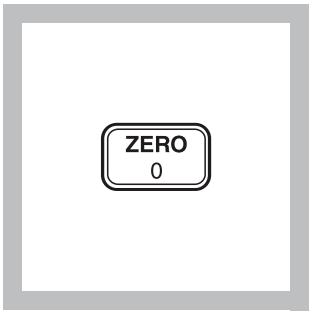


6. When the timer beeps, fill an empty sample cell with 10 mL of sample (the blank).



7. Wipe the outside of the sample cell with a towel. Place the blank into the cell holder. Tightly cover the sample cell with the instrument cap.

Note: *Wiping with a damp cloth, followed by a dry pne, removes fingerprints and other marks.*

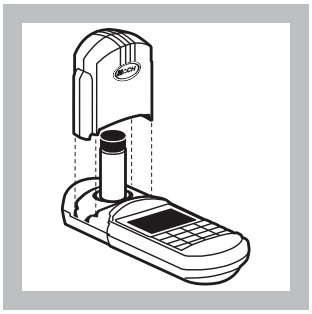


8. Press: **ZERO**

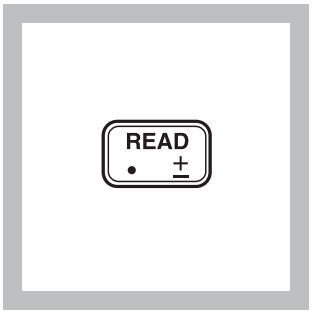
The cursor will move to the right, then the display will show:

0.000 mg/L NO2-N

Note: *If Reagent Blank Correction is on, the display may flash "limit." See Section 1.*



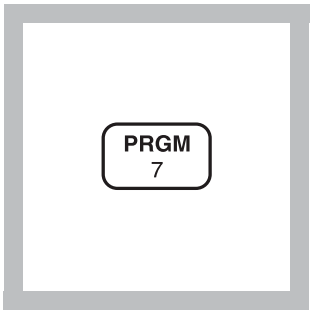
9. Place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.



10. Press: **READ**

The cursor will move to the right, then the result in mg/L nitrite nitrogen (or an alternate form) will be displayed.

Using AccuVac Ampuls



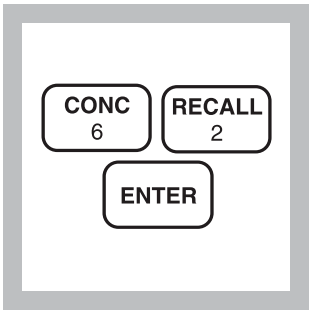
1. Enter the stored program number for nitrite nitrogen (NO_2^--N), AccuVac Ampuls.

Press: **PRGM**

The display will show:

PRGM ?

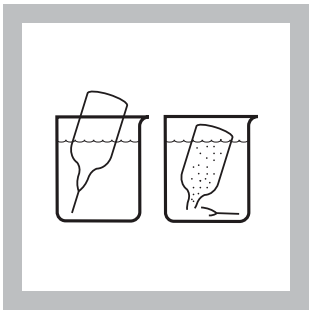
Note: *For most accurate results, perform a Reagent Blank Correction using deionized water (see Section 1).*



2. Press: **62 ENTER**

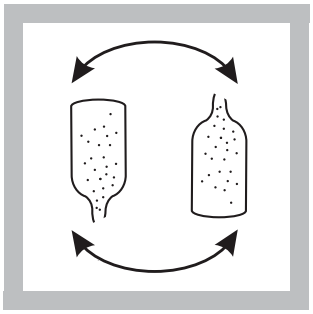
The display will show **mg/L, NO2-N** and the **ZERO** icon**.**

Note: *For alternate forms (NO_2^-, $NaNO_2$), press the* **CONC** *key.*



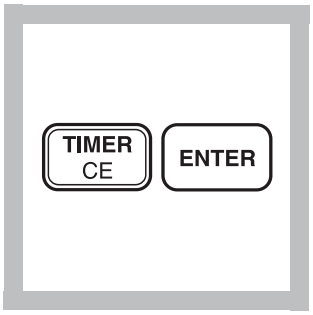
3. Collect at least 40 mL of sample in a 50-mL beaker. Fill a NitriVer 3 Nitrite AccuVac Ampul with the sample.

Note: *Keep the tip immersed while the ampul fills completely.*



4. Quickly invert the ampul several times to mix. Wipe off any liquid or fingerprints.

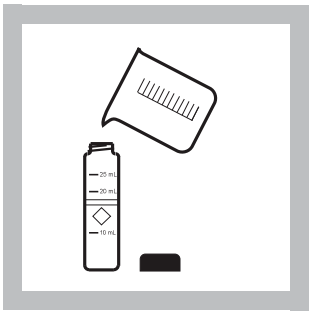
Note: *Accuracy is not affected by undissolved powder.*



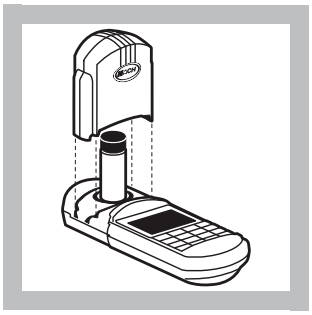
5. Press:
TIMER ENTER

A 15-minute reaction period will begin.

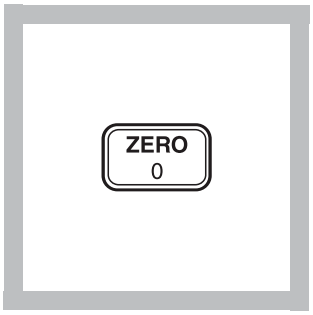
Note: *A pink color will develop if nitrite is present.*



6. When the timer beeps, fill a sample cell with at least 10 mL of sample (the blank).



7. Place the blank into the cell holder. Tightly cover the sample cell with the instrument cap.

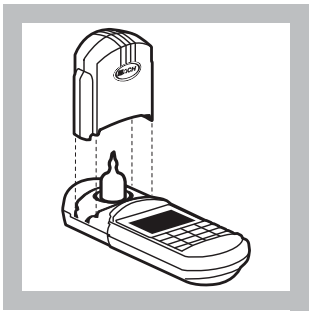


8. Press: **ZERO**

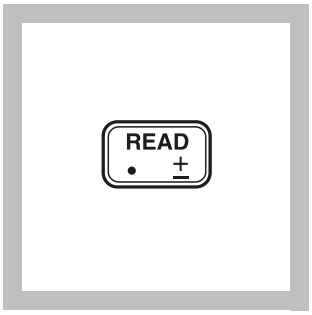
The cursor will move to the right, then the display will show:

0.000 mg/L NO2-N

Note: *If Reagent Blank Correction is on, the display may flash "limit." See Section 1.*



9. Place the AccuVac Ampul into the cell holder. Tightly cover the ampul with the instrument cap.



10. Press: **READ**

The cursor will move to the right, then the result in mg/L nitrite nitrogen will be displayed.

Sampling and Storage

Collect samples in clean plastic or glass bottles.

Store at 4 °C (39 °F) or lower and analyze within 48 hours. Warm to room temperature before running the test.

Do not use acid preservatives.

Remove the suspended solids by filtration.

Accuracy Check

Standard Solution Method

Pipet 5.00 mL of a fresh 250 mg/L NO_2^--N standard into a 250.0 mL volumetric flask. Dilute to the mark with deionized water. This makes a 5.00-mg/L intermediate standard. To prepare a 0.100-mg/L NO_2^--N standard solution, dilute 10.00 mL of the 5.00-mg/L intermediate standard to 500 mL in a volumetric flask. Prepare this solution immediately before use.

Run the test using the 0.100 mg/L NO_2^--N standard in place of the sample. Results should be between 0.090 and 0.110 mg/L NO_2^--N.

Method Performance

Precision

In a single laboratory, using a standard solution of 0.250 mg/L nitrite nitrogen and two representative lots of reagent with the instrument, a single operator obtained a standard deviation of ±0.001 mg/L NO_2^--N for the powder pillow method and ±0.003 mg/L NO_2^--N for the
AccuVac method.

Estimated Detection Limit

The estimated detection limit for programs 60 and 62 is 0.005 mg/L NO_2^--N. For more information on derivation and use of Hach's estimated detection limit, see *Section 1*.

Interferences

Interfering Substance	Interference Levels
Antiminous ions	Interfere by causing precipitation
Auric ions	Interfere by causing precipitation
Bismuth ions	Interfere by causing precipitation
Chloroplatinate ions	Interfere by causing precipitation
Cupric ions	Cause low results
Ferric ions	Interfere by causing precipitation
Ferrous ions	Cause low results
Lead ions	Interfere by causing precipitation
Mercurous ions	Interfere by causing precipitation
Metavanadate ions	Interfere by causing precipitation
Nitrate	Very high levels of nitrate (>100 mg/L nitrate as N) appear to undergo a slight amount of reduction to nitrite, either spontaneously or during the course of the test. A small amount of nitrite will be found at these levels.
Silver ions	Interfere by causing precipitation
Strong oxidizing and reducing substances	Interfere at all levels

Summary of Method

Nitrite in the sample reacts with sulfanilic acid to form an intermediate diazonium salt. This couples with chromotropic acid to produce a pink colored complex directly proportional to the amount of nitrite present.

REQUIRED REAGENTS

Description	Quantity Required Per Test	Unit	Cat. No.
NitriVer 3 Nitrite Reagent Powder Pillows	1 pillow	100/pkg	21071-69
or			
NitriVer 3 Nitrite Reagent AccuVac Ampuls	1 ampul	25/pkg	25120-25

REQUIRED APPARATUS

Beaker, 50 mL (for AccuVac procedure)	1	each	500-41H
or			
Sample Cells, 10-20-25 mL (powder pillow procedure)	2	6/pkg	24019-06

OPTIONAL REAGENTS

Nitrite Standard Solution, 250 mg/L as NO_2^--N		500 mL	23402-49
Water, deionized		4 L	272-56

OPTIONAL APPARATUS

Description	Unit	Cat. No.
AccuVac Snapper Kit	each	24052-00
Flask, volumetric, 250 mL	each	14574-46
Flask, volumetric, 500 mL	each	14574-49
Pipet, serological, 10 mL	each	532-38
Pipet, TenSette, 1 to 10 mL	each	19700-01
Pipet Tips for 19700-01 TenSette Pipet	50/pkg	21856-96
Pipet Tips, for 19700-01 TenSette Pipet	1000/pkg	21856-28
Pipet, volumetric, Class A, 5.00 mL	each	14515-37
Pipet, volumetric, Class A, 10.00 mL	each	14515-38
Pipet Filler, safety bulb	each	14651-00
Thermometer, –20 to 110 °C	each	26357-02

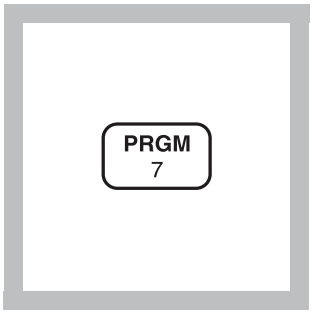
For Technical Assistance, Price and Ordering

In the U.S.A. call 800-227-4224

Outside the U.S.A.—Contact the Hach office or distributor serving you.

NITRATE, High Range (0 to 30.0 mg/L NO_3^--N) For water, wastewater, and seawater*

Cadmium Reduction Method (Using Powder Pillows or AccuVac Ampuls)
Using Powder Pillows



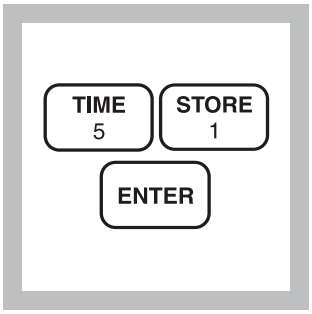
1. Enter the stored program number for high range nitrate nitrogen (NO_3^-–N) powder pillows.

Press: **PRGM**

The display will show:

PRGM ?

Note: *For most accurate results, perform a Reagent Blank Correction using deionized water (see Section 1).*



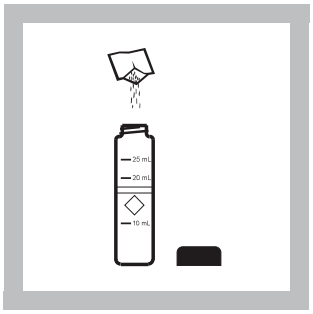
2. Press: **51 ENTER**

The display will show **mg/L, NO3-N** and the **ZERO** icon**.**

Note: *For alternate forms (NO_3), press the* **CONC** *key.*

3. Fill a sample cell with 10 mL of sample.

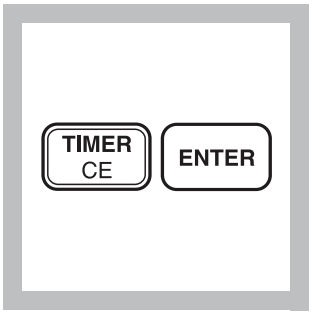
Note: *Adjust the pH of stored samples before analysis.*



4. Add the contents of one NitraVer 5 Nitrate Reagent Powder Pillow to the sample cell (the prepared sample). Cap the sample cell.

Note: *It is important to remove all of the powder from the foil pillow. Tap the pillow until no more powder pours out.*

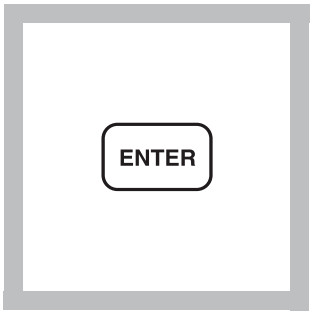
* Seawater requires a manual calibration; see Interferences.



5. Press:
TIMER ENTER

A one-minute reaction period will begin. Shake the sample cell vigorously until the timer beeps.

Note: *It is important to shake the cell vigorously. Shaking time and technique influence color development. For most accurate results, do successive tests on a standard solution and adjust the shaking time to obtain the correct result.*



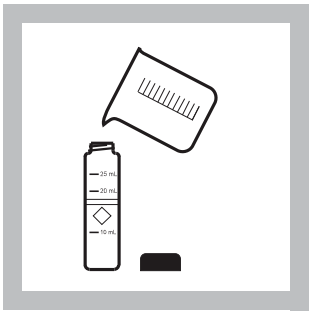
6. After the timer beeps, the display will show:
5:00 TIMER 2

Press: **ENTER**

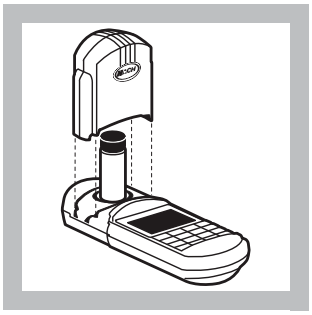
A five-minute reaction period will begin.

Note: *A deposit will remain after the reagent dissolves and will not affect test results.*

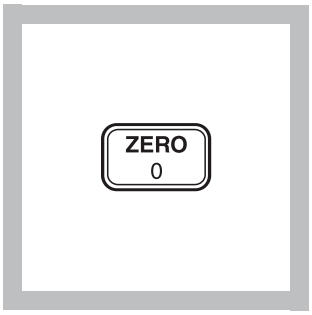
Note: *An amber color will develop if nitrate nitrogen is present.*



7. Fill another cell with 10 mL of sample (the blank). Wipe off any fingerprints or liquid.



8. Place the blank into the cell holder. Tightly cover the sample cell with the instrument cap.

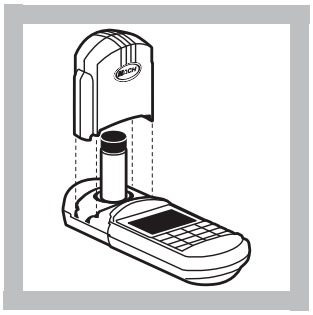


9. When the timer beeps, press **ZERO.**

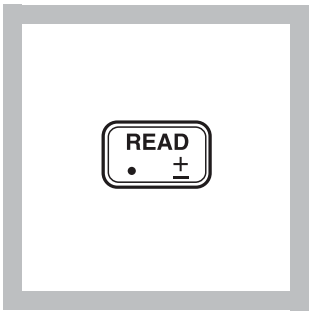
The cursor will move to the right, then the display will show:

0.0 mg/L NO3-N

Note: *If Reagent Blank Correction is on, the display may flash "limit". See Section 1.*



10. Place the prepared sample into the cell holder. Tightly cover the sample cell with the instrument cap.



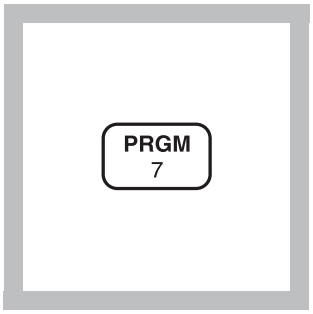
11. Press: **READ**

The cursor will move to the right, then the result in mg/L NO_3-N (or alternate form) will be displayed.

Note: *Use of the Standard Adjust feature for each new lot of reagent is highly recommended. See* Accuracy Check.

Note: *Rinse the sample cell immediately after use to remove all cadmium particles. Save the spent sample for proper hazardous waste disposal for cadmium.*

Using AccuVac Ampuls



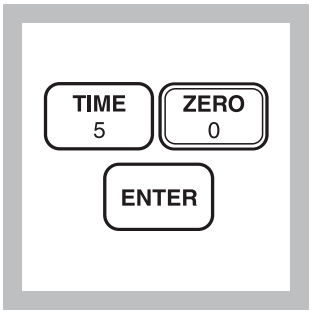
1. Enter the stored program number for high range nitrate nitrogen (NO_3^-–N) AccuVac Ampuls.

Press: **PRGM**

The display will show:

PRGM ?

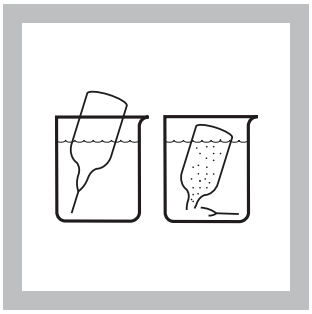
Note: *For most accurate results, perform a Reagent Blank Correction using deionized water (see Section 1).*



2. Press: **50 ENTER**

The display will show **mg/L, NO3-N** and the **ZERO** icon.

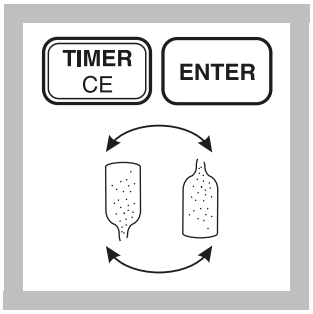
Note: *For alternate forms (NO_3), press the* **CONC** *key.*



3. Collect at least 40 mL of sample in a 50-mL beaker. Fill a NitraVer 5 Nitrate AccuVac Ampul with sample. Place a stopper over the tip of the ampul.

Note: *Keep the tip immersed while the ampul fills. The ampul will not fill completely.*

Note: *Adjust the pH of stored samples before analysis.*

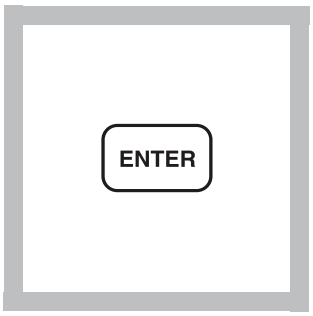


4. Press:

TIMER ENTER

A one-minute mixing period will begin. Invert the ampul repeatedly back and forth until the timer beeps. Wipe off any liquid or fingerprints.

Note: *Mixing time and technique influence color development. For most accurate results, do successive tests on a standard solution and adjust the mixing time to obtain the correct result.*



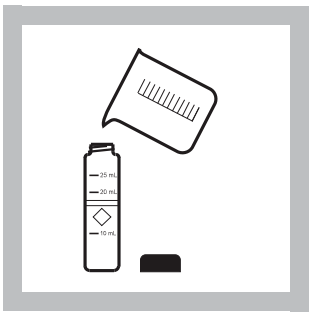
5. The display will show: **5:00 TIMER 2**

Press: **ENTER**

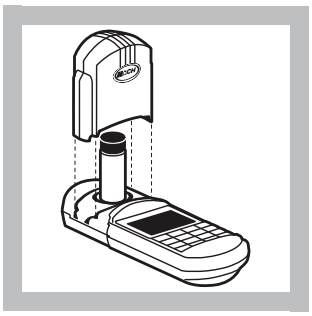
A five-minute reaction period will begin.

Note: *A deposit will remain after the reagent dissolves and will not affect results.*

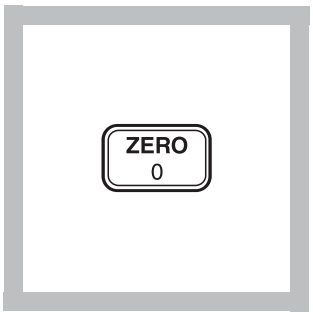
Note: *An amber color will develop if nitrate nitrogen is present.*



6. Fill a sample cell with at least 10 mL of sample (the blank).



7. When the timer beeps, place the blank in the cell holder. Tightly cover the sample cell with the instrument cap.

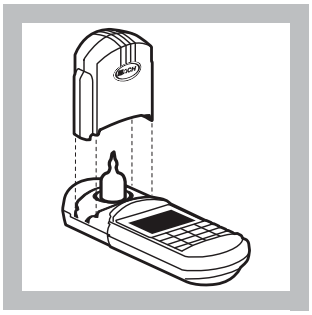


8. Press: **ZERO**

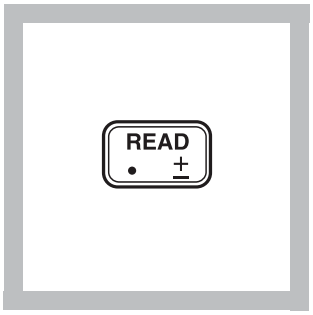
The cursor will move to the right, then the display will show:

0.0 mg/L NO3-N

Note: *If Reagent Blank Correction is on, the display may flash "limit". See Section 1.*



9. Place the AccuVac Ampul into the cell holder. Tightly cover the ampul with the instrument cap.



10. Press: **READ**

The cursor will move to the right, then the result in mg/L NO_3-N (or alternate form) will be displayed.

Note: *Use of the Standard Adjust feature for each new lot of reagent is highly recommended. See* Accuracy Check.

Note: *See Pollution Prevention and Waste Management for proper disposal of cadmium.*

Sampling and Storage

Collect samples in clean plastic or glass bottles. Store at 4 °C (39 °F) or lower if the sample is to be analyzed within 24 to 48 hours. Warm to room temperature before running the test. For longer storage periods, adjust sample pH to 2 or less with sulfuric acid, ACS (about 2 mL per liter). Sample refrigeration is still required.

Before testing the stored sample, warm to room temperature and neutralize with 5.0 N Sodium Hydroxide Standard Solution.

Do not use mercury compounds as preservatives.

Correct the test result for volume additions; see *Correction for Volume Additions* (*Section 1*) for more information.

Accuracy Check

Standard Additions Method

a) Fill three 25-mL mixing cylinders with 25 mL of sample.

b) Snap the neck off a Nitrate Nitrogen Ampule Standard, 500 mg/L nitrate nitrogen.

c) Use the TenSette Pipet to add 0.1, 0.2, and 0.3 mL of Nitrate Nitrogen Standard Solution to the three samples. Stopper and
mix thoroughly.

d) For AccuVac analysis, transfer the solutions to clean, dry 50-mL beakers. For analysis with powder pillows, transfer only 10 mL of solution to clean, dry sample cells.

e) Analyze each sample as described above. The nitrate nitrogen (NO_3^--N) concentration should increase 2.0 mg/L for each 0.1 mL of standard added.

f) If these increases do not occur, see *Standard Additions* (*Section 1*) for more information.

Standard Solution Method

Use a Hach Nitrate-Nitrogen Standard Solution, 10.0 mg/L NO_3^--N, listed under Optional Reagents as the sample and perform the procedure as described above.

Standard Adjust

To adjust the calibration curve using the reading obtained with the 10.0-mg/L standard solution, press the **SETUP** key and scroll (using the arrow keys) to the STD setup option. Press **ENTER** to activate the standard adjust option. Then enter **10.0** to edit the standard concentration to match that of the standard used. Press **ENTER** to complete the curve adjustment. See *Section 1*, *Standard Curve Adjustmen*t for more information. If you are using a reagent blank correction, the blank correction should be entered before the Standard Adjust value is entered.

Method Performance

Precision

In a single laboratory using standard solutions of 25.0 mg/L nitrate nitrogen (NO_3^--N) and two representative lots of reagent with the instrument, a single operator obtained a standard deviation of $\pm$0.3 mg/L nitrate nitrogen for program #50 and ±1.7 mg/L nitrate nitrogen for program # 51.

Estimated Detection Limit

The estimated detection limit for program 50 is 0.5 mg/L NO_3^--N and 0.8 mg/L NO_3^--N for program 51. For more information on the estimated detection limit, see *Section 1*.

Interferences

Interfering Substance	Interference Levels and Treatments
Chloride	Chloride concentrations above 100 mg/L will cause low results. The test may be used at high chloride concentrations (seawater) but a calibration must be done using standards spiked to the same chloride concentration.
Ferric iron	All levels
Nitrite	All levels Compensate for nitrite interference as follows: Add 30-g/L Bromine Water dropwise to the sample in Step 3 until a yellow color remains. Add one drop of 30-g/L Phenol Solution to destroy the color. Proceed with Step 4. Report the results as total nitrate and nitrite.
pH	Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagents and require sample pretreatment.
Strong oxidizing and reducing substances	Interfere at all levels.

Summary Of Method

Cadmium metal reduces nitrates present in the sample to nitrite. The nitrite ion reacts in an acidic medium with sulfanilic acid to form an intermediate diazonium salt which couples to gentisic acid to form an amber-colored product.

Pollution Prevention and Waste Management

NitraVer 5 contains cadmium metal. Both samples and reagent blanks will contain cadmium (D006) at a concentration regulated as hazardous wastes by the Federal RCRA. Do not pour these solutions down the drain. See *Section 3* for more information on proper disposal of these materials.

REQUIRED REAGENTS & APPARATUS (Using Powder Pillows)

Description	Quantity Required Per Test	Unit	Cat. No.
NitraVer 5 Nitrate Reagent Powder Pillows	1 pillow	100/pkg	21061-69
Sample Cell, 10-20-25 mL, w/cap	2	6/pkg	24019-06

REQUIRED REAGENTS (Using AccuVac Ampuls)

NitraVer 5 Nitrate Reagent AccuVac Ampul	1 ampul	25/pkg	25110-25

REQUIRED APPARATUS (Using AccuVac Ampuls)

Beaker, 50 mL	1	each	500-41H
Stopper	1	6/pkg	1731-06

OPTIONAL REAGENTS

Bromine Water 30 g/L		29 mL*	2211-20
Nitrate Nitrogen Standard Solution, 10.0 mg/L as (NO_3^--N)		500 mL	307-49
Nitrate Nitrogen Standard Solution, 1000 mg/L as (NO_3^--N)		500 mL	12792-49
Nitrate Nitrogen Standard Solution, PourRite ampule, 500 mg/L as NO_3^--N, 2 mL		20/pkg	14260-20
Phenol Solution		29 mL	2112-20
Sodium Hydroxide Standard Solution, 5.0 N		50 mL*	2450-26
Sulfuric Acid, ACS		500 mL*	979-49
Water, deionized		4 L	272-56

OPTIONAL APPARATUS

AccuVac Snapper Kit		each	24052-00
Cylinder, graduated, mixing, 25 mL		each	1896-40
Dropper, for 29-mL bottle		each	2258-00
pH Indicator Paper, 1 to 11 pH		5 rolls/pkg	391-33
pH Meter, *sens**ion***™*1*, portable, with electrode		each	51700-10
Pipet Filler, safety bulb		each	14651-00
Pipet, serological, 2 mL		each	532-36
Pipet, TenSette, 0.1 to 1.0 mL		each	19700-01
Pipet Tips, for 19700-01 TenSette Pipet		50/pkg	21856-96
Pipet Tips, for 19700-01 TenSette Pipet		1000/pkg	21856-28
PourRite Ampule Breaker		each	24846-00
Thermometer, –20 to 110 °C, non-mercury		each	26357-02

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APPENDIX C

Nitrogen Isotope Analysis Methodology

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analytical chemistry

TECHNICAL NOTE

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Technical Updates to the Bacterial Method for Nitrate Isotopic Analyses

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ABSTRACT: The bacterial conversion of aqueous nitrate (NO_3^-) to nitrous oxide (N_2O) for isotopic analysis has found widespread use since its introduction (Sigman, D. M.; Casciotti, K. L.; Andreani, M.; Galanter, M.; Böhlke, J. K. *Anal. Chem.* **2001**, *73*, 4145−4153; Casciotti, K. L.; Sigman, D. M.; Galanter Hastings, M.; Böhlke, J. K.; Hilkert, A. *Anal. Chem.* **2002**, *74*, 4905−4912). The bacterial strain *Pseudomonas aureofaciens* (ATTC no. 13985) was shown to convert NO_3^- to N_2O while retaining both N and O isotopic signatures, and automation of the isotopic analysis of N_2O greatly increased the throughput of the method (Casciotti, K. L.; Sigman, D. M.; Galanter Hastings, M.; Böhlke, J. K.; Hilkert, A. *Anal. Chem.* **2002**, *74*, 4905−4912). Continued development of the denitrifier method has led to increased precision and throughput of NO_3^- isotopic analysis. Presented here are several recent procedural modifications and the demonstration of their effectiveness.

A bacterial method capable of measuring natural abundance nitrogen and oxygen isotope ratios in nitrate has found widespread use since publication,[1,2] including isotopic analysis of nitrate in seawater,[3] groundwater,[4] streamwater,[5−7] precipitation,[6−9] and soil extracts,[7,9,10] as well as analysis of organic nitrogen dissolved in seawater[11] and bound to diatom[12] or foraminiferal mineral phases.[13] The method is based on the use of strains of denitrifying bacteria that quantitatively convert nitrate to nitrous oxide. The method has dramatically decreased the sample concentration and size requirements for isotopic analysis of nitrate compared to previous methods,[14−16] as well as reducing the blank size (amount of blank N) and analysis time. This is in part due to the ease with which N_2O can be cryogenically isolated from a sample for analysis on an isotope ratio mass spectrometer (IRMS) and the relatively low background of atmospheric N_2O relative to N_2, which reduces the risk of atmospheric contamination.

Presented here are several modifications that have been made to the denitrifier method since its original publications[1,2] which are improved analytical precision, concentration range (sensitivity), and throughput. Some of these modifications include technologies that were adapted from other systems and are shown to benefit the denitrifier method. We have evaluated all modifications made to the procedure by examining the results from standard analyses over the past four years, as well as additional tests of system performance. In total, the updates described here have enabled the denitrifier method to obtain accurate and precise isotopic compositions of both N and O down to 1 nmol of N_2O or 0.2 μM NO_3^- and have increased analytical throughput to batches of 80 vials (61 samples, 18 standards, and 1 blank) in 26 h. Increasing precision at lower concentrations and amounts of N enables isotopic analysis of nitrate in a larger range of samples.

MODIFICATIONS TO MATERIALS AND METHODS

Bacterial Culture Conditions. Preparation of *Pseudomonas aureofaciens* working cultures was similar to Casciotti et al.[2] but with modifications that have improved consistency and throughput. The tryptic soy broth (TSB) used to grow *P. aureofaciens*[2] was prepared in 440 mL batches in 500 mL media bottles (Wheaton Prod No. 223952) and sealed with aluminum capped 30 mm gray butyl septa (Wheaton Prod No. 224100-331). These media bottles were then autoclaved for 50 min and allowed to cool overnight in the sealed autoclave. *P. aureofaciens* was maintained on agar plates in a sealed plastic container, and 1 mL of starter culture grown overnight from a single colony was injected into each 500 mL media bottle to produce the working cultures. As in the original description, the working cultures were shaken continuously (at approximately 60 rpm in the dark at room temperature) and harvested after 5−10 days.

On the day of sample preparation, two of the 440 mL working cultures were emptied into two centrifuge bottles (Eppendorf 5810 729.009) and centrifuged in a swinging bucket rotor at 4000 rpm and 20 °C for 30 min. The supernatant was discarded completely, and the *P. aureofaciens* cells were resuspended in 240 mL of fresh nitrate-free medium (TSB amended with 7.5 mM NH_4Cl and 36 mM KH_2PO_4, autoclaved for 30 min) with 1.5 mL

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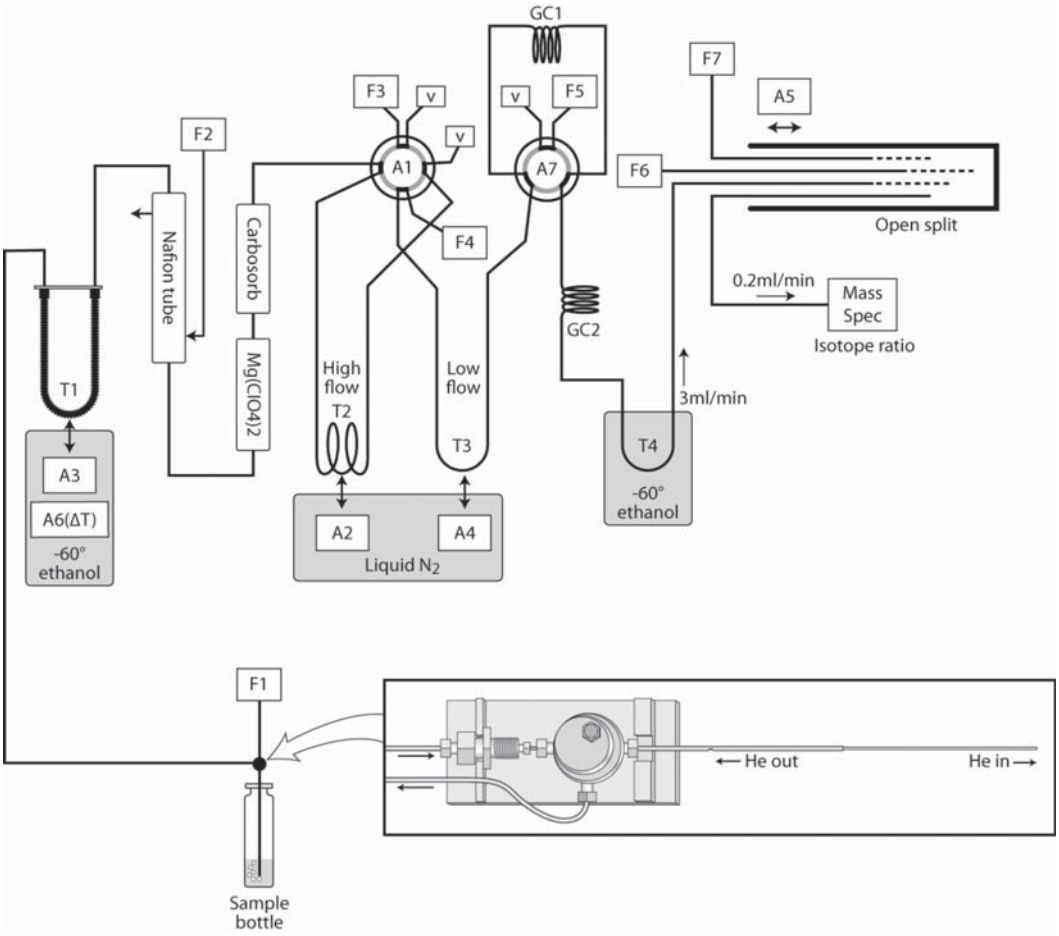

Figure 1. Purge and trap system: T = trap, A = automation controlled by Isodat, F = flow controller, GC = gas chromatogram, V = vent to atmosphere. Inset: custom concentric needle design using the CombiPAL 1 mL syringe holder. Gas flow paths are indicated by arrows. Please refer to text for additional details.

antifoam B emulsion (Sigma Prod No. A6707) added,[1] which represents a 3.7-fold concentration of cells. Three milliliter volumes of the cell suspension were pipetted into each of 80 20-mL headspace vials (Restek Prod No. 24686), capped with gray butyl septa (MicroLiter Analytical Supply Inc. Prod No. 20-0025) and aluminum crimp seals (National Scientific Prod No. C4020–3A), and purged for at least 3 h at approximately 40 mL min^{-1} per vial with high purity N_2 gas.[2]

Sample Preparation. For purging the bacteria vials, a new needle rack was designed to increase throughput. The rack was made by connecting eight pneumatic manifolds (MSC Industrial Supply Inc. Prod No. 64300600) in parallel to a high purity N_2 gas tank with a 0-60 PSI regulator. Luer lock to NPT adapters (MSC Industrial Supply Inc. Prod No. TSD931-6) were attached to the upward facing outlets on the manifolds, and a 1/2 in. 26 gauge needle (Becton Dickinson Co. Prod No. 305111) was connected to each adapter. Twenty-two gauge, 1.5 in. needles (Becton Dickinson Co. Prod No. 305156) were inserted through the gray butyl septa on the sample vials, and each vial was inverted and placed on a needle attached to the rack. The restriction in gas flow on the purge rack was at the 26 gauge needles;[1] therefore, the gas pressure from the regulator produced a uniform flow rate to each vial.

Fresh or seawater NO_3^- samples are typically injected in volumes equivalent to 20, 10, or 5 nmol of NO_3^-, although measurements down to 1 nmol are possible (see below). A 6 mL headspace is recommended to prevent media from entering the purge and trap system. Therefore, the maximum volume of a sample is 11 mL (which when added to the bacteria culture in the vial totals 14 mL), and the minimum sample nitrate concentration is 0.1−0.2 μM. Nitrate isotope standards (USGS32, USGS34, and USGS35)[17] are typically made to concentrations of 200 μM KNO_3 in deionized distilled water (DIW), and volumes are injected to produce the same amount of N_2O (but not necessarily the same volume) as the samples. This matching of sample and standard amounts decreases error associated with nonlinearity of the mass spectrometer and blank corrections,[1,2] assuming that the blank is not volume dependent.

Autosampler Modification. A sample rack was constructed from a sheet of HDPE plastic (30 cm wide by 23 cm long by 25 mm thick) drilled (23 mm holes) in a grid pattern of 8 by 10 holes spaced at intervals of 27.2 mm between center points. The drilled plastic sheet was bolted to a 6 mm thick sheet of aluminum (30 cm wide, 30 cm long), which was aligned on the table beneath the autosampler with two 6 mm bolts. The legs of the autosampler were bolted to the same table surface as the sample rack. The autosampler was programmed to locate the samples on the grid, and the needle penetration depth was set 5 mm above the interior bottom of the glass vials.

The analytical system (Figure 1) consisted of a GC-PAL autosampler (CTC analytics, LEAP Technologies), a custom-built

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trapping system to isolate and purify N_2O, and an isotope ratio mass spectrometer (Finnigan Delta^{PLUS} XP). A two-way concentric needle (Figure 1, Inset A) similar to that described previously[18] was designed for this system to increase reliability and flexibility of the purge and trap system. It allowed use of the gastight gray butyl septa described above, reduced needle penetration errors/bending, and allowed the use of an open rack design so that sample vials need not be clamped down. It was constructed using widely available materials: (1) a 6 in., 22 gauge needle (Popper deflected point noncoring stainless steel, Prod No. 7176), (2) 70 mm of 18 gauge stainless steel tubing (McMaster Carr, narrow wall; Prod No. 89935K228), (3) a 3-way tubing tee connector (1/16 in. tubing outer diameter (o.d.), Valco Prod No. ZT1L), and (4) a 1/16−1/32 in. internal reducing bulkhead union (Valco Prod No. ZRU1.5T). All stainless steel tubing used throughout the system was 1/16 in. o.d. by 0.040 in. inner diameter (i.d.) unless otherwise specified. The tee was bolted to the existing autosampler 1 mL syringe holder by drilling a hole through the body of the tee and the syringe holder and attaching with a flat head 10−32 machine screw counter-sunk at the back of the holder. A 1/4 in. by 1/2 in. by 1 in. spacer (drilled and cut aluminum stock) between the tee and the syringe holder was required to align the needle with the autosampler needle guides. The luer lock end of the needle was removed at the base, and the needle was connected to the 1/32 in. side of the bulkhead union that was attached to the top of the syringe holder. A piece of 1/16 in. stainless tubing was attached to the other side of the bulkhead union and led to the purge and trap system (Figure 1). The 22 gauge needle passed through the opposing ports of the tee and was fastened at the top port with a polyimide ferrule (Valco Prod No. FS11.0-5) with the tip of the needle 120 mm from the center of the tee. The 70 mm length of stainless tubing was affixed in the lower port of the tee using a 1/16 in. stainless steel ferrule, and a 1 mm hole was filed into the tube 60 mm from the center of the tee to provide an alternate flow path for sparging gas to exit the vial and lessen the likelihood of vial over pressurization caused by clogging in the outer needle. A piece of 1/16 in. stainless tubing was attached to the side port of the tee, which supplied gas flow to and from the outer sleeve (Figure 1, Inset A). The clear plastic window that covers the syringe holder was removed to make room for the tubing that connected the needle assembly to the purge and trap system. No other modifications were required for the GC-PAL autosampler. The rest of the purge and trap system is the same as described previously.[18]

Sample Analysis. The online sample processing (Figure 1) was most substantially altered from the published automated system[2] in its inclusion of (1) a concentric needle designed to minimize penetration failure, (2) the −60 °C trap to be heated during the 'inject mode' (A1, gray lines) (3) the inclusion of a backflush period for the GC column. A typical sample was processed as follows. At the start of the run, the −60 °C trap (T1) is lowered into the chilled ethanol, the N_2O high flow trap (T2) is lowered into liquid nitrogen, and the 8-port valve (A1) is set to the "load" position (black lines in Figure 1).The 6-port valve (A7) remains in 'backflush' position (gray lines in Figure 1). At this time, the autosampler is sent to the sample bottle and the concentric needle assembly penetrates the septum. Helium (F1) flows through the inner needle into the sample bottle and bubbles helium through the sample and exits the vial through the outer needle into the trap system. The sample is degassed for 700 s at 30 mL min^{-1} to transfer all dissolved N_2O to the tubing loop (T2) immersed in liquid nitrogen. At 690 s, the low flow trap (T3) is immersed in liquid nitrogen to cool the trap. After 700 s, the 8-port valve is switched to the inject position (A1, gray lines), the −60 °C trap (T1) is removed from the chilled ethanol, and the high flow trap (T2) is removed from the LN_2. The trapped N_2O is transferred from T2 to T3 at a He flow rate of 3 mL min^{-1}. Three seconds after T1 is raised, the trap is heated by passing a 15A current (at 5 V) through the convoluted stainless steel tubing (ΔT).[18] This trap is heated for 3 minutes before the current is switched off. At 800 s, the 6-port valve is switched to "inject" mode (A7, black lines), and at 900 s, the low flow trap (T3) is raised, allowing the N_2O to pass through the GC column (30 m × 0.320 mm i.d. GS-Q column, J&W Scientific). After the N_2O peak is detected on the MS (approximately 1080 s), the 6-port valve is switched to backflush the first half of the column (A7, gray lines). After the run ends at 1200 s, the mass spectrometer is autotuned, and the sequence restarts with the next sample.

Calibration of Isotope Ratios. As in the original method,[1,2] molecular (N_2O^+) ion measurements at m/z 44, 45, and 46 are made simultaneously on each gas sample using an isotope ratio mass spectrometer (IRMS). Analyses of $\delta^{15}N$ $(=(({}^{15}N/{}^{14}N)_{sample}/({}^{15}N/{}^{14}N)_{AIR} - 1) \times 1000)$ and $\delta^{18}O$ $(=(({}^{18}O/{}^{16}O)_{sample}/({}^{18}O/{}^{16}O)_{VSMOW} - 1) \times 1000)$ were provisionally referenced to atmospheric N_2 (AIR) and Vienna standard mean ocean water (VSMOW) scales, respectively, by normalizing to the third N_2O reference gas peak injected through the open split interface prior to each sample (at 620−640 s). However, for nitrate isotopes, the N_2O reference gas is not the absolute reference. The primary modification in standardization procedures from the original method is that each set of samples contains six analyses of USGS32, USGS34, and USGS35 nitrate standards[17] that are used to reference nitrate samples to AIR and VSMOW, rather than using IAEANO3 and a $\delta^{18}O$ exchange correction based on incorporation of ^{18}O-labeled H_2O. As originally described, the standards are processed at the same time as the samples and the amount of standard nitrate is matched to that of the samples, which corrects for nonlinearity of the mass spectrometer and blanks associated with the procedure. The slope and intercept of the linear regression between the measured isotopic values of the standards (normalized to AIR and VSMOW using the N_2O reference gas tank) and known isotopic values of the standards (vs AIR and VSMOW) are then used to calculate the absolute isotopic values of the nitrate samples vs AIR and VSMOW from the measured values.[2]

■ ASSESSMENT AND FURTHER CONSIDERATIONS

Precision. Drift over the course of an 80 sample run was observed using the previously published method, resulting in overall decreased precision. Two possible contributors to the drift were addressed here: a gradual increase in baseline signal due to slowly eluting compounds and a decrease in the sample peak area through septum leakage during the course of the run.

The backflush system for the GC column was installed to remedy the increased baseline signal. Without backflushing, an unknown interfering agent would sometimes increase the background signal at m/z 46 (from 5 mV to over 50 mV) after running approximately 30 samples on the automated system and would take many hours to decrease back to baseline after sample injections stopped. The initial solution was to swap the column

Table 1. Analysis of Nitrate Isotope Standards Showing Improvements after MS Interface Alterations[a]

analysis date:	12/14/2005	6/21/2006	11/3/2009	11/4/2009	12/16/2009	2/3/2010
backflush:	N	N	Y	Y	Y	Y
inlet pres. (mbar):	1.7×10^{-6}	2.8×10^{-6}	2.8×10^{-6}	2.8×10^{-6}	2.8×10^{-6}	2.8×10^{-6}
amount of NO_3^-(nmol):	20	20	10	20	10	20
	$\delta^{18}O$	$\delta^{18}O$	$\delta^{18}O$	$\delta^{18}O$	$\delta^{18}O$	$\delta^{18}O$
USGS32:	63.0 ± 0.2	62.8 ± 0.5	61.9 ± 0.1	62.5 ± 0.1	62.3 ± 0.1	62.5 ± 0.1
USGS34:	13.0 ± 0.4	11.5 ± 0.5	8.7 ± 0.1	8.5 ± 0.0	8.9 ± 0.2	8.8 ± 0.1
USGS35:	92.2 ± 0.5	93.4 ± 0.4	93.3 ± 0.1	94.4 ± 0.1	93.9 ± 0.1	94.2 ± 0.1
slope:	0.931	0.963	0.991	1.006	0.995	1.000
intercept:	39.8	39.1	36.4	36.6	36.8	36.8
	$\delta^{15}N$	$\delta^{15}N$	$\delta^{15}N$	$\delta^{15}N$	$\delta^{15}N$	$\delta^{15}N$
USGS32:	177.1 ± 0.5	178.5 ± 0.1	177.0 ± 0.2	178.5 ± 0.2	176.9 ± 0.1	178.1 ± 0.1
USGS34:	−0.1 ± 0.2	−0.3 ± 0.2	−1.5 ± 0.0	−0.9 ± 0.1	−1.9 ± 0.1	−1.1 ± 0.1
USGS35:	5.3 ± 0.2	5.3 ± 0.2	4.0 ± 0.0	4.6 ± 0.0	3.8 ± 0.1	4.4 ± 0.0
slope:	0.975	0.983	0.981	0.987	0.983	0.985
intercept:	1.6	1.5	0.3	0.9	−0.1	0.7
	area (Vs)	area (Vs)	area (Vs)	area (Vs)	area (Vs)	area (Vs)
blank:	0.17	0.09	0.09	0.06	0.05	0.08
USGS32:	5.5 ± 0.3	19.1 ± 0.6	12.4 ± 0.1	24.8 ± 0.3	12.5 ± 0.1	23.3 ± 0.9
USGS34:	5.5 ± 0.3	19.5 ± 0.5	12.0 ± 0.1	24.0 ± 0.3	12.0 ± 0.1	23.6 ± 0.9
USGS35:	5.3 ± 0.3	19.0 ± 0.7	12.1 ± 0.1	24.2 ± 0.4	12.1 ± 0.3	22.8 ± 0.9

[a] Average and standard deviations are from six replicates of each standard over the course of an 80 sample run. d18O values are reported as N_2O in permil vs. VSMOW and d15N values are reported as N_2O in permil vs. AIR. Standards run on 6/21/2006 and 12/14/2005 were before installation of GC column backflush (backflush = N), while results from later runs had the benefit of column backflush (backflush = Y). Standards on 12/14/2005 were also run before increasing the flow rate into the MS ion source (inlet pressure = 1.7×10^{-6} mbar), after which peak areas increased by a factor of 4 (inlet pressure = 2.8×10^{-6} mbar).

with a spare while backflushing the original, but this was a time-consuming process. Later, the column was split in half and connected according to Rockmann et al.,[19] to backflush the first half of the column after every sample. With backflushing, the background signal for m/z 46 remained at 5 mV through the course of an 80 sample run and resulted in precision of replicate standards of 0.1−0.2‰ for both $\delta^{15}N$ and $\delta^{18}O$, compared to 0.2−0.5‰ and 0.4−0.5‰ for $\delta^{15}N$ and $\delta^{18}O$, respectively (Table 1). There also appears to be an increase in calibration slope for $\delta^{18}O$ during this time, which may be related to lowered blanks (from 3% of signal to 0.5% of signal for a sample size of 20 nmol of N).

Loss of N_2O through the septa was suspected as the cause for the decrease in peak area through the course of a run. Septa (or stoppers) that seal the vials need to be both impermeable to N_2O and pliable enough to allow operation of the autosampler. Three potential seals were found to be compatible with the autosampler: gray butyl stoppers (MicroLiter Analytical Supply Inc. Prod No. 20-0025), Teflon-lined silicone septa (MicroLiter Analytical Supply Inc. Prod No. 20-0060A), and aluminum-lined silicone septa (MicroLiter Analytical Supply Inc. Prod No. 20-0050). A large set of test samples was made by adding 20 μL of 1 mM nitrite standards (RSIL-N7373 and RSIL-N10219) to 3 mL of artificial seawater in 20 mL headspace vials (sealed with one of the three septa listed above) and converted to N_2O using the azide method.[20] Each septum was pierced twice with 22 gauge needles during reagent addition, and the samples were stored at room temperature after neutralization with septa facing down. Duplicate vials for each reference material and septum type were analyzed periodically over the course of 6 months to check for loss of N_2O and isotopic consistency. One to two drops of antifoam B was added to each vial using a syringe and 26 gauge needle immediately before analysis.

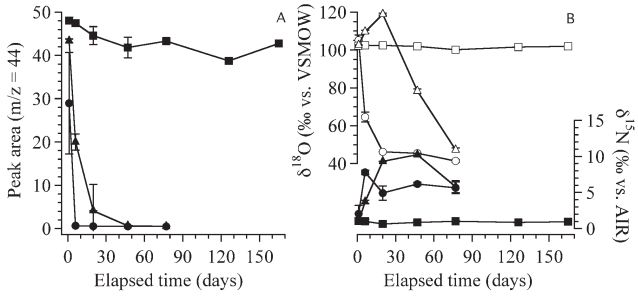

Figure 2. Preservation of N_2O over time using various vial seals. Error bars indicate 1 standard deviation of duplicate samples analyzed at each time point. (A) Peak areas for m/z = 44 observed on the MS over time. Gray butyl septa (squares), aluminum-lined septa (circles), Teflon-lined septa (triangles). (B) Nitrogen (filled symbols) and oxygen (open symbols) isotope ratios of N_2O over time, with different septa marked as in (A). All samples were generated from reaction of potassium nitrite N10219 with sodium azide. Similar results were obtained for N7373 (not shown).

Significant amounts of N_2O were lost using Teflon-lined silicone and aluminum-lined silicone septa over the course of 6 days with corresponding shifts in measured $\delta^{15}N$ and $\delta^{18}O$ (Figure 2). However, several months passed without significant loss of N_2O from the gray butyl stoppers. Moreover, the N and O isotopic composition remained unchanged for vials capped with gray butyl septa for the length of the experiment (165 days). Because gray

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butyl is superior to other materials for gas impermeability and does not inhibit growth of *P. aureofaciens*, it is recommended that these stoppers be used to seal the 20 mL glass headspace vials.

This experiment was performed prior to the installation of the GC backflush, which may explain the larger than expected variations between dates for the gray butyl septa N_2O amounts observed in Figure 2. Since the installation of the column backflush, higher accuracy and precision have been achieved in the determination of NO_3^- concentrations with the denitrifier method using the gray butyl septa.

Medium Preparation and Bacterial Growth. It had been previously observed that some problems with growing the working bacterial cultures were associated with the length of time that the growth medium was autoclaved and/or stored (R. Ho and D. Sigman, unpublished results). Specifically, it was noted that *P. aureofaciens* grown in medium autoclaved for short durations (30 min or less) and used immediately (within a week of autoclaving) more commonly accumulated nitrite during the initial growth phase and either entirely failed to denitrify upon harvesting, or did denitrify but contained a high blank. In testing different autoclave protocols, we found that if the medium was autoclaved for 80 min, the bacteria grew slowly and produced a low maximum cell density (absorbance of 0.23 at 550 nm (A_{550}) versus uninoculated medium through a 1 cm cell) after 11 days. If the medium was autoclaved for 30 min, the bacteria tended to grow too rapidly (peaking in less than 4 days with $A_{550} = 0.36$) and produce inconsistent results, often resulting in residual nitrite in the medium. The correct autoclave time should allow the bacteria to completely denitrify the nitrate in the medium to N_2O (with no residual nitrate or nitrite) in approximately 4 to 5 days. We have obtained consistent results by autoclaving the medium for 50 min using a Market Forge Sterilmatic and allowing it to cool slowly overnight with the door shut. This preparation produced medium with an absorbance at 500 nm versus deionized water through a 1 cm cell (A_{500}) of 0.335 and peak cell density ($A_{550} = 0.27$) in less than 6 days of growth. Autoclaving for 80 min (too long) produced a dark brown medium with an A_{500} of 0.581, while autoclaving for 30 min (too short) produced a light brown medium with an A_{500} of 0.164.

Blanks. The original denitrifier method reports a blank of 0.5 nmoles of N (0.25 nmoles of N_2O) associated with the bacteria.[1] While this blank is only 2.4% of a 20 nmole NO_3^- sample, efforts have been made to further reduce the blank associated with the method. Here, an experiment was performed to test blank levels using either fresh nitrate-free medium or spent medium to resuspend the bacteria. In addition, different cell concentrations and volumes (2 mL of 10-fold concentrated cell suspension or 3 mL of 3.7-fold concentrated cell suspension) and varying vial purge times (2, 3, and 4 h) were tested. In each case, the bacteria were grown for 7 days prior to harvesting.

Although longer purge times did systematically lower the blank size, the use of fresh medium to resuspend the cells resulted in lower blanks compared with spent medium, regardless of vial purge time or cell concentration (Table 2). Furthermore, although there was no significant difference between cell concentrations when fresh medium was used, simply lowering the cell concentration in the original protocol actually resulted in larger blanks rather than smaller blanks, regardless of purge time. This may have been due to a trace amount of nitrite remaining in the spent medium that was removed more efficiently by the higher cell concentration while purging. Nitrite concentration was not rigorously determined in the spent medium, although it was checked visually for color change after nitrite reagent addition.[21] While the blanks obtained by following the original method in this experiment may have been higher than is typical,

Table 2. Peak Areas for Blanks Using Different Bacteria Preparation Techniques[a]

		major ion (m/z = 44) peak area (Vs)		
cell conc.	medium	2 h purge	3 h purge	4 h purge
10×	spent	2.73 ± 0.44	1.78 ± 0.39	1.29 ± 0.65
3.7×	spent	4.07 ± 0.57	3.15 ± 0.71	1.90 ± 0.25
10×	fresh	0.096 ± 0.016	0.076 ± 0.013	0.036 ± 0.011
3.7×	fresh	0.094 ± 0.012	0.067 ± 0.011	0.038 ± 0.007

[a] Bacterial cells were centrifuged and concentrated 10-fold or 3.7-fold in either fresh nitrate-free medium (fresh) or the spent medium in which the bacteria were grown (spent). Bacteria were added to sample vials in either 2 mL (10-fold concentration) or 3 mL (3.7-fold concentration) amounts. In each case, bacteria were grown for 7 days before harvesting.

use of fresh medium to resuspend the cells resulted with a 4 h purge time still resulted in lower blanks (0.04 Vs, corresponding to approximately 0.04 nmol of N) than reported in the original method (0.5 nmol of N). The lowest blank size obtained in this experiment is typical of blanks (0.04−0.08) obtained over the last 3 to 4 years since we have implemented this protocol.

Thus, compared to the original method (10× concentration in spent medium with 2 to 3 h purge time), the blank areas obtained with the protocol recommended here (resuspension in fresh medium with a 4 h purge time) were measurably lower. It was apparently the use of fresh medium rather than the change in cell density or purge time that resulted in the largest improvement. We hypothesize that use of fresh medium provided a source of labile organic carbon to the bacteria that decreased the chance of retaining residual nitrite from incomplete denitrification in the initial growth phase through the vial preparation procedure.

Method Evaluation. A series of test samples was analyzed to check the lower limit of bacterially produced N_2O that would provide sufficient precision and accuracy after all modifications were made to the system. Because it is difficult to separate concentration, nmol amount, and volume effects with natural samples, test samples were produced using USGS32 and USGS34 in distilled deionized water (DIW) and USGS32 in 0.2 μm-filtered Sargasso Sea surface water (SSW; Table 3). In the first test, all volumes were relatively low (2.5−50 μL) so that the main variable was the nmol amount of NO_3^- added. In the second test, a much larger range of sample volumes (0.5−10 mL) made volume the primary variable.

Results from these tests show that the nmol amounts of USGS32 and USGS34 analyzed affected both the measured $\delta^{15}N$ value (relative to the N_2O reference gas) and the precision of the measurements. In all cases, the standard deviations for $\delta^{15}N$ and $\delta^{18}O$ were better than 0.5‰ (and frequently as good as 0.2‰) down to 2 nmol of NO_3^- (1 nmol of N_2O; Table 3). The range of measured $\delta^{15}N$ and $\delta^{18}O$ values in the first test reflects the size of the method blank (associated with the bacteria and purge and trap system) relative to the sample size. For USGS32, the blank had a much larger effect on measured $\delta^{15}N$ than USGS34, most likely because the $\delta^{15}N$ value of USGS32 is elevated. The change in measured $\delta^{15}N$ for USGS34 was so small as to approach the nonlinearity previously described for our system.[18] On the other hand, the $\delta^{18}O$ effect for USGS34 was quite large, most likely because its $\delta^{18}O$ is low relative to potential sources of blank NO_3^- and N_2O. These simple blank (and nonlinearity) effects are correctable using the sample/standard matching scheme described above. However, as can be seen in the second test, using larger volumes of standard to achieve

Table 3. Measured $\delta^{15}N$ and $\delta^{18}O$ of Nitrate Standards USGS32 and USGS34 in Distilled De-Ionized Water (DIW) or Sargasso Sea Water (SSW), Reported as N_2O Relative to AIR and VSMOW by Comparison to N_2O Reference Tank Values[16,a]

volume (mL)	NO_3 concentration (μM)	amount of N (nmol)	$\delta^{15}N$ (vs AIR)	$\delta^{18}O$ (vs VSMOW)	area (Vs)
USGS 32: Constant Concentration, Variable Volume in DIW					
0.0025	200	0.5	165.3 ± 1.4	61.4 ± 0.4	0.6 ± 0.0
0.005	200	1	172.4 ± 0.7	62.5 ± 0.1	1.1 ± 0.0
0.01	200	2	174.5 ± 0.6	62.0 ± 0.5	2.3 ± 0.0
0.015	200	3	175.8 ± 0.3	61.9 ± 0.1	3.5 ± 0.0
0.025	200	5	177.0 ± 0.1	61.9 ± 0.1	5.8 ± 0.0
0.05	200	10	177.9 ± 0.1	61.4 ± 0.1	11.8 ± 0.1
USGS 34: Constant Concentration, Variable Volume in DIW					
volume (mL)	NO_3 concentration (μM)	amount of N (nmol)	$\delta^{15}N$ (vs AIR)	$\delta^{18}O$ (vs VSMOW)	area (Vs)
0.0025	200	0.5	−2.1 ± 0.5	10.6 ± 0.1	0.6 ± 0.0
0.005	200	1	−2.5 ± 0.2	9.7 ± 0.5	1.2 ± 0.0
0.01	200	2	−2.2 ± 0.1	8.9 ± 0.5	2.3 ± 0.0
0.015	200	3	−1.9 ± 0.2	8.7 ± 0.1	3.6 ± 0.0
0.025	200	5	−1.9 ± 0.1	8.4 ± 0.2	6.0 ± 0.0
0.05	200	10	−1.6 ± 0.1	7.8 ± 0.1	12.1 ± 0.0
USGS 32: Constant Concentration, Variable Volume in SSW					
volume (mL)	NO_3 concentration (μM)	amount of N (nmol)	$\delta^{15}N$ (vs AIR)	$\delta^{18}O$ (vs VSMOW)	area (Vs)
0.5	1	0.5	160.9 ± 1.5	62.1 ± 0.6	0.6 ± 0.0
1	1	1	167.2 ± 0.6	61.8 ± 0.5	1.1 ± 0.0
2	1	2	169.1 ± 0.1	62.3 ± 0.3	2.2 ± 0.0
3	1	3	170.2 ± 0.2	62.6 ± 0.4	3.3 ± 0.1
5	1	5	171.7 ± 0.5	62.4 ± 0.1	5.3 ± 0.0
10	1	10	172.7 ± 0.2	62.4 ± 0.1	10.7 ± 0.1

[a] Standard deviations are for triplicate analysis. A concentration of approximately 0.020 μM NO_3^- in SSW resulted in deviations from expected isotopic values for USGS32 standards diluted in SSW. Blank areas were 0.035 ± 0.006 Vs for 0.05 mL DIW and 0.265 ± 0.007 Vs for 10 mL SSW.

a particular nmol amount of N_2O can lead to an additional shift in measured $\delta^{15}N$ values (Table 3). We believe this shift to be due to a small (20 nM) blank in the SSW used to dilute the standards to appropriate volumes. This underscores a challenge for matching sample and standard volumes: unless standards are made up in truly nitrate-free water, blanks associated with the standards that are not present in the samples may compromise the calibration results. To minimize this effect, we typically make up standards as 200 μM solutions and match the amount of N analyzed between samples and standards (to correct for method blank and nonlinearity) but not the volumes.

Throughput. Modifications to the needle design, bacterial growth and harvesting, and the N_2O trapping system have greatly reduced the time required to process and analyze nitrate isotopic samples via the denitrifier method. The needle was designed to fit the CTC analytics autosampler, which allowed minimal modifications to the existing syringe bracket and needle guide (Figure 1). Use of the existing needle guide allowed a simple rack to hold the vials without the need for a bolted top rack to hold the vials in place. However, it is recommended that the shock cord on the GC PAL autosampler be changed annually to maintain the necessary tension on the needle guide to extract the needle from the stopper.

The use of the large swinging-bucket centrifuge and the vial purge rack greatly reduced bacterial preparation time, and large batches of medium were prepared to reduce medium preparation time. The autoclave used could fit up to 24 of the 1/2 L Wheaton bottles, of which only two were used per run; therefore, at peak sample processing times, media is made about twice per month. A set of 80 samples can now be prepared in approximately 6 h (including centrifuging the bacteria, distributing into vials, purging, and sample injection), with less than 3 h of that time requiring user attention.

The increased reliability of the purge and trap interface described here has also greatly increased throughput of the system. Addition of the organics trap and GC backflush have enabled the system to be used nearly nonstop with only brief maintenance periods to change trap contents or thaw the final cold trap (T4 in Figure 1). The large capacity liquid nitrogen dewars need to be filled just once at the beginning of the run; therefore, user attention is not generally required after the start of a run.

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APPENDIX D

Hach® Digital Tritrator Alkalinity Procedures

Appendix D-1

Hach® Digital Titrator General Procedures

Appendix D-2

Hach® Digital Titrator Alkalinity Analysis Procedures

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16900-08

Digital Titrator

Model 16900

jk/dk March 2013 25 ed

SPECIFICATIONS

Digital Titrator

Delivery: 800 digits/mL or 0.00125 mL/digit

Accuracy*: ± 1% for readings over 100 digits. (Uncertainty of readings is 1 digit. Most samples require more than 100 digits.)

Weight: 132 g (4.7 oz.)

Cartridges for the Digital Titrator

Volume: 13 mL

Number of tests: Most reagents are formulated to provide 100 typical titrations; the number may vary depending on sample concentration.

Weight (full): 56.75 g (2 oz.)

* Overall method accuracy includes, in addition to the Digital Titrator, other sources of error controlled by the analyst. The other sources of error include: sampling, sample volume, dilution (if required), end point detection, reagent quality, and interferences.

OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

PERIGO

A manipulação de amostras, padrões e reagentes químicos pode ser perigosa. Reveja a folha dos dados de segurança do material e familiarize-se com todos os procedimentos de segurança antes de manipular quaisquer produtos químicos.

GENERAL DESCRIPTION

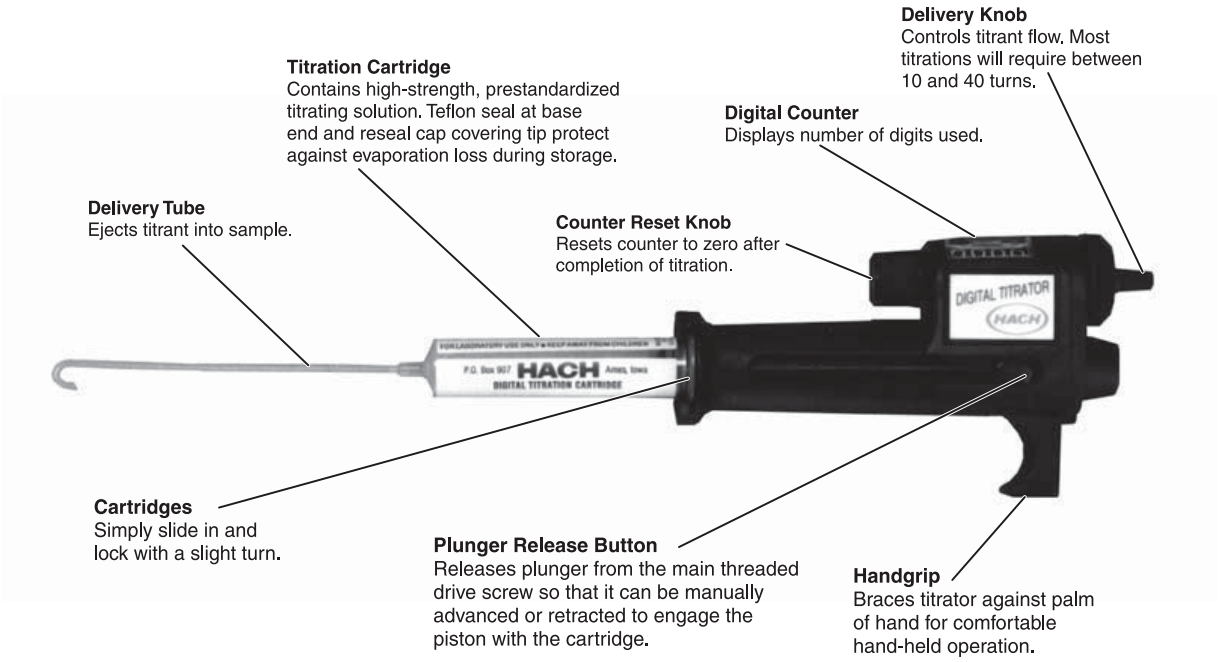
1.1 Introduction

Hach's Digital Titrator is a new concept in titrimetric analysis. It is a precision dispensing device fitted with compact cartridges that contain concentrated titrants. Accurate titrations are made without the bulk and fragility of conventional burets.

A main drive screw in the Digital Titrator controls a plunger which forces the concentrated titrant from a titration cartridge in a carefully regulated flow. The titrator body is constructed of precision-molded, heavy-duty, chemical- and impact-resistant acetal plastic. Accuracy is rated at ± 1% or better for a titration of more than 100 digits. For titrations less than 100, accuracy is ± 1 digit.

Titration solutions (titrants) are packaged in disposable polypropylene or Kynar® containers with Teflon-covered neoprene seals and polyethylene resealable closures to cover the cartridge tips. Each cartridge contains approximately 13 mL of titrating solution, enough for 50–100 average titrations. Titrant solutions are typically controlled to ± 0.5% concentration with normality and tolerances listed on the label. Titrant concentrations are designed for titrations of 10 to 40 turns (100 to 400 digits) of the delivery knob. For the most commonly used concentration ranges, the digits appearing in the counter window correspond to the sample concentration.

Figure 1 Hach Digital Titrator



Both portable and fixed-position titrations are possible with the Digital Titrator. The instrument has a grip for hand-held operation or it can be clamped to a TitraStir® Stir Plate or laboratory stand for stationary setups. See *Figure 1*.

Each Digital Titrator comes with five delivery tubes and a methods manual, which covers the most commonly tested parameters and the corresponding titrant cartridges. Right-angle (ninety-degree) delivery tubes for stationary setups are available as an optional accessory.

1.1.1 Following a Procedure for the First Time

Each method is divided into five sections: Procedure, Accuracy Check, Interferences, Summary of Method, and Reagents and Apparatus. For more information about how to select a procedure or for answers to chemical questions, see Hach's *Water Analysis Handbook* (literature 8376). For more information about chlorine measurement, also see the technical booklet titled, *Current Technology of Chlorine Analysis for Water and Wastewater* (literature 7019).

The **Procedure** details how to perform the method step-by-step. To select the appropriate sample volume and titration cartridge based on expected sample concentration, use the

tables provided in each procedure. If the expected sample concentration is not known, start with one of the smaller sample volumes and determine its approximate concentration. Retest with the appropriate sample size.

The ranges in the table overlap to offer more flexibility. In most procedures, the number of digits used for each concentration range will be 100 to 400 digits.

To determine the actual concentration of the sample, use the correct digit multiplier for the sample volume and titration cartridge used.

Throughout the procedure, the notes will provide additional information.

The **Accuracy Check** provides a way to verify the results and determine if interferences are present. It also provides a method for checking the performance of reagents, the Digital Titrator and the operator's technique. Further information is provided in *Appendix A, Accuracy Check and Standard Additions*.

The **Interferences** section identifies common interferences causing inaccurate results and describes how to eliminate their effects. The interference levels are based on the sample volume that has 1.0 as the digit multiplier. Higher interference levels may be tolerated if a smaller sample is used.

The **Summary of Method** section discusses the chemical reaction taking place and information that applies to the entire procedure.

The **Reagents and Apparatus** list concludes the procedure. All the items required to perform the test are listed first and are available from Hach. The items listed in the notes or interferences sections are included in the optional listings.

1.2 Step-By-Step

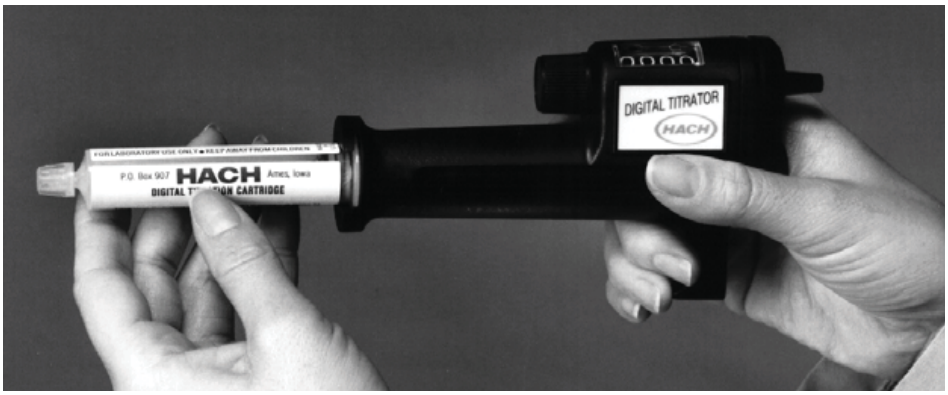
1. Select a sample volume and titration cartridge corresponding to the expected sample concentration from the table given in each procedure.

If the expected sample concentration is not known, start with one of the smaller sample volumes and determine

its approximate concentration. Retest with the appropriate sample size.

2. Slide the cartridge into the titrator receptacle and lock in position with a slight turn. See *Figure 2.*

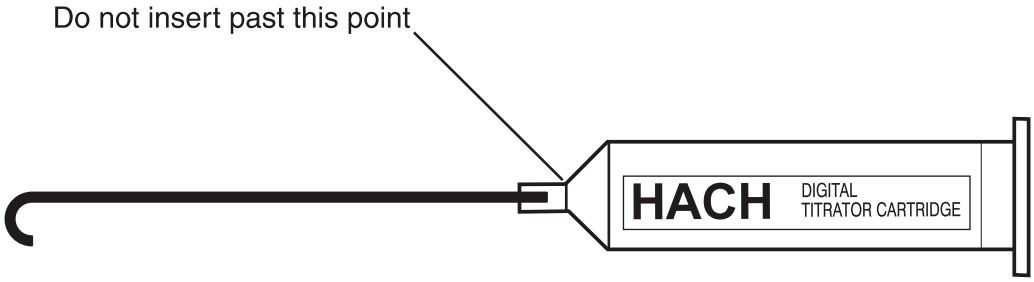
Figure 2 Sliding the Cartridge into Place



3. Remove the polyethylene cap and insert a clean delivery tube into the end of the cartridge until it is tight. See *Figure 3.* Use a straight tube with a hook at the end for hand-held titrations; use a 90° tube with a hook at the end for stationary setups.

   Do not insert tube past cartridge extension; see illustration below. In some instances, it might be necessary to remove a small burr on the leading edge of the tube before insertion.

Figure 3 Inserting the Delivery Tube



4. For stationary titrations, use a TitraStir Stir Plate or a clamp holder and clamp to attach the titrator to a laboratory stand. See *Figure 4* and *Figure 5.*

   The TitraStir Stir Plate holds the Digital Titrator during the titration and also stirs the sample at a constant speed, leaving the analyst free to detect the end point.

When a TitraStir Stir Plate is used, substitute or add the following Optional Apparatus.

APPARATUS

Description	Quantity Required Per Test	Unit	Cat. No.
Delivery Tubes, 90° with hook for TitraStir® Stir Plate	1	5/pkg	41578-00
Flask, Erlenmeyer, 125 mL	1	each	505-43
Flask, Erlenmeyer, 250 mL	1	each	505-46
Stir Bar, 28.6 x 7.9 mm	1	each	20953-52
TitraStir® Stir Plate, 115 Vac	1	each	19400-00
TitraStir® Stir Plate, 230 Vac	1	each	19400-10

5. To start titrant flowing and flush the delivery tube, hold the tip of the cartridge up. Advance the plunger release button to engage the piston with the cartridge (push the button in and toward the cartridge). Do not expel solution when pushing the piston toward the cartridge. Turn the delivery knob until air is expelled and several drops of solution flow from the tip. As you turn the knob a drive screw pushes a piston against the cartridge seal and forces liquid out through the delivery tube. Then use the counter reset knob to turn the digital counter back to zero and wipe the tip. The tip can be rinsed with deionized water rather than wiped, if desired.

Figure 4 Using the TitraStir® Stir Plate

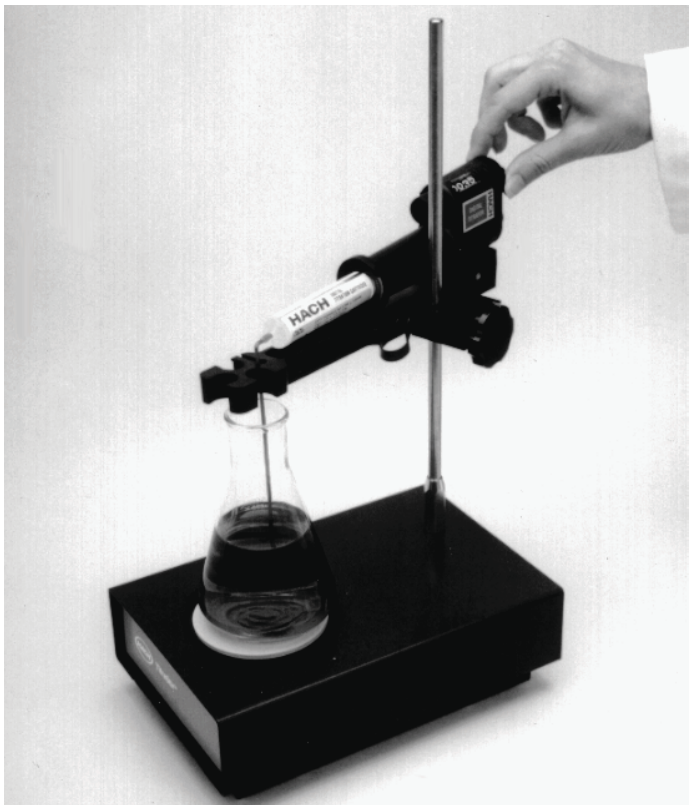


Figure 5 Using a Laboratory Stand

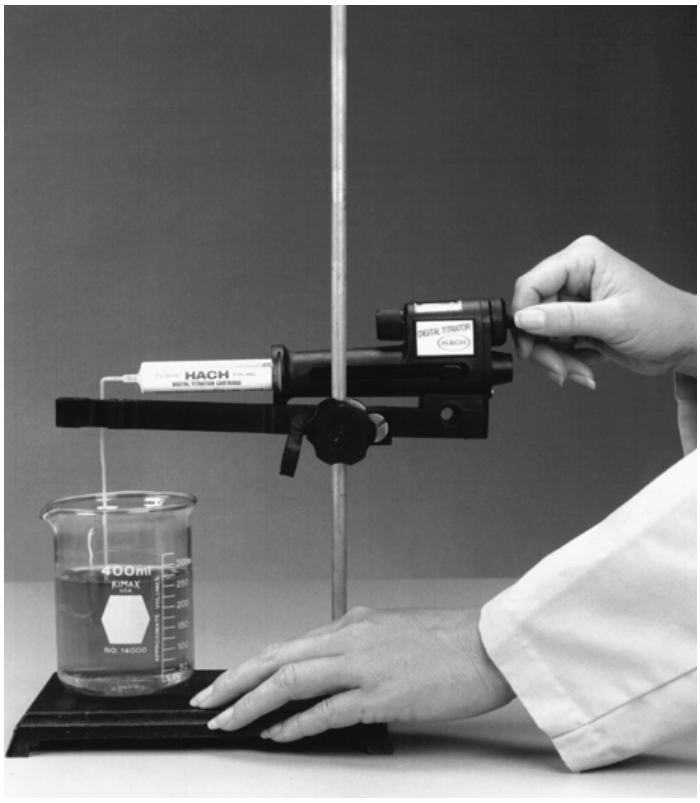


Figure 6 Titrating the Sample

6. Use the smallest appropriate graduated cylinder or pipet to measure the sample volume from the given table. Transfer the sample into a 125-mL or 250-mL Erlenmeyer flask. Dilute to the appropriate total volume with deionized water if necessary.

Note: *Sample volume measurements and dilutions (if required) must be made accurately. However, final total volume of titrated solution is not critical.*

7. Add the necessary reagents to the sample and swirl to mix.

8. Immerse the delivery tube tip in the solution and swirl the flask while titrating. Titrate by turning the delivery knob. Keep turning the knob and swirling the sample until the end point is reached. Record the number of

digits that appear in the digital counter window. See *Figure 6*.

Note: *The number of digits required will usually range from 100 to 400. In nearly all of the procedures if the digits required is less than 100 or more than 400, an alternate sample volume or titrant cartridge should be used.*

Note: *Inaccurate results will occur if the delivery tube tip is held out of the solution rather than under the solution surface.*

9. Calculate the concentration of your sample by using the following formula:

Digits Required × Digit Multiplier = Sample Concentration

Where:

Digits Required = the number that appeared in the digital counter window in Step 8.

Digit Multiplier = the number from the table given in the procedure. It takes into account the sample dilution and titrant strength.

10. After completing testing for the day, press the plunger release button and manually retract the plunger into the body of the titrator. Remove the cartridge. Remove the delivery tube and reseal the cartridge with the polyethylene cap. See *Figure 7.*

Figure 7 Retracting the Plunger

11. Discard or clean the delivery tube immediately after use. To clean, force water, then air, into the tube opening with a syringe or wash bottle.

1.3 Helpful Hints

1.3.1 To Reuse a Partially Emptied Cartridge

1. With the plunger fully retracted, attach cartridge to the titrator.
2. Press the plunger release; then manually push the plunger against the cartridge seal.
3. Attach a delivery tube. Hold the tip of the cartridge up. Eject air and a few drops of titrant, zero the counter, and wipe the tip.
4. Titrate as usual.

1.3.2 To Calculate Titrant Volume Used

Normalities of many Hach titration cartridge solutions have been designed so that the number of digits used in a titration corresponds to the sample concentration in mg/L. To determine the volume used in mL, divide the Digital Titrator reading by 800.

1.3.3 To Fill Your Own Titration Cartridges

Cartridges may be cleaned and refilled, or new empty cartridges, Cat. No. 14495-01, can be purchased from Hach Company. See *Figure 8*. When preparing to refill old cartridges, push the cartridge seal out of the cartridge with air pressure applied through the tip. Cap the tip, fill with solution and reinsert the cartridge seal using care to avoid wrinkling the Teflon sheath. Filling also can be accomplished at the tip with a syringe.

Figure 8 Digital Titrator Cartridges

1.3.4 Verifying Technique

Whenever procedures are changed or new equipment is used, it is helpful to run a sample of known concentration. This technique will confirm the operator is following the procedure correctly and the new equipment is working properly. One objective important to Hach Company is making our tests self-verifying. This means Hach makes the tools available so the operator can check their own work for accurate results without relying on an outside lab or chemist.

For most of the tests in this manual, *Table 1* on page *21* lists each procedure, the suggested standard, the volume of standard needed, the titration cartridge used, and the number of expected digits when the test is performed correctly. The suggested standards are Voluette® or PourRite™ Ampules whenever possible because of their superior accuracy and stability.

To use titration standards follow these steps:

1. Select the procedure of interest and order the appropriate standard. Use the given catalog numbers.
2. Measure the volume of standard to be used as the sample in the procedure using a TenSette® Pipet or Class A pipet.
3. Perform the procedure as written, adding deionized water as necessary.

4. After titrating, the required number of digits should approximately equal the expected digits.

Call Hach Technical and Customer Service (1-800-227-4224) for additional help.

.

Table 1 Titration Standards

Procedure (Parameter)	Standard Description (Cat. No.)	Volume of Standard (mL)	Titration Cartridge (Cat. No.)	Expected Digits
Acid-Base: Acid	0.500 N H_2SO_4 (2121-26)	1.0	1.600 N NaOH (14379-01)	250
		5.0	8.00 N NaOH (14381-01)	250
Base	0.500 N Na_2CO_3 (14278-10)	1.0	1.600 N H_2SO_4 (14389-01)	250
		5.0	8.00 N H_2SO_4 (14391-01)	250
Acidity	0.500 N H_2SO_4 (2121-26)	0.1	0.1600 N NaOH (14377-01)	250
		1.0	1.600 N NaOH (14379-01)	250
Alkalinity	0.500 N Na_2CO_3 (14278-10)	0.1	0.1600 N H_2SO_4 (14388-01)	250
		1.0	1.600 N H_2SO_4 (14389-01)	250
Calcium*: mg/L $CaCO_3$	10,000 mg/L $CaCO_3$ (2187-10)	0.1	0.0800 M EDTA (14364-01)	100
		1.0	0.800 M EDTA (14399-01)	100
G.d.h.	10,000 mg/L $CaCO_3$ (2187-10)	0.2	0.1428 M EDTA (14960-01)	112
		1.0	0.714 M EDTA (14959-01)	112
Carbon Dioxide	10,000 mg/L CO_2 (14275-10)	0.2	0.3636 N NaOH (14378-01)	100
		2.0	3.636 N NaOH (14380-01)	

Table 1 Titration Standards (Continued)

Procedure (Parameter)	Standard Description (Cat. No.)	Volume of Standard (mL)	Titration Cartridge (Cat. No.)	Expected Digits
Chloride	12,500 mg/L Cl (14250-10)	0.1	0.2256 N $Hg(NO_3)_2$ (14393-01)	125
		0.1	0.2256 N $AgNO_3$ (14396-01)	125
		1.0	1.128 N $AgNO_3$ (14397-01)	250
		1.0	2.256 N $Hg(NO_3)_2$ (921-01)	125
Chlorine	~50 mg/L Cl_2 (14268-20) (see certificate)	2.0	0.02256 N $Na_2S_2O_3$ (24091-01)	varies**
	~25 mg/L Cl_2 (26300-20)	0.5	0.00564 N FEAS (22923-01)	varies***
Chromate	1000 mg/L Cr (2231 mg/L CrO_4) (14664-42)	1.0	0.2068 N $Na_2S_2O_3$ (22676-01)	223
Hardness: mg/L $CaCO_3$	10,000 mg/L $CaCO_3$ (2187-10)	0.1	0.0800 M EDTA (14364-01)	100
		0.1	0.0800 M CDTA (14402-01)	100
		1.0	0.800 M EDTA (14399-01)	100
		1.0	0.800 M CDTA (14403-01)	100
G.d.h.	10,000 mg/L $CaCO_3$ (2187-10)	0.2	0.1428 M EDTA (14960-01)	112
		1.0	0.714 M EDTA (14959-01)	112
Iron	50 mg/L Fe (14254-10)	10.0	0.0716 M TitraVer (20817-01)	200
	1000 mg/L Fe (2271-42)	10.0	0.716 M TitraVer (20818-01)	100
Oxygen, Dissolved****	10 mg/L as DO (401-11)	100	0.2000 N $Na_2S_2O_3$ (22675-01)	500
		200	2.00 N $Na_2S_2O_3$ (14401-01)	100
Sulfite	5000 mg/L SO_3 (22674-10)	1.0	0.3998 N KIO_3–KI (14961-01)	250

* One to two drops of Magnesium Standard Solution (10 g/L as $CaCO_3$) must be added to get a sharp end point. These added drops will not change the results.

** The expected digits equal the volume of standard times the concentration on the certificate (e.g., 2 mL x 50 mg/L = 100 digits).
*** The expected digits equals the volume of standard times the concentration on the certificate times the constant, 4. (Example: 0.5 mL x 50 mg/L x 4 = 100 digits)
**** Add one Sulfamic Acid Powder Pillow to the volume of standard and follow Steps 10 to 12 in the Dissolved Oxygen Procedure. It is not necessary to add the first two reagents.

1.4 Adapting a Buret Titration to the Digital Titrator

Adapt any standard titration procedure using a buret to the Digital Titrator by using the following procedure.

1. Determine the approximate number of digits required. The Digital Titrator dispenses 1 mL per 800 digits on the counter. Using the following equation, determine the digits required for your buret method.

$$\text{Digits Required} = \frac{N_t \times mL_t \times 800}{N_c}$$

Where:

N_t = Normality of buret titrant
mL_t = milliliters of buret titrant required for an average titration
N_c = Normality of Digital Titrator cartridge

2. If the number of digits required is within the range of 70 to 350, you can use the procedure as written, substituting the Digital Titrator directly for the buret. Or, if the number of digits is outside of this range, make the following modifications:

a. If the number of digits required is more than 350, reduce the sample size to save titrant.

b. If the number of digits required is less than 70, increase the sample size to increase precision.

c. If the sample size is altered, adjust the amount of buffering or indicating reagents by the same proportion.

3. When using the Digital Titrator for your buret method, note the number of digits required for a sample titration.

To convert the digits required to the equivalent number of milliliters if the buret method was used, calculate:

$$\text{Equivalent Buret Milliliters} = \text{Digits Required} \times \frac{N_c}{800 \times N_t}$$

If the sample size was changed, adjust the equivalent buret milliliters accordingly. If the sample size was increased, reduce the equivalent buret milliliters; if the sample size was reduced increase the equivalent buret milliliters. Multiply the equivalent buret milliliters by any normally used factors to calculate concentration in oz/gal, g/L, etc.

Example: Adapt a buret procedure, which normally requires about 20 mL of a 0.4 N titrant, to the Digital Titrator. Try an 8.0 N titration cartridge. The first equation above gives:

$$\text{Digits Required} = \frac{0.4 \times 20 \times 800}{8.0} = 800 \text{ digits}$$

Because this would use excessive titrant, reduce the sample size to one fourth its normal size to reduce the digits required to 200, well within the recommended range.

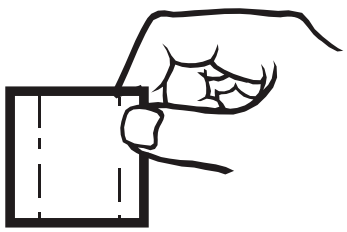
Upon completion of the titration using the smaller sample size, calculate the equivalent buret milliliters by the second equation above. If 205 were the digits required:

$$\text{Equivalent Buret Milliliters} = \frac{205 \times 8.0}{800 \times 0.4} = 5.13 \text{ mL}$$

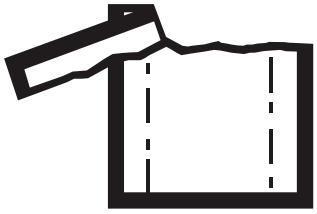
Multiply the 5.13 mL by 4 to account for the reduction in sample size to give the true equivalent buret milliliters of 20.5 mL. If the buret method called for multiplying the number of milliliters of titrant by a factor to calculate the concentration of a sample component, then multiply 20.5 by that factor.

1.5 Using PermaChem® Powder Pillows

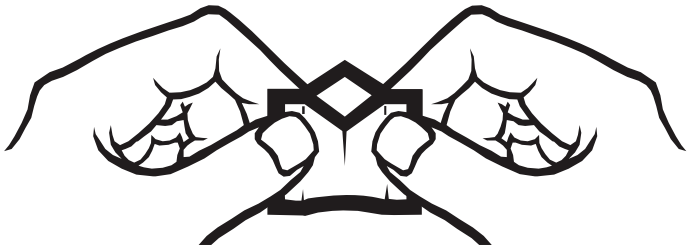
1. **Tap** the PermaChem on a hard surface to collect the powdered reagent in the bottom.



2. **Tear** across on the dotted pillow line marked “TEAR” holding the pillow away from your face.



3. Using two hands, **Push** both sides toward each other until thumbs and forefingers form a diamond. Make sure to **Crease** the foil pack, so that it forms a spout.



4. **Pour** the pillow contents into the sample. The polyfilm lining is specially formulated to deliver all the powder necessary for accurate results (no tapping on the vessel edge is necessary).

1.6 Safety

Safety is the responsibility of each individual when performing analysis procedures, and the analyst must develop and maintain good safety habits. Because many of the procedures in this methods handbook use potentially hazardous chemicals and apparatus, it is important that the analyst practice good laboratory techniques to minimize accidents. The following paragraphs present several techniques applicable to water analysis in the laboratory and in the field. They are not all inclusive, of course, nor do

they apply only to the procedures provided in this handbook. They are general in nature but emphasize practices that are often key factors in personal injury incidents.

- Read labels carefully. Never remove the label from a reagent container. When preparing a reagent or standard solution, be sure to label the container clearly and date it.

- A Material Safety Data Sheet (MSDS) comes with each reagent. This sheet contains helpful information on first aid, spill and disposal procedures, and precautionary measures and should be read before using the product.

- Warning labels also appear on some of the apparatus used with the test procedures.

- Wear protective clothing when handling chemicals that cause irritation or burns. Eye protection in particular is important to guard against spattering and splashes from accidental spills when caustic materials are being used.

- Use tongs or finger cots when transferring apparatus that is hot.

- Use mechanical pipetters: Mouth pipetting could result in accidentally ingesting dangerous chemicals. Make a habit of using mechanical pipet fillers for all pipetting. This will avoid mistakes that could cause serious injury.

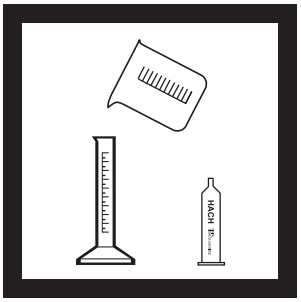
- Use special care with dangerous chemicals and apparatus.

- Follow the test procedure steps carefully and observe all precautionary measures. It is good practice to read the entire procedure carefully before beginning the procedure. Use safety equipment, such as pipet fillers, protective clothing, and ventilating hoods, appropriate for the test being conducted. Wipe up all spills promptly. Do not smoke or eat in an area where toxic or irritating chemicals are used. Use reagents and apparatus only as they were meant to be used and use them only as

directed in the test procedure. Do not use damaged labware and malfunctioning equipment.

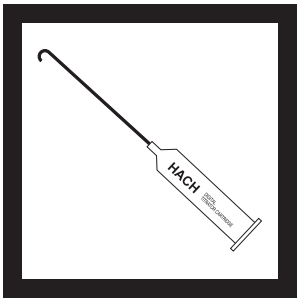
ALKALINITY (10 to 4000 mg/L as $CaCO_3$)

Phenolphthalein and Total Method

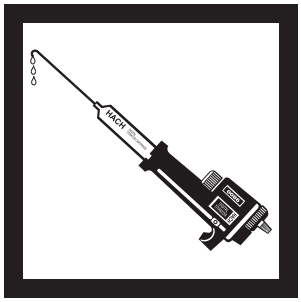


1. Select the sample volume and Sulfuric Acid (H_2SO_4) Titration Cartridge corresponding to the expected alkalinity concentration as mg/L calcium carbonate ($CaCO_3$) from *Table 1*.

Note: *See Sampling and Storage following these steps.*

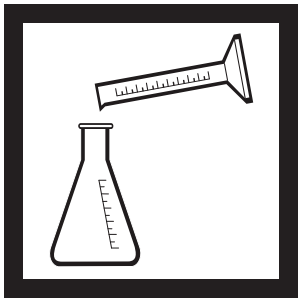


2. Insert a clean delivery tube into the titration cartridge. Attach the cartridge to the titrator body. See *General Description, Step-by-Step* for assembly instructions, if necessary.



3. Turn the delivery knob to eject a few drops of titrant. Reset the counter to zero and wipe the tip.

Note: *For added convenience use the TitraStir® Stir Plate. See General Description, Step 3 in Step-by-Step.*



4. Use a graduated cylinder or pipet to measure the sample volume from *Table 1*. Transfer the sample into a clean 250-mL Erlenmeyer flask. Dilute to about the 100-mL mark with deionized water, if necessary.

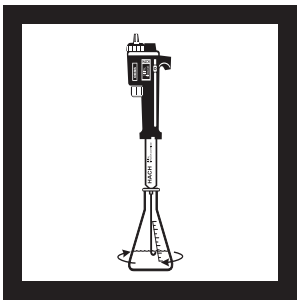
Table 1

Range (mg/L as $CaCO_3$)	Sample Volume (mL)	Titration Cartridge (H_2SO_4)	Catalog Number	Digit Multiplier
10-40	100	0.1600	14388-01	0.1
40-160	25	0.1600	14388-01	0.4
100-400	100	1.600	14389-01	1.0
200-800	50	1.600	14389-01	2.0
500-2000	20	1.600	14389-01	5.0
1000-4000	10	1.600	14389-01	10.0

5. Add the contents of one Phenolphthalein Indicator Powder Pillow and swirl to mix.

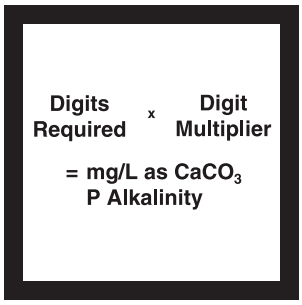
Note: *A solution of one pH 8.3 Buffer Powder Pillow and one Phenolphthalein Powder Pillow in 50 mL of deionized water is recommended as a comparison for determining the proper end point color.*

Note: *Four drops of Phenolphthalein Indicator Solution may be substituted for the Phenolphthalein Indicator Powder Pillow.*



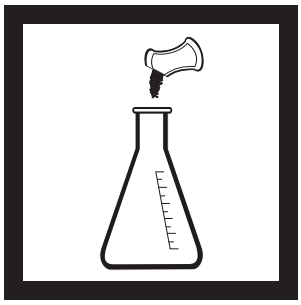
6. If the solution turns pink, titrate to a colorless end point. Place the delivery tube tip into the solution and swirl the flask while titrating with sulfuric acid. Record the number of digits required.

Note: *If the solution is colorless before titrating with sulfuric acid, the Phenolphthalein (P) Alkalinity is zero; proceed with step 8.*



7. Calculate:

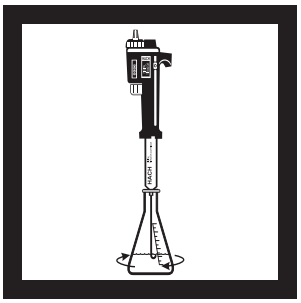
Digits Required x Digit Multiplier = mg/L $CaCO_3$ P Alkalinity

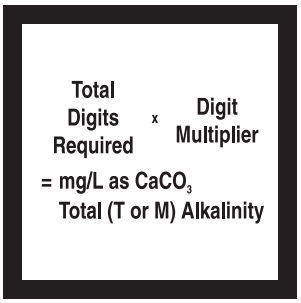


8. Add the contents of one Bromcresol Green-Methyl Red Indicator Powder Pillow to the flask and swirl to mix.

Note: *Four drops of Methyl Purple Indicator Solution may be substituted for the Bromcresol Green-Methyl Red Indicator Powder Pillow. Titrate from green to a gray end point (pH 5.1).*

Note: *Four drops of Bromcresol Green-Methyl Red Indicator Solution may be substituted for the Bromcresol Green-Methyl Red Indicator Powder Pillow.*





9. Continue the titration with sulfuric acid to a light greenish blue-gray (pH 5.1), a light violet-gray (pH 4.8), or a light pink (pH 4.5) color, as required by the sample composition; see *Table 2.* Record the number of digits required.

Note: *A solution of one Bromcresol Green-Methyl Red Powder Pillow and one pillow of the appropriate pH buffer in 50 mL of deionized water is recommended as a comparison for judging the proper end point color. If the pH 3.7 end point is used, use a Bromphenol Blue Powder Pillow instead of a Bromcresol Green-Methyl Red and titrate to a green end point.*

10. Calculate:

Total Digits Required x Digit Multiplier = mg/L as CaCO3 Total (T or M) Alkalinity

Note: *Carbonate, bicarbonate and hydroxide concentrations may be expressed individually using the relationships shown in Table 3.*

Note: *meq/L Alkalinity = mg/L as $CaCO_3$ ÷ 50.*

Table 2

Sample Composition	End Point
Alkalinity about 30 mg/L	pH 4.9
Alkalinity about 150 mg/L	pH 4.6
Alkalinity about 500 mg/L	pH 4.3
Silicates or Phosphates present	pH 4.5
Industrial waste or complex system	pH 4.5

Sampling and Storage

Collect samples in clean plastic or glass bottles. Fill completely and cap tightly. Avoid excessive agitation or prolonged exposure to air. Samples should be analyzed as soon as possible after collection but can be stored at least 24 hours by cooling to 4 °C (39 °F) or below. Warm to room temperature before analyzing.

Alkalinity Relationship Table

Total alkalinity primarily includes hydroxide, carbonate and bicarbonate alkalinities. The concentration of these alkalinities in a sample may be determined when the phenolphthalein and total alkalinities are known (see *Table 3*).

Table 3 Alkalinity Relationship

Row	Result of Titration	Hydroxide Alkalinity is equal to:	Carbonate Alkalinity is equal to:	Bicarbonate Alkalinity is equal to:
1	Phenolphthalein Alkalinity = 0	0	0	Total Alkalinity
2	Phenolphthalein Alkalinity equal to Total Alkalinity	Total Alkalinity	0	0
3	Phenolphthalein Alkalinity less than one half of Total Alkalinity	0	2 times the Phenolphthalein Alkalinity	Total Alkalinity minus two times Phenolphthalein Alkalinity
4	Phenolphthalein Alkalinity equal to one half of Total Alkalinity	0	Total Alkalinity	0

Table 3 Alkalinity Relationship

Row	Result of Titration	Hydroxide Alkalinity is equal to:	Carbonate Alkalinity is equal to:	Bicarbonate Alkalinity is equal to:
5	Phenolphthalein Alkalinity greater than one half of Total Alkalinity	2 times the Phenolphthalein minus Total Alkalinity	2 times the difference between Total and Phenolphthalein Alkalinity	0

To use the table follow these steps:

a. Does the phenolphthalein alkalinity equal zero? If yes, use Row 1.

b. Does the phenolphthalein alkalinity equal total alkalinity? If yes, use Row 2.

c. Multiply the phenolphthalein alkalinity by 2.

d. Select Row 3, 4, or 5 based on comparing the result of *step c* with the total alkalinity.

e. Perform the required calculations in the appropriate row, if any.

f. Check your results. The sum of the three alkalinity types will equal the total alkalinity.

For example:
A sample has 170 mg/L as $CaCO_3$ phenolphthalein alkalinity and 250 mg/L as $CaCO_3$ total alkalinity. What is the concentration of hydroxide, carbonate and bicarbonate alkalinities?

The phenolphthalein alkalinity does not equal 0 (it is 170 mg/L), see *step a*.

The phenolphthalein alkalinity does not equal total alkalinity (170 mg/L vs. 250 mg/L), see *step b*.

The phenolphthalein alkalinity multiplied by 2 = 340 mg/L, see *step c*.

Because 340 mg/L is greater than 250 mg/L, select Row 5, see *step d*.

The hydroxide alkalinity is equal to: (see *step e*).

340 – 250 = 90 mg/L hydroxide alkalinity

The carbonate alkalinity is equal to:

250 – 170 = 80
80 x 2 = 160 mg/L carbonate alkalinity

The bicarbonate alkalinity equals 0 mg/L.

Check: (see *step f*).

90 mg/L hydroxide alkalinity + 160 mg/L carbonate alkalinity +
0 mg/L bicarbonate alkalinity = 250 mg/L

The above answer is correct; the sum of each type equals the total alkalinity.

Accuracy Check

Standard Additions Method
This accuracy check should be performed when interferences are suspected or to verify analytical technique.

1. Snap the neck off an Alkalinity Standard Solution Voluette® Ampule, 0.500 N.

2. Use a TenSette® Pipet to add 0.1 mL of standard to the sample titrated in Steps 6 or 9. Resume titration back to the same end point. Record the number of digits needed.

3. Repeat, using two more additions of 0.1 mL. Titrate to the end point after each addition.

4. Each 0.1 mL addition of standard should require 25 additional digits of 1.600 N titrant or 250 digits of 0.1600 N titrant. If these uniform increases do not occur, refer to *Appendix A, Accuracy Check and Standard Additions*.

Interferences

- Highly colored or turbid samples may mask the color change at the end point. Use a pH meter for these samples.
- Chlorine may interfere with the indicators. Add one drop of 0.1 N Sodium Thiosulfate to eliminate this interference.

Summary of Method

The sample is titrated with sulfuric acid to a colorimetric end point corresponding to a specific pH. Phenolphthalein alkalinity is determined by titration to a pH of 8.3, as evidenced by the color change of phenolphthalein indicator, and indicates the total hydroxide and one half the carbonate present. M (methyl orange) or T (total) alkalinity is determined by titration to a pH between 3.7 and 5.1, and includes all carbonate, bicarbonate and hydroxide.

REQUIRED REAGENTS
(varies with sample characteristics)

Description	Unit	Cat. No
Alkalinity Reagent Set (about 100 tests)		22719-00
Includes: (1) 942-99, (1) 943-99, (1) 14388-01, (1) 14389-01		
Bromcresol Green-Methyl Red Powder Pillows	100/pkg	943-99
Phenolphthalein Powder Pillows	100/pkg	942-99
Sulfuric Acid Titration Cartridge, 1.600 N	each	14389-01
Sulfuric Acid Titration Cartridge, 0.1600 N	each	14388-01
Water, deionized	4 L	272-56

REQUIRED APPARATUS

Digital Titrator	each	16900-01
Flask, Erlenmeyer, 250-mL	each	505-46
Select one or more based on sample concentration:		
Cylinder, graduated, 10-mL	each	508-38
Cylinder, graduated, 25-mL	each	508-40
Cylinder, graduated, 50-mL	each	508-41
Cylinder, graduated, 100-mL	each	508-42

OPTIONAL REAGENTS

Alkalinity Standard Solution Voluette® Ampules, 0.500 N Na_2CO_3, 10-mL	16/pkg	14278-10
Bromcresol Green-Methyl Red Indicator Solution	100 mL MDB	23292-32
Bromphenol Blue Indicator Solution	100 mL MDB	14552-32
Bromphenol Blue Powder Pillows	100/pkg	14550-99
Buffer Powder Pillows, pH 3.7	25/pkg	14551-68
Buffer Powder Pillows, pH 4.5	25/pkg	895-68
Buffer Powder Pillows, pH 4.8	25/pkg	896-68
Buffer Powder Pillows, pH 5.1	25/pkg	897-68
Buffer Powder Pillows, pH 8.3	25/pkg	898-68
Methyl Purple Indicator Solution	100 mL MDB	21934-32
Phenolphthalein Indicator Solution, 5 g/L	100 mL MDB*	162-32
Sodium Thiosulfate Standard Solution, 0.1 N	100 mL MDB	323-32

* Contact Hach for larger sizes.

OPTIONAL APPARATUS

Description	Unit	Cat. No
Bottle, wash, poly, 500-mL	each	620-11
Clamp, 2-prong extension, 38-mm	each	21145-00
Clamp Holder	each	326-00
Demineralizer Assembly, 473-mL	each	21846-00
Delivery Tubes, with 180° hook	5/pkg	17205-00
Delivery Tubes, 90° with hook for TitraStir® Stir Plate	5/pkg	41578-00
Pipet, TenSette® 0.1 to 1.0 mL	each	19700-01
Pipet Tips for 19700-01 TenSette® Pipet	50/pkg	21856-96
Pipet, volumetric, Class A, 10-mL	each	14515-38
Pipet, volumetric, Class A, 20-mL	each	14515-20
Pipet, volumetric, Class A, 25-mL	each	14515-40
Pipet, volumetric, Class A, 50-mL	each	14515-41
Pipet, volumetric, Class A, 100-mL	each	14515-42
Pipet Filler, safety bulb	each	14651-00
*sens**ion**™**1*** Basic Portable pH Meter with electrode	each	51700-10
Support Ring Stand	each	563-00
TitraStir® Stir Plate, 115 Vac	each	19400-00
TitraStir® Stir Plate, 230 Vac	each	19400-10
Voluette® Ampule Breaker Kit	each	21968-00

APPENDIX E

Field Forms

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Project Name: _____

Project Location _____

Instrument Serial Number:

Date	Time	Sample No.	Sample Type	Purge Vol.	Temp	DO	Spec. Cond.	pH	ORP	Location/Remarks

Ship to:					**Sampler Name:**							**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814
					Sampler Signature							
Carrier		**Air Bill/Cert. Mail No.**				Analysis Required						comments
Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt							
Sample Condition Upon Receipt at Laboratory:												
Special Instructions/Comments:												

#1 Released by (Sig.)	Date	#2 Released by (Sig.) NA	Date	Page: of
Organization Name: University of Hawaii	time 10:30	Organization Name:	time	
#2 Received by: (Sig.)	Date	#3 Received by: (Sig.)	Date	
Organization Name:	Time	Organization Name:	Time	

Instrument Information

Instrument Type Water Quality Analyzer

Model _____ Serial Number: _____

Date	Time	Parameter	Units	Std. Lot. No.	Exp. Date	Conc. or Stand. Value	Initial Reading	Final Reading	Reason for Calibration

Instrument Information

Instrument Type Colorimeter

Model _____ Serial Number: _____

Date	Time	Analyte	Units	Std. Lot. No.	Exp. Date	Conc.	Initial Reading	Reading after Adj.	Reason for Calibration

APPENDIX F

HydraSleeve® Standard Operating Procedure

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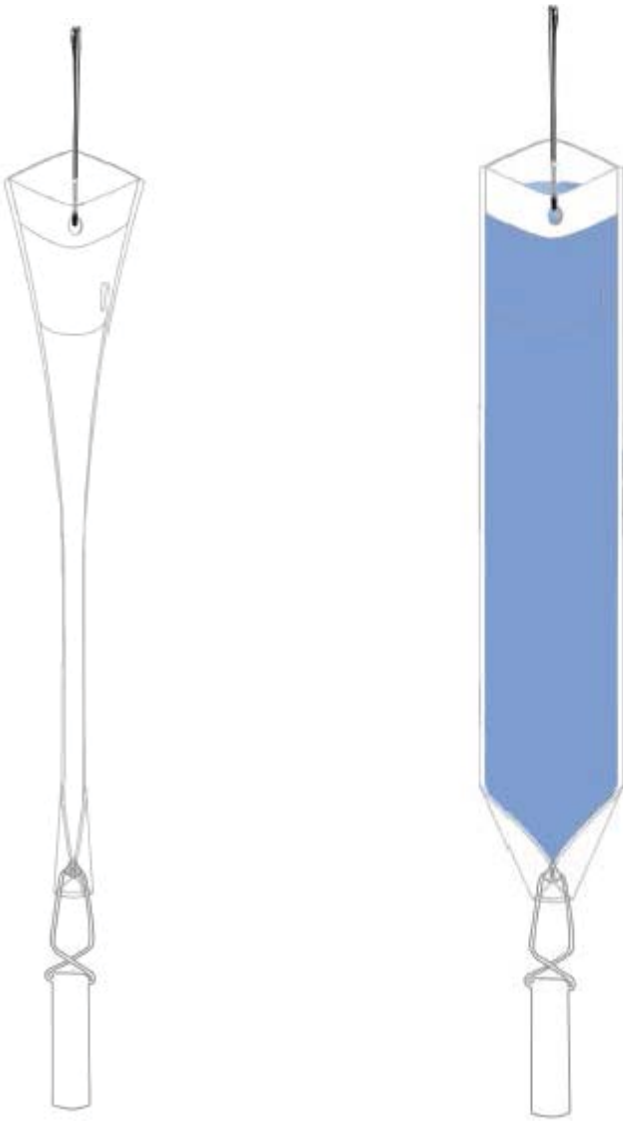
HYDRASleeve™

Simple by Design US Patent No. 6,481,300; No. 6,837,120 others pending

Standard Operating Procedure: Sampling Groundwater with a HydraSleeve



This guide should be used in addition to field manuals and instructions appropriate to the chosen sampling device (i.e., HydraSleeve, SpeedBag or Super/Skinny Sleeve and W3 HybridSleeve).

Find the appropriate field manual and instructions on the HydraSleeve website at http://www.hydrasleeve.com.

For more information about the HydraSleeve, or if you have questions, contact:
GeoInsight, P.O. Box 1266, Mesilla Park, NM 88047
800-996-2225, info@hydrasleeve.com.

Table of Contents

Introduction

The HydraSleeve is classified as a no-purge (passive) grab sampling device, meaning that it is used to collect groundwater samples directly from the screened interval of a well without having to purge the well prior to sample collection. When it is used as described in this Standard Operating Procedure (SOP), the HydraSleeve causes no drawdown in the well (until the sample is withdrawn from the water column) and only minimal disturbance of the water column, because it has a very thin cross section and it displaces very little water (<100 ml) during deployment in the well. The HydraSleeve collects a sample from within the screen only. It excludes water from any other part of the water column in the well through the use of a self-sealing check valve at the top of the sampler. It is a single-use (disposable) sampler that is not intended for reuse, so there are no decontamination requirements for the sampler itself.

The use of no-purge sampling as a means of collecting representative groundwater samples depends on the natural movement of groundwater (under ambient hydraulic head) from the formation adjacent to the well screen through the screen. Robin and Gillham (1987) demonstrated the existence of a dynamic equilibrium between the water in a formation and the water in a well screen installed in that formation, which results in formation-quality water being available in the well screen for sampling at all times. No-purge sampling devices like the HydraSleeve collect this formation-quality water as the sample, under undisturbed (non-pumping) natural flow conditions. Samples collected in this manner generally provide more conservative (i.e., higher concentration) values than samples collected using well-volume purging, and values equivalent to samples collected using low-flow purging and sampling (Parsons, 2005).

Applications of the HydraSleeve

The HydraSleeve can be used to collect representative samples of groundwater for all analytes (volatile organic compounds [VOCs], semi-volatile organic compounds [SVOCs], common metals, trace metals, major cations and anions, dissolved gases, total dissolved solids, radionuclides, pesticides, PCBs, explosive compounds, and all other analytical parameters). Designs are available to collect samples from wells from 1" inside diameter and larger. The HydraSleeve can collect samples from wells of any yield, but it is especially well-suited to collecting samples from low-yield wells, where other sampling methods can't be used reliably because their use results in dewatering of the well screen and alteration of sample chemistry (McAlary and Barker, 1987).

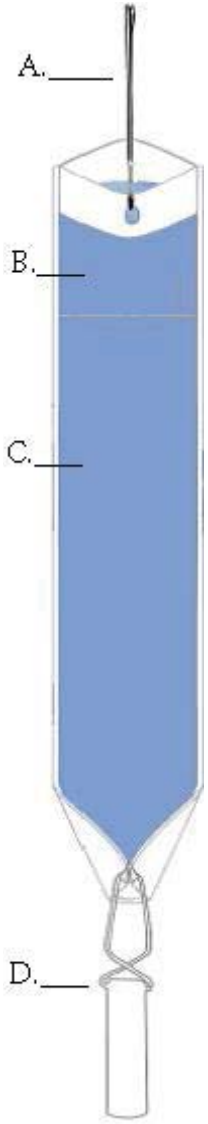
The HydraSleeve can collect samples from wells of any depth, and it can be used for single-event sampling or long-term groundwater monitoring programs. Because of its thin cross section and flexible construction, it can be used in narrow, constricted or damaged wells where rigid sampling devices may not fit. Using multiple HydraSleeves deployed in series along a single suspension line or tether, it is also possible to conduct in-well vertical profiling in wells in which contaminant concentrations are thought to be stratified.

As with all groundwater sampling devices, HydraSleeves should not be used to collect groundwater samples from wells in which separate (non-aqueous) phase hydrocarbons (i.e., gasoline, diesel fuel or jet fuel) are present because of the possibility of incorporating some of the separate-phase hydrocarbon into the sample.

Description of the HydraSleeve

The basic HydraSleeve (Figure 1) consists of the following components*:

- A suspension line or tether (A.), attached to the spring clip or directly to the top of the sleeve to deploy the device into and recover the device from the well. Tethers with depth indicators marked in 1-foot intervals are available from the manufacturer.
- A long, flexible, 4-mil thick lay-flat polyethylene sample sleeve (C.) sealed at the bottom (this is the sample chamber), which comes in different sizes, as discussed below with a self-sealing reed-type flexible polyethylene check valve built into the top of the sleeve (B.) to prevent water from entering or exiting the sampler except during sample acquisition.
- A reusable stainless-steel weight with clip (D.), which is attached to the bottom of the sleeve to carry it down the well to its intended depth in the water column. Bottom weights available from the manufacturer are 0.75" OD and are available in a variety of sizes. An optional top weight may be attached to the top of the HydraSleeve to carry it to depth and to compress it at the bottom of the well (not shown in Figure 1);
- A discharge tube that is used to puncture the HydraSleeve after it is recovered from the well so the sample can be decanted into sample bottles (not shown).
- Just above the self-sealing check valve at the top of the sleeve are two holes which provide attachment points for the spring clip and/or suspension line or tether. At the bottom of the sample sleeve are two holes which provide attachment points for the weight clip and weight.



*Other configurations such as top weighted assemblies, Super/SkinnySleeves, Speedbags, and W3 Hybrids are available.

Note: The sample sleeve and the discharge tube are designed for one-time use and are disposable. The spring clip, weight and weight clip may be reused after thorough cleaning. Suspension cord is generally disposed after one use although, if it is dedicated to the well, it may be reused at the discretion of the sampling personnel.

Selecting the HydraSleeve Size to Meet Site-Specific Sampling Objectives

It is important to understand that each HydraSleeve is able to collect a finite volume of sample because, after the HydraSleeve is deployed, you only get one chance to collect an undisturbed sample. Thus, the volume of sample required to meet your site-specific sampling and analytical requirements will dictate the size of HydraSleeve you need to meet these requirements.

Table 1. Dimensions and Volumes of HydraSleeve Models.

Diameter	Volume	Length	Lay-Flat Width	Filled Dia.
2-Inch HydraSleeves				
Standard 600 mls HydraSleeve	~600mls	30”	2.5”	1.4”
Standard 1-liter HydraSleeve	~1 Liter	38”	3”	1.9”
Super/SkinnySleeve 1-liter	~1 Liter	38”	2.5"	1.5”*
Super/SkinnySleeve 1.5-liter	~1.5 Liters	52”	2.5”	1.5”*
Super/SkinnySleeve 2-liter	*~2Liters*	*66"*	*2.5"*	*1.5"**
4-Inch HydraSleeves				
Standard 2.5 liter	~2 Liters	38”	4”	2.7”

* outside diameter on the Heavy Duty Universal Super/SkinnySleeves is 1.5" however when using with schedule 40 hardware the O.D. of the assembly will be 1.9"

It's also recommended that you size the diameter of the HydraSleeve according to the diameter of the well (i.e. use 2-inch HydraSleeves in 2-inch wells). Using smaller sleeves in larger diameter wells (i.e. 2-inch HydraSleeves in 4-inch wells) will result in a longer fill rate and will require special retrieval instructions (explained later).

The volume of sample collected by the HydraSleeve varies with the diameter and length of the HydraSleeve. Dimensions and volumes of available HydraSleeve models are detailed in Table 1.

HydraSleeves can be custom-fabricated by GeoInsight in varying diameters and lengths to meet specific volume requirements. HydraSleeves can also be deployed in series (i.e., multiple HydraSleeves attached to one tether) to collect additional sample to meet specific volume requirements, as described below.

If you have questions regarding the availability of sufficient volume of sample to satisfy laboratory requirements for analysis, it is recommended that you contact the laboratory to discuss the minimum volumes needed for each suite of analytes. Laboratories often require only 10% to 25% of the volume they specify to complete analysis for specific suites of analytes, so they can often work with much smaller sample volumes that can easily be supplied using a HydraSleeve.

HydraSleeve Deployment

Information Required Before Deploying a HydraSleeve

Before installing a HydraSleeve in any well, you will need to know the following:

- The inside diameter of the well
- The length of the well screen
- The water level in the well
- The position of the well screen in the well
- The total depth of the well

The inside diameter of the well is used to determine the appropriate HydraSleeve diameter for use in the well. The other information is used to determine the proper placement of the HydraSleeve in the well to collect a representative sample from the screen (see HydraSleeve Placement, below), and to determine the appropriate length of tether to attach to the HydraSleeve to deploy it at the appropriate position in the well.

Most of this information (with the exception of the water level) should be available from the well log; if not, it will have to be collected by some other means. The inside diameter of the well can be measured at the top of the well casing, and the total depth of the well can be measured by sounding the bottom of the well with a weighted tape. The position and length of the well screen may have to be determined using a down-hole camera if a well log is not available. The water level in the well can be measured using any commonly available water-level gauge.

HydraSleeve Placement

The HydraSleeve is designed to collect a sample directly from the well screen. It fills by pulling it up through the screen a distance equivalent to the length of the sampler when correctly sized to the well diameter. This upward motion causes the top check valve to open, which allows the device to fill. To optimize sample recovery, it is recommended that the HydraSleeve be placed in the well so that the bottom weight rests on the bottom of the well and the top of the HydraSleeve is as close to the bottom of the well screen as possible. This should allow the sampler to fill before the top of the device reaches the top of the screen as it is pulled up through the water column, and ensure that only water from the screen is collected as the sample. In short-screen wells, or wells with a short water column, it may be necessary to use a top-weight on the HydraSleeve to compress it in the bottom of the well so that, when it is recovered, it has room to fill before it reaches the top of the screen.

Example

2" ID PVC well, 50' total depth, 10' screen at the bottom of the well, with water level above the screen (the entire screen contains water).

Correct Placement (figure 2): Using a standard HydraSleeve for a 2" well (2.5" flat width/1.5" filled OD x 30" long, 600 ml volume), deploy the sampler so the weight (a 5 oz., 2.5" long weight with a 2" long clip) rests at the bottom of the well. The top of the sleeve is thus set at ~34" above the bottom of the well. When the sampler is recovered, it will be pulled upward approximately 30" before it is filled; therefore, it is full (and the top check valve closes) at approximately 64" (5.3 feet) above the bottom of the well, which is well before the sampler reaches the top of the screen. In this example, only water from the screen is collected as a sample.

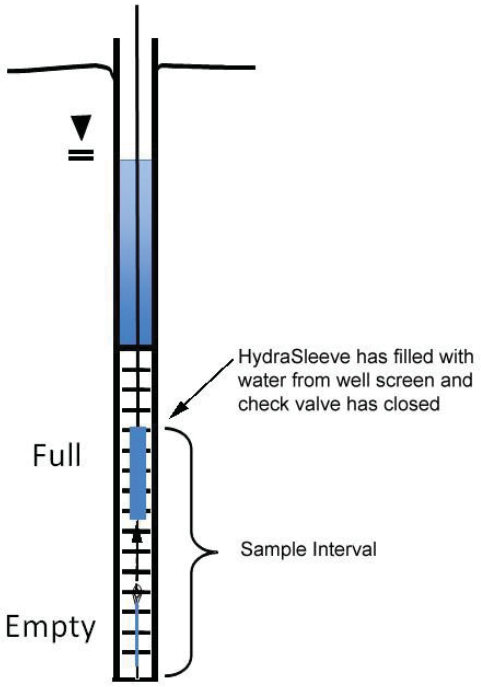


Figure 2. Correct Placement of HydraSleeve.

Incorrect Placement (figure 3): If the well screen in this example was only 5' long, and the HydraSleeve was placed as above, it would not fill before the top of the device reached the top of the well screen, so the sample would include water from above the screen, which may not have the same chemistry.

The solution? Deploy the HydraSleeve with a top weight, so that it is collapsed to within 6" of the bottom of the well. When the HydraSleeve is recovered, it will fill within 36" (3 feet) from the bottom of the well, or 2-feet before the sampler reaches the top of the screen, so it collects only water from the screen as the sample.

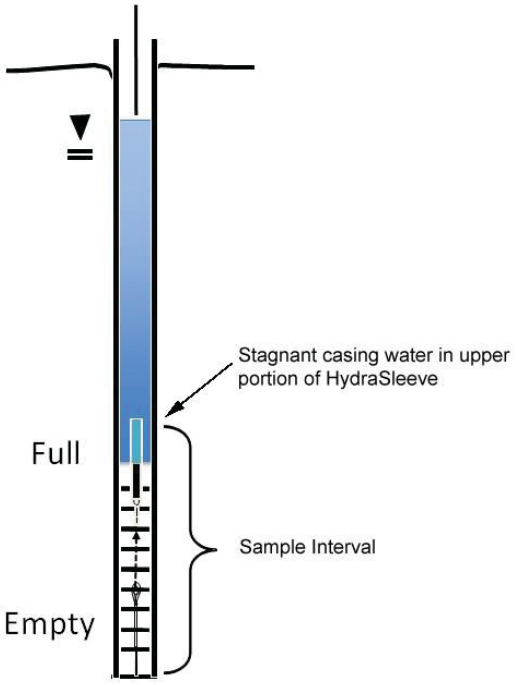


Figure 3. Incorrect placement of HydraSleeve.

This example illustrates one of many types of HydraSleeve placements. More complex placements are discussed in a later section.

NOTE: Using smaller diameter HydraSleeves (2-inch) in larger diameter wells (4-inch) causes a slower fill rate. Special retrieval methods are necessary if this is your set up (shown later in this document).

Procedures for Sampling with the HydraSleeve

Collecting a groundwater sample with a HydraSleeve is usually a simple one-person operation.

Note: Before deploying the HydraSleeve in the well, collect the depth-to-water measurement that you will use to determine the preferred position of the HydraSleeve in the well. This measurement may also be used with measurements from other wells to create a groundwater contour map. If necessary, also measure the depth to the bottom of the well to verify actual well depth to confirm your decision on placement of the HydraSleeve in the water column.

Measure the correct amount of tether needed to suspend the HydraSleeve in the well so that the weight will rest on the bottom of the well (or at your preferred position in the well). Make sure to account for the need to leave a few feet of tether at the top of the well to allow recovery of the sleeve.

Note: Always wear sterile gloves when handling and discharging the HydraSleeve.

I. Assembling the Basic HydraSleeve*

1. Remove the HydraSleeve from its packaging, unfold it, and hold it by its top.
2. Crimp the top of the HydraSleeve by folding the hard polyethylene reinforcing strips at the holes.
3. Attach the spring clip to the holes to ensure that the top will remain open until the sampler is retrieved.
4. Attach the tether to the spring clip by tying a knot in the tether.

Note: Alternatively, if spring clips are not being utilized, attach the tether to one (NOT both) of the holes at the top of the Hydrasleeve by tying a knot in the tether.

5. Fold the flaps with the two holes at the bottom of the HydraSleeve together to align the holes and slide the weight clip through the holes.
6. Attach a weight to the bottom of the weight clip to ensure that the HydraSleeve will descend to the bottom of the well.

*See Super/SkinnySleeve assembly manual and HydraSleeve Field Manual for other assembly instructions.

II. Deploying the HydraSleeve

1. Using the tether, carefully lower the HydraSleeve to the bottom of the well, or to your preferred depth in the water column

   During installation, hydrostatic pressure in the water column will keep the self-sealing check valve at the top of the HydraSleeve closed, and ensure that it retains its flat, empty profile for an indefinite period prior to recovery.

Note: Make sure that it is not pulled upward at any time during its descent. If the HydraSleeve is pulled upward at a rate greater than 0.5'/second at any time prior to recovery, the top check valve will open and water will enter the HydraSleeve prematurely.

2. Secure the tether at the top of the well by placing the well cap on the top of the well casing and over the tether.

Note: Alternatively, you can tie the tether to a hook on the bottom of the well cap (you will need to leave a few inches of slack in the line to avoid pulling the sampler up as the cap is removed at the next sampling event).

III. Equilibrating the Well

The equilibration time is the time it takes for conditions in the water column (primarily flow dynamics and contaminant distribution) to restabilize after vertical mixing occurs (caused by installation of a sampling device in the well).

- Situation: The HydraSleeve is deployed for the first time or for only one time in a well

  The basic HydraSleeve is very thin in cross section and displaces very little water (<100 ml) during deployment so, unlike most other sampling devices, it does not disturb the water column to the point at which long equilibration times are necessary to ensure recovery of a representative sample.

  In some cases, like when useing the SpeedBags, the HydraSleeve can be recovered immediately (with no equilibration time) or within a few hours. In regulatory jurisdictions that impose specific requirements for equilibration times prior to recovery of no-purge sampling devices, these requirements should be followed.

  NOTE: If using top weights additional equilibration time is needed to allow the top weight time to compress the HydraSleeve into the bottom of the well.

- Situation: The HydraSleeve is being deployed for recovery during a future sampling event.

  In periodic (i.e., quarterly, semi-annual, or annual) sampling programs, the sampler for the current sampling event can be recovered and a new sampler (for the next sampling event) deployed immediately thereafter, so the new sampler remains in the well until the next sampling event.

Thus, a long equilibration time is ensured and, at the next sampling event, the sampler can be recovered immediately. This means that separate mobilizations, to deploy and then to recover the sampler, are not required. HydraSleeves can be left in a well for an indefinite period of time without concern.

IV. HydraSleeve Recovery and Sample Collection

1. Hold on to the tether while removing the well cap.
2. Secure the tether at the top of the well while maintaining tension on the tether (but without pulling the tether upwards)
3. Measure the water level in the well.
4. Use one of the following 3 retrieval methods. In all 3 scenarios, when the HydraSleeve is full, the top check valve will close. You should begin to feel the weight of the HydraSleeve on the tether and it will begin to displace water. The closed check valve prevents loss of sample and entry of water from zones above the well screen as the HydraSleeve is recovered.

   a. In one smooth motion, pull the tether up 30"-60" (the length of the sampler) at a rate of about 1 foot per second (or faster). The motion will open the top check valve and allow the HydraSleeve to fill (it should fill in about 1:1 ratio or the length of the HydraSleeve if the sleeve is sized to fit the well). This is analogous to coring the water column in the well from the bottom up.

   b. There are times it is recommended that the HydraSleeve be oscillated in the screen zone to ensure it is full before leaving the screen area. Pull up 1-3 feet, let the sleeve assembly drop back down and repeat 3-5 times before pulling the sleeve to the surface. The collection zone will be the oscillation zone. ***When in doubt use this retrieval method.***

   c. SpeedBags require check valve activation and oscillation during recovery: When retrieving the SpeedBag, pull up hard 1-2 feet to open the check valve; let the assembly drop back down to the starting point; REPEAT THIS PROCESS 4 TIMES; and then quickly recover the SpeedBag through the well sceen to the surface.

5. Continue pulling the tether upward until the HydraSleeve is at the top of the well.
6. Discard the small volume of water trapped in the Hydrasleeve above the check valve by pinching it off at the top under the stiffeners (above the check valve).

v. Sample Discharge

NOTE: Sample collection should be done immediately after the HydraSleeve has been brought to the surface to preserve sample integrity.

Be sure you have discarded the water sitting above the check valve – see step #6 above.

1. Remove the discharge tube from its sleeve.
2. Hold the HydraSleeve at the check valve
3. Puncture the HydraSleeve at least 3-4 inches below the reinforcement strips with the pointed end of the discharge tube. NOTE: For some contaminants (VOC's/sinkers) the best location for discharge is the middle to bottom of the sampler. This would be representative of the deeper portion of the well screen.
4. Discharge water from the HydraSleeve into your sample containers. Control the discharge from the HydraSleeve by either raising the bottom of the sleeve, by squeezing it like a tube of toothpaste, or both.
5. Continue filling sample containers until all are full.

Measurement of Field Indicator Parameters

Field indicator parameter measurement is generally done during well purging and sampling to confirm when parameters are stable and sampling can begin. Because no-purge sampling does not require purging, field indicator parameter measurement is not necessary for the purpose of confirming when purging is complete.

If field indicator parameter measurement is required to meet a specific non-purging regulatory requirement, it can be done by taking measurements from water within a HydraSleeve that is not used for collecting a sample to submit for laboratory analysis (i.e., a second HydraSleeve installed in conjunction with the primary sample collection HydraSleeve [see Multiple Sampler Deployment below]).

Alternate Deployment Strategies

Deployment in Wells with Limited Water Columns

For wells in which only a limited water column needs to be sampled, the HydraSleeve can be deployed with an optional top weight in addition to a bottom weight. The top weight will collapse the HydraSleeve to a very short (approximately 6" to 24") length, depending on the length and volume of the sampler. This allows the HydraSleeve to fill in a water column only 3' to 10' in height (again) depending on the sampler size. Note the SuperSleeves accomplish the same thing but provide greater sample volume at a lower per sample cost.

Multiple Sampler Deployment

Multiple sampler deployment in a single well screen can accomplish two purposes:

1. It can collect additional sample volume to satisfy site or laboratory-specific sample volume requirements.
2. It can be used to collect samples from multiple intervals in the screen to allow identification of possible contaminant stratification.

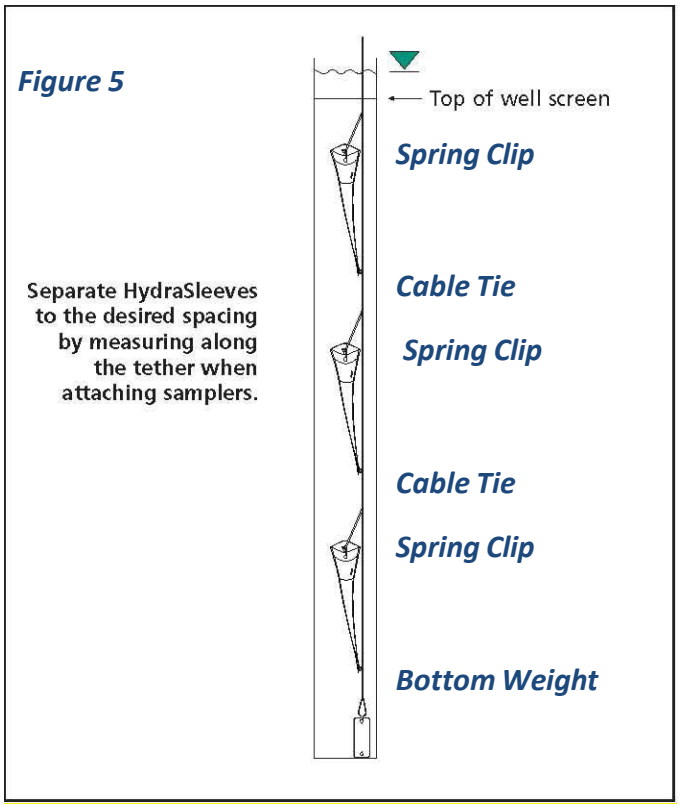


Figure 5. Multiple HydraSleeve deployment

If there is a need for only 2 samplers, they can be installed as follows. The first sampler can be attached to the tether as described above, a second attached to the bottom of the first using your desired length of tether between the two and the weight attached to the bottom of the second sampler (figure 6). This method can only be used with 2 samplers; 3 or more HydraSleeves in tandem need to be attached as described above.

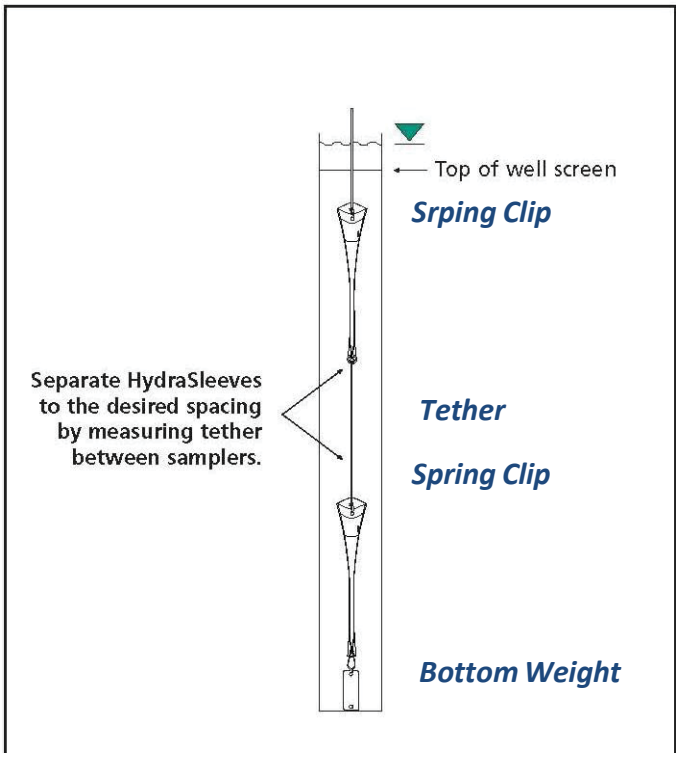


Figure 6. Alternative method for deploying multiple HydraSleeves.

In either case, when attaching multiple HydraSleeves in series, more weight will be required to hold the samplers in place in the well than would be required with a single sampler. Recovery of multiple samplers and collection of samples is done in the same manner as for single sampler deployments.

Post-Sampling Activities

The recovered HydraSleeve and the sample discharge tubing should be disposed as per the solid waste management plan for the site. To prepare for the next sampling event, a new HydraSleeve can be deployed in the well (as described previously) and left in the well until the next sampling event, at which time it can be recovered.

The weight and weight clip can be reused on this sampler after they have been thoroughly cleaned as per the site equipment decontamination plan. The tether may be dedicated to the well and reused or discarded at the discretion of sampling personnel.

References

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APPENDIX G

Determination of Total Nitrogen (as Nitrate + Nitrite)

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Determination of Total Nitrogen (as Nitrate + Nitrite) Modified SM 4500-N C, Alkaline Persulfate with Ultraviolet (UV) Digestion

1.0 Summary, Scope and Application

1.1 The purpose of this method is to provide a procedure for determining total nitrogen (as NO_3^- + NO_2^- nitrogen) concentration in brackish, ocean, and surface waters as well as industrial and domestic aqueous wastes.

1.2 The alkaline persulfate digestion procedure oxidizes all forms of inorganic and organic nitrogen to nitrate (NO_3^-). Nitrate is then quantitatively reduced to nitrite (NO_2^-) by passing the digested ample through a cadmium reduction column. The nitrite is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine hydrochloride. The resulting water-soluble dye has a magenta color that is read at 540 nm.

1.3 The applicable range is 25-2000 µg N/L. Measurements are made using a nutrient auto analyzer (Seal Analytical AA3) at 520 nm using a 10-mm flow cell. Concentrations below 25 µg N/L are reported as below the minimum reporting level (<MRL) of the method. Regardless of sample salinity, fresh, brackish, and oceanwater samples are analyzed together and quantitated using digested calibration standards prepared in deionized water.

2.0 References

2.1 "Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, Water Environment Federation, 21st edition, 2005, 4500-NO3 F. Automated Cadmium Reduction Method.

2.2 Seal Analytical AutoAnalyzer Applications. Nitrate and Nitrite in Water and Seawater, Total Nitrogen in Persulfate Digests, Method No. G-172-96 Rev. 12 (Multitest 19). July 2009.

2.3 EPA 353.2 Determination of Nitrate-Nitrite Nitrogen by Automated Colorimetry. Revision 2.0. August 1993. Environmental Monitoring Systems Laboratory. Office of Research and Development. US EPA. Cincinnati, Ohio 45268.

2.4 Ace Glass Inc. General Operating Instructions for Ace Photochemical U.V. Power Supplies and Mercury Vapor Lamps.

3.0 Definitions

3.1 Laboratory Reagent Blank (LRB) – An aliquot of reagent water that is treated exactly like a sample including exposure to all glassware, equipment, and reagents that are used with the other samples. It is used to determine whether method analytes or other interferences are present in the laboratory environment, glassware, reagents or equipment.

3.2 Calibration Blank (Cal Blank) – A volume of reagent water without the analytes.

3.3 Calibration Standard (CAL) – A solution prepared from the stock standard solution (SSS). The CAL solutions are used to calibrate the instrument with respect to analyte concentration.

3.4 Initial/Continuing Calibration Verification (ICV/CCV) – A solution of a known concentration of the analyte used to evaluate the performance of the instrument with respect to a defined set of criteria.

3.5 Laboratory Fortified Blank (LFB) – An aliquot of reagent water to which a known concentration of the analyte is added in the laboratory. It is analyzed exactly like a sample, and is used to determine whether the methodology is in control, and whether the laboratory can make accurate and precise measurements.

3.6 Linear Calibration Range (LCR) – The concentration range over which the instrument response is linear.

3.7 Matrix Spike (MS) – An aliquot of a sample to which known concentration of the analyte is added in the laboratory. It is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results.

3.8 Quality Control Sample (QCS) – A solution of method analyte of known concentration that is used to fortify the LRB. The QCS is obtained from a source external to the laboratory and different from the source of the calibration standards. It is used to check laboratory performance with externally prepared materials.

3.9 Stock Standard Solution (SSS) – A concentrated solution (1000 mg N/L) of the method analyte purchased commercially.

4.0 Sampling and Storage

4.1 High-density polyethylene bottles are used for sample collection and storage. Samples for total nitrogen analysis are not pre-filtered.

4.2 Samples are frozen at ≤ -20°C for up to 31 days.

4.3 Prior to digestion or analysis, samples should be brought to room temperature.

5.0 Interferences

5.1 Solvents, reagents, glassware, and other sample-processing hardware may yield artifacts that affect results. All materials used in the analysis shall be demonstrated to be free from interferences by running laboratory blanks

6.0 Safety

Procedures shall be carried out in a manner that protects the health and safety of all DOH personnel. The following requirements must be met:

6.1 Good laboratory practices should be observed always when preparing reagents and while working in the laboratory. A laboratory coat, safety goggles, and appropriate gloves should be worn always especially when preparing acid solutions.

6.2 The health and safety hazards of many of the chemicals used in this procedure have not been fully defined. Additional health and safety information can be obtained from the MSDS files maintained in the laboratory.

6.3 Exposure to chemicals will be maintained as low as reasonably achievable.

7.0 Apparatus

7.1 Seal Analytical Auto Analyzer (AAIII) consisting of the following components:

7.1.1 Compact auto sampler.
7.1.2 Peristaltic pump
7.1.3 Analytical Cartridge.
7.1.4 Voltage Stabilizer.
7.1.5 Colorimeter (10mm x 1.5mm flow cell/ 520 nm filters).
7.1.6 AACE Software version 5.44G or higher
7.1.7 Data handler system

7.2 Ultra-violet (UV) light oxidation unit- Ace-Hanovia photochemical lamp (1200 W) and power supply (230 V, 60Hz) operational with spring-wound internal timer (Intermatic).

8.0 Reagents

8.1 Color Reagent

Sulfanilamide	9.1 g
Phosphoric Acid	185 mL
NEDD	0.71 g
DI H_2O	1000 mL
Brij-35, 30% solution (wetting agent)	3.0 mL

While stirring, add 185 mL of concentrated phosphoric acid and 9.1 g of sulfanilamide to 700 mL of DI water. Add 0.71 g of NEDD reagent and stir until dissolved. Dilute to 1L with DI water. Add approximately 3.0 mL of Brij-35 wetting agent. Store in amber container inside the refrigerator. Reagent is stable for a month.

8.2 Ammonium Chloride Reagent

Ammonium chloride	97.0 g
50% NaOH (w/w)	for pH adjustment
Disodium EDTA	0.23 g
Stock copper sulfate, 0.01M	2.0 mL
DI water	1000 mL
Brij-35 solution	3.0 mL

Dissolve 97.0 g of ammonium chloride and 0.23 g of EDTA in about 900 mL of DI water. Add 2.0 mL of the stock copper sulfate solution and mix. Dilute to 1L with DI water. Adjust the pH of the solution to 8.5 by adding drops of 50% NaOH. Add approximately 3.0 mL of Brij-35 solution. This reagent has to be prepared weekly.

8.3 2N HCl (to be prepared as needed)

Concentrated HCl	165 mL
DI water	1000 mL
Brij-35 solution	3.0 mL

Do this under the hood. While stirring, slowly add 165 mL of concentrated HCl to approximately 600 mL of DI water. Add 3.0 mL of Brij-35 and mix thoroughly. The solution remains stable as long as it remains clear.

8.4 Stock Copper Sulfate Solution "A" 0.01 M.

Cupric sulfate	2.5 g
DI water	1000 mL

Dissolve 2.5 g of cupric sulfate in 600 mL of DI water and dilute to a final volume of 1000 mL and mix thoroughly.

8.5 Nitrate-Nitrogen and Nitrite-Nitrogen Standard (1000 µg N/L) from HACH, ERA, Fisher Scientific or Environmental Express.

8.6 Copper Activating Solution

Stock Copper Sulfate "A" 0.01M	50 mL
DI water	100 mL
Brij-35	0.30 mL

Dilute 50 mL of stock copper sulfate solution to 100 mL with DI water. Add 0.30 mL of Brij-35 and mix thoroughly.

8.7 QC standard: Second source quality control standard purchased from Environmental Associates (ERA), RICCA, Fisher Scientific or SPEX CertiPrep, Inc. Since the concentration of purchased QC standard varies depending on the lot number, the QC standard is diluted appropriately to approximate the concentration of the middle calibration standard solution.

8.8 Potassium Persulfate Digestion Reagent

Dissolve 25.0 g low nitrogen (<0.001% N) recrystallized potassium persulfate, 7.5 g NaOH, and 15 g boric acid in DI water and dilute to 500 mL just before use. Prepare a fresh batch of digestion reagent every time.

9.0 Procedure

9.1 Ultra-violet (UV) Digestion

9.1.1 Measure 50 mL of calibration standards, blank, quality control standards, or samples and transfer to a quartz digestion tube.

9.1.2 Add 5 mL of potassium persulfate digestion solution to each tube. Cap and mix the contents of the tube by inverting three times.

9.1.3 Irradiate tube and its contents for 6 hours.

9.1.4 Quality control (QC) samples are included in each digestion batch to check for UV-digestion efficiency.

9.2 Analysis by AA3

9.2.1 Calibration standards are prepared as follows:

Standard Name	Concentration (mg N/L) of calibration standard	mL of Intermediate Standard (10.0 mg N/L) diluted to 50.0 mL
Calibration Blank	0.000	0.00
Standard 1	0.025	0.125
Standard 2	0.050	0.25
Standard 3	0.100	1.0
Standard 4	0.250	1.25
Standard 5	0.500	2.5
Standard 7	1.00 (2.00)	5.0 (10.0)

9.2.2 A standard calibration curve is performed for every sample run.

9.2.3 For the calibration curve to be acceptable the correlation coefficient (r) should be 0.995 or higher. After the last calibration standard is run, the calibration curve and its corresponding correlation coefficient value is shown on the monitor screen. If the calibration is acceptable, mid-level instrument calibration verification (ICV) standard is run. Otherwise, the run is aborted and a new set of calibration standards is run. Proceed with running samples, sample duplicates, matrix spikes, and quality control samples. Before the end of the run a continuing calibration verification (CCV) standard is analyzed.

9.2.4 A typical run sequence is as follows:

Baseline, Primer, Drift, High Standard, Low Standard, Low Standard, Calibration Standards, Baseline, Calibration Blank (Cal. Blank), Laboratory Reagent Blank (LRB), Laboratory Fortified Blank (LFB), ICV, QC Check Sample, Samples, Sample Duplicate, Sample Matrix Spike, Calibration Blank, CCV, Drift, Final Baseline.

10.0 Analysis/ Operation

10.1 Calibration and Maintenance

Refer to Seal Analytical AACE Software Operation Manual, Software version 5.46 or higher.

10.2 Checking the Baseline before a RUN

10.2.1 Switch on all Analyzer modules and pump deionized water plus wetting agent (Brij 35 solution) through all reagent lines.

N.B. Compact sampler wash solution does not contain wetting agent.

10.2.2 Check bubble pattern in all lines, especially flow cell waste line. Bubbles must be of the same size, shape, and distance apart. Desirable bubble shape in all plastic tubing must be round at the front and back. Irregular and misshapen bubbles could be due to insufficient wetting agent, contaminated or incorrect type of tubing.

10.2.3 Click on AACE software icon. Click Charting in the System window on the AACE desktop. Check the colorimeter Base, Gain, and Lamp settings. Make sure you are using the correct Analysis , which would show on the lower left corner of the Channel control block.

10.2.4 Check the baseline. It should be stable and almost flat. The software has a default value of 5% for baseline monitoring. If you observe noise, spikes or baseline drift, refer to the analyzer operation manual for possible causes and remedial action.

10.2.5 After obtaining a stable baseline with deionized water, replace reagent lines with reagents. Check bubble pattern with reagents going through all the lines. Check to make sure that the bubble pattern is still OK with reagents going through the system. When the reagents have reached the flow cell and the chart reading increases, check the baseline. It should still be stable and almost flat.

10.3 Adjusting Baseline and Sensitivity

10.3.1 Make sure the system is pumping reagents, the baseline is stable and Charting windows are displayed on the screen.

10.3.2 Aspirate your highest calibration standard for 1 minute. Wait until the standard reaches the flow cell.

10.3.3 To adjust the GAIN value, click the right mouse button in the chart and Set Gain from the local menu. This will adjust the reading to the Chart % entered in the Configure – Software (normally 95% for default value).

10.3.4 Return sample probe to the wash cup by clicking on Wash and then Cancel.

10.4 Starting a Run

10.4.1 With the system pumping reagents, observe the bubble pattern and make any other final checks, which might be necessary before starting the run.

10.4.2 When the analyzer is ready, select “Run” from the Main Menu. If the run name generator was used, the run name has been created automatically. Otherwise enter a run name. Settings for the run name generator can be changed in Run Settings in the *Configure-Software.*

10.5 Run in Progress

10.5.1 After a run is started a run chart will appear for each selected channel.

10.5.2 A run will stop automatically when all calibration standards and samples have been analyzed and the final baseline has been taken and a message saying that the run was completed will appear.

10.6 Stopping a Run

10.6.1 A whole run can also be stopped at any time before it has finished. Click Run in the Main Menu, then point to Stop and click the system you want to stop.

10.7 Retrieving the Results of a Run

11.7.1 To view the analysis results after a run is completed; select Retrieve – Report in the Main Menu. The run results can be displayed and printed after the end of a run.

11.0 Quality Control

11.1 Acceptance Criteria/ Method Validation

11.1.1 The following protocol must be followed for data to be acceptable.

QC Sample	Frequency	Criteria	Corrective Action
Initial calibration verification (ICV)	Immediately after calibration	90 - 110%	ICV/CCV can be re-run only once. Recalibrate and reanalyze all samples since last acceptable ICV/CCV.
Continuing calibration verification (CCV)	Every after 10 samples and before the end of a sample run	80 - 120%	
Laboratory reagent blank (LRB)	1 per sample run	< 0.025 mg N/L (less than the Minimum Reporting Limit)	Rerun LRB only once. If rerun fails, re-analyze all samples associated with unacceptable LRB.
Calibration Blank (Cal Blank)	1 for every ten samples	< 0.025 mg N/L	Rerun Cal Blank once. If rerun fails, re-analyze all samples associated with unacceptable LRB.
Laboratory Fortified Blank (LFB)	1 per sample run	90-110%	Rerun LFB only once. If rerun fails, re-analyze all samples associated with unacceptable LFB.
Quality control sample (QCS)	One per sample run	80% - 120%	Re-run QCS and if still fails, re-analyze all samples associated with unacceptable QCS
Matrix spike (MS)	One for every 10 samples	70% - 130%	If recovery is out of range but LRB, LFB, ICV/CCV and QCS are within range, flag result as possible sample matrix interference.

11.2 Initial Demonstration of Performance

11.2.1 The initial demonstration of performance is used to characterize instrument performance (determination of LCR and analysis of QCS) and laboratory performance (determination of MDL).

11.2.2 Linear Calibration Range (LCR) - An LCR study shall be done on an annual basis (usually at the beginning of the year) or whenever a significant change in instrument response is expected (e.g. replacing photometer, filter, or flow cell) or new instrument operator. The initial demonstration of linearity must use sufficient standards to ensure that the resulting curve is linear. The verification of linearity must use a minimum of a blank, and three standards (to include lowest and highest standards used in the actual analysis). If any data exceeds the initial values by ±10%, linearity must be re-established.

11.2.3 Quality Control Sample (QCS) – On an annual basis (at the beginning of the year), verify the calibration standards and acceptable instrument performance with the analysis of a QCS (preferably with a concentration at the mid-range of the calibration standards). The actual concentration should fall within ±20% of the expected value, and if not, the source of the problem must be identified and corrected.

11.2.4 Minimum Detection Limit (MDL) - An MDL study for total nitrogen shall be established on an annual basis or after any major instrument maintenance or modification. To prepare the MDL samples, use reagent water (blank) fortified at a concentration approximately 2-3 times the instrument detection limit. Take seven replicates of the fortified reagent water and analyze them through the entire analytical method. The MDL is calculated from the standard deviation and student's t-value as described in the Code of Federal Regulations CFR 40, Appendix B to part 136, DEFINITION AND PROCEDURE FOR THE DETERMINATION OF METHOD DETECTION LIMIT. Seven replicates are used with a 95% confidence limit.

The MDL is calculated as follows:

$$MDL = (t)\ (SD)$$

Where, SD = standard deviation of the replicate analyses

t= student's t value for n-1 degrees of freedom at the 99 % confidence limit; t = 3.143 for six degrees of freedom.

12.0 Calculations

12.1 The AACE software calculates standard calibration curve by plotting peak heights (expressed as digits) of processed standards against known standard concentrations.

12.2 The software will automatically compute concentration values for the samples.

12.3 The software allows for re-adjustment of the peak marker if the peak is incorrectly marked. If peak markers were re-adjusted or a calibration standard is deleted (nulled), a copy of the original run should be printed and included with the data package for that run. A rationale should be written to explain why peak markers were manually adjusted or why a calibration standard has been deleted.

13.0 Records Management/ Documentation

13.1 Analysis results are printed out and results are also automatically saved in the equipment computer's hard drive.

13.2 Records associated with a sample run are stored as follows:

13.2.1 Raw Data – Printout of results are stored in the WP section supervisor's office.

13.2.2 Completed summary of analytical results are sent to the different programs requesting for the analysis and copies are also filed in the Water Pollution Section supervisor's office.

13.2.3 Both electronic and hard copies of lab results are sent to the programs that requested for the analysis.

13.2.4 Hard copies of lab results summary kept in the lab are disposed of after 6 years of storage.

APPENDIX H

Water Isotope Analysis Methodology

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Direct determination of δ(D) and δ(18O) in water samples using cavity ring down spectrometry: Application to bottled…

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Direct determination of δ(D) and δ(^{18}O) in water samples using cavity ring down spectrometry: Application to bottled mineral water

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ABSTRACT

The repeatability, reproducibility and accuracy of the direct measurement of δ(D) and δ(^{18}O) isotopes in water samples were evaluated using Cavity Ring-Down Spectrometry, and values comparable with the Isotopic Ratio Mass Spectrometry were obtained. Memory effect correction was negligible after five successive injections, and the time for each sample analysis was approximately 70 minutes. Application of the method to Brazilian bottled mineral water has shown that it is possible to trace the origin of the water to at least the state level within Brazilian geographical regions. National and regional meteoric water lines were constructed with substantial differences between geographical regions, in particular for the central region of the country, with a slope coefficient of approximately seven and no deuterium excess.

1. Introduction

Brazilian mineral water production has reached 7.2 billion liters annually, according to the Brazilian Mineral Water Industry Association (ABINAM). However, because of the size of the country (8.5 million km^2), mineral water production has a local character with few brands available nationally. Large metropolitan areas such as Rio de Janeiro and São Paulo represent important markets where several brands may be found, many of which are sold only seasonally. During the summer, relatively unknown brands often appear in the market, in particular those sold in 20-l returnable bottles, causing concerns about their provenance. Additionally, some international brands are also found in the Brazilian market; however, these brands usually have a markedly higher price, which could be a temptation for the production of counterfeits. However, because the δ(D) and δ(^{18}O) content should reflect the water source (geographical location and altitude), these isotopes represent a potential tool for detecting fraud and mislabeling related to bottled mineral water (Bong et al., 2009; Bowen et al., 2005; Brencic and Vreca, 2006, 2010; Dotsika et al., 2010; Ingraham et al., 2004).

Although the theoretical basis for Cavity Ring Down Spectrometry (CRDS) had been available in the literature for several decades, the first cavity ring-down absorption measurements were first reported by O'Keefe and Deacon in 1988 (Lehmann et al., 2009). Cavity Ring Down Spectrometry (CRDS) is a direct absorption technique with a significantly higher sensitivity than conventional absorption spectroscopy. CRDS is based on light circulating in an optical cavity and measures of the rate of absorption, rather than the magnitude of absorption, of that light. The decay time is called the cavity ring-down time and is inversely proportional to all losses inside the cavity. In an empty cavity, the losses are only controlled by the reflectivity of the cavity mirrors. Inserting an absorbing sample inside the cavity leads to a larger cavity loss and, consequently, to a shorter ring-down time (Fig. 1) (Lehmann et al., 2009).

The sensitivity of the CRDS technique arises from two different factors. The effective absorption path length, which depends on the reflectivity of the cavity mirrors, can be very long (10 km for the Picarro water isotopes analyzer) while the sample volume can be kept at 1–2 μL. Additionally, since the absorption is determined from the time behavior of the signal, the sensitivity is independent of possible intensity fluctuations of the light source. In typical CRDS experiments, the standard error in measuring the ring-down time is approximately 1–0.01%. The ring-down time is defined as the 1/e decay time of the exponentially decaying light intensity inside the cavity. Assuming a value of 0.1%, then a sample loss per pass of only 3 parts per billion could be detected with a signal-to-noise ratio of 2:1 in a single cavity decay (Lehmann et al., 2009).

At least for the determination of δ(D) and δ(^{18}O) in water samples, Cavity Ring Down Spectrometry (CRDS) represents an alternative to Isotopic Ratio Mass Spectrometry (IRMS), allowing for δ(D) and δ(^{18}O) detection directly without any sample preparation. Moreover, the technique may achieve a precision of 0.011‰ and 0.038‰ for δ(D) and δ(^{18}O), respectively.

This work aims to quantify δ(D) and δ(^{18}O) isotopes using CRDS and then use these data to test the authenticity of bottled mineral water in the Brazilian market.

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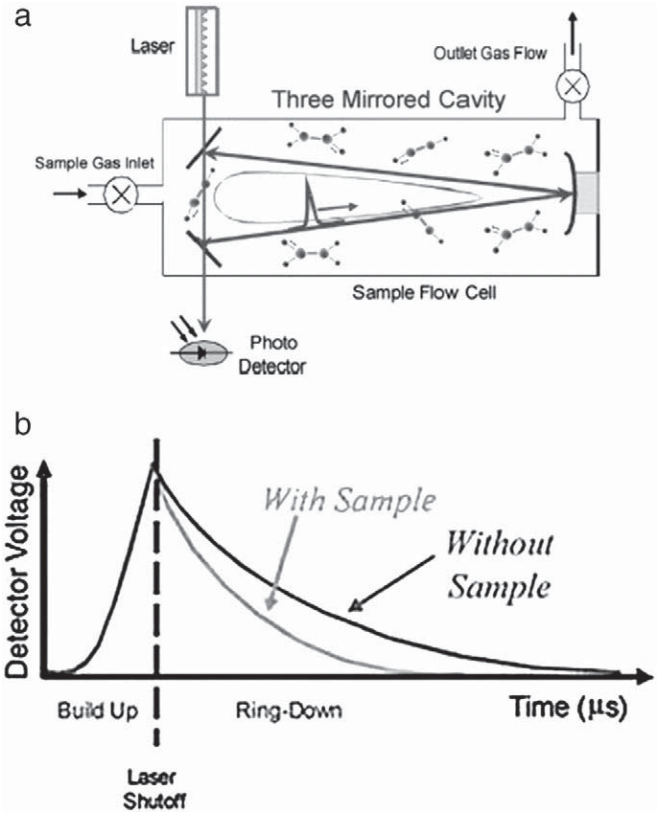

Fig. 1. Cavity Ring-Down Spectrometry principle (a) and the change on the ring-down time with the presence of a sample inside the chamber (b), adapted from Crosson (2008).

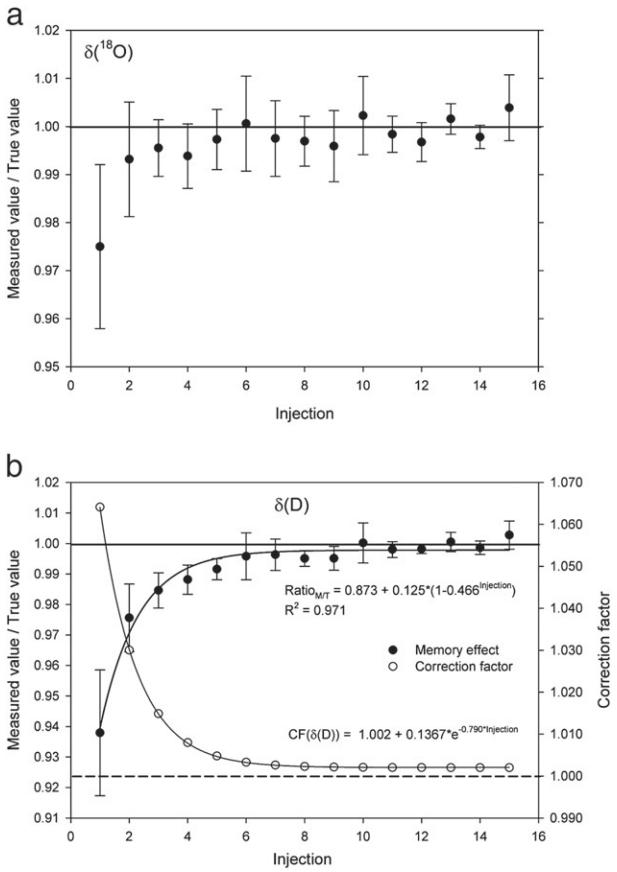

Fig. 2. Memory effect testing: (a) $\delta(^{18}O)$ and (b) $\delta(D)$.

Table 1
Achieved accuracy on $\delta(D)$ and $\delta(^{18}O)$ determination (N = 4, values as ‰).

Sample code		IAEA OH-13	IAEA OH-14	IAEA OH-15	IAEA OH-16
δ(D)					
CRDS Present study	Mean	−2.36	−37.34	−78.01	−114.40
	SD	0.42	0.60	0.47	0.94
IRMS labs mean value[a]	Mean	−2.8	−38.97	−79.3	−114.83
	SD	1.0	0.93	1.0	0.81
δ(^{18}O)					
CRDS Present study	Mean	−1.21	−5.69	−9.56	−15.55
	SD	0.09	0.08	0.08	−0.14
IRMS labs mean value[a]	Mean	−0.98	−5.60	−9.39	−15.44
	SD	0.10	0.10	0.11	0.13

[a] (Choudhry et al., 2011).

2. Materials and methods

The stable isotope abundances are reported in δ-notation in parts per thousands (‰), where:

$$\partial = \left(\frac{R_A}{R_S} - 1\right) \times 1000$$

R_A is the molar ratio of the rare to abundant isotope (e.g., D/^{1}H or ^{18}O/^{16}O), and R_S the molar ratio of the sample of interest to an international standard. The international standard for both hydrogen and oxygen stable isotope analysis is Vienna Standard Mean Ocean Water (VSMOW).

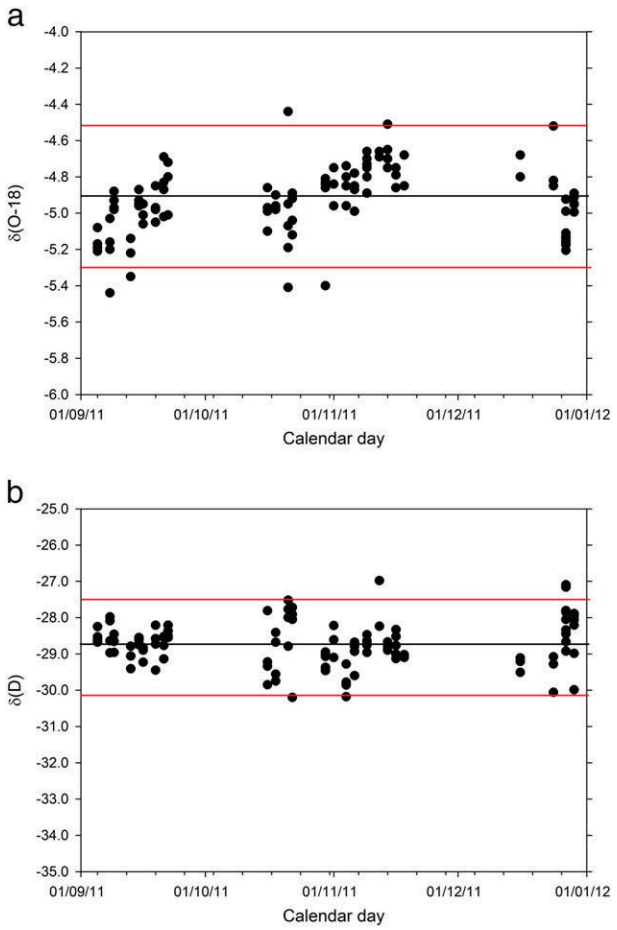

Fig. 3. Control charts: (a) $\delta(^{18}O)$ [$\delta(^{18}O) = -4.93$‰ (SD = 0.19‰, N = 108)] and (b) $\delta(D)$ [$\delta(D) = -28.85$‰ (SD = 0.70‰, N = 108)].

Table 2
Delta values obtained for bottled Brazilian mineral water and some international brands (values as ‰).

Brand	City	State	Geographical region	Delta (O-18)	Delta (D)
La Priori	Brasília	DF	CW	−5.82	−37.12
Indaiá, source Cerrado	Sobradinho-Brasília	DF	CW	−4.22	−30.67
Indaiá, source Opala	Sobradinho-Brasília	DF	CW	−5.54	−34.87
Schin	Alexânia	GO	CW	−5.30	−35.51
Acqua Lia	Anápolis	GO	CW	−4.92	−32.28
Acqua Lia Premium	Anápolis	GO	CW	−4.93	−31.90
Água Cristalina	Anápolis	GO	CW	−5.23	−34.37
Pura	Bela Vista de Goiás	GO	CW	−5.99	−38.93
Goyá	Bom Jesus	GO	CW	−5.94	−40.59
Itiquira	Formosa	GO	CW	−6.43	−41.70
Água Iza	Goiânia	GO	CW	−6.49	−43.32
Ipê	Hidrolândia	GO	CW	−5.81	−38.27
Mariza	Hidrolândia	GO	CW	−6.19	−39.20
Nativa	Hidrolândia	GO	CW	−5.49	−37.41
Rinco	Rio Verde	GO	CW	−7.00	−46.43
Pará Oby	Rio Verde	GO	CW	−7.72	−53.27
Cristal Mina	São Miguel do Passa Quatro	GO	CW	−5.28	−36.49
Sara	Zona Rural	GO	CW	−6.41	−40.80
Crystal	Campo Grande	MS	CW	−5.30	−34.06
Mineral Life	Campo Grande	MS	CW	−5.59	−37.67
Santa Clara do TO	Aparecida do RN	TO	N	−3.15	−18.31
Águas da Serra	Palmas	TO	N	−3.13	−16.41
Crystal Nordeste	Maceió	AL	NE	−1.01	2.18
Indaiá	Dias D'Ávila	BA	NE	−2.02	−3.21
Aquality	Fortaleza	CE	NE	−3.00	−16.67
Naturágua	Fortaleza	CE	NE	−2.49	−13.20
Indaiá CE	Fortaleza	CE	NE	−2.69	−13.92
Indaiá PB	Santa Rita	PB	NE	−2.00	−5.19
Crystal Pureza	Guabiraba, Recife	PE	NE	−0.98	0.17
Schin	Recife	PE	NE	−1.35	−0.34
Diamante Azul	Recife	PE	NE	−0.88	1.19
Ouro da Mina	Fonte São Pedro	PI	NE	−4.12	−25.13
Gurguéia	Corrente	PI	NE	−3.22	−19.58
Ouro Fino	Campo Largo	PR	S	−5.56	−32.85
Sarandi	Barra Funda	RS	S	−5.65	−32.77
Floresta	Barra Funda	RS	S	−4.92	−27.30
Fonte Ijuí	Ijuí	RS	S	−5.54	−33.16
Água da Pedra	Lajeado	RS	S	−4.74	−26.60
Charrua	Porto Alegre	RS	S	−4.36	−23.25
Pedra Azul	Marechal Floriano	ES	SE	−4.71	−25.27
Caxambu	Caxambu	MG	SE	−7.20	−49.70
Puríssima	Dom Aquino	MG	SE	−5.55	−35.94
Natural	Igarapé	MG	SE	−7.75	−52.97
Bonafont	Jacutinga	MG	SE	−6.38	−41.73
Passa 4	Passa Quatro	MG	SE	−5.70	−41.08
Pouso Alto	Pouso Alto	MG	SE	−7.34	−48.71
São Lourenço	São Lourenço	MG	SE	−6.75	−49.14
Schincariol	Cachoeiras de Macacú	RJ	SE	−5.03	−29.39
Cascataí	Cachoeiras de Macacú	RJ	SE	−3.85	−19.96
Fênix	Carmo	RJ	SE	−6.19	−40.29
Donna	Carmo	RJ	SE	−5.27	−33.51
Da Montanha	Magé	RJ	SE	−4.20	−21.41
Hidrovita	Muriaé	RJ	SE	−5.36	−31.92
Petropolis	Petropolis	RJ	SE	−4.96	−28.78
Agua Fresh	Rio de Janeiro	RJ	SE	−4.83	−28.31
Da Vida	Teresópolis	RJ	SE	−6.08	−38.57
Soft	Três Rios	RJ	SE	−5.93	−39.42
Prata gaseous	Águas da Prata	SP	SE	−5.83	−40.99
Prata normal	Águas da Prata	SP	SE	−6.52	−42.87
Pureza Vital	Águas de Santa Bárbara	SP	SE	−7.64	−52.07
Nova Mineral	Atibaia	SP	SE	−6.81	−44.18
Attiva	Bananal	SP	SE	−5.56	−36.38
Crystal	Bauru	SP	SE	−8.36	−57.00
Minalba	Campos do Jordão	SP	SE	−6.62	−46.86
Indaiá	Campos do Jordão	SP	SE	−7.50	−50.10
Schin	Itu	SP	SE	−6.53	−43.74
Schin	Itu	SP	SE	−7.08	−45.20
Bioleve	Lindoia	SP	SE	−7.37	−46.09
Lindoia Original	Lindoia	SP	SE	−7.05	−44.99
Lindoia Verão	Lindoia	SP	SE	−6.90	−44.02
Crystal	Mogi das Cruzes	SP	SE	−6.85	−46.55
Fontagua	Mogi das Cruzes	SP	SE	−6.61	−37.65
Acqua Panna			Italy	−7.74	−45.73
San Pellegrino			Italy	−9.10	−60.60
Perrier			France	−6.30	−39.82
Eden			Chile	−11.54	−83.81
Voss			Norway	−9.69	−65.00
Arrowhead			USA	−9.87	−65.92

on a model L1102-i water analyzer (Picarro, Sunnyvale, CA, USA). Water samples were introduced into the vaporization chamber using an attached PAL auto sampler (Leap Technologies, Carrboro, NC, USA). The equipment operation was described in detail by Brand et al. (2009).

Each sample was analyzed eight times (that means, eight consecutive injections and processing), to avoid memory effects, only the last three injections were considered in each of the calculations. Each sample was analyzed alongside a set of three reference materials, Vienna Standard Mean Ocean Water-2 (VSMOW-2), Greenland Ice Sheet Precipitation (GISP) and Standard Light Antarctic Precipitation-2 (SLAP-2), which were purchased from the International Atomic Energy Agency (Vienna, Austria).

The measurement sequence observed is similar to that suggested by the equipment producer (which is VSMOW-2, GISP, check sample, 6 unknown samples, SLAP-2, check sample, 6 unknown samples, VSMOW-2, GISP, check sample, 6 unknown samples, etc.). The original factory calibration is preserved, and the reference material results are used to build a calibration curve; external sample results are then recorded digitally. One check sample is used to validate each sample sequence and to build a control chart, where the check sample represents a sample that has been analyzed several times. A large volume of this sample is kept sealed in a refrigerator.

The system was tested for memory effects, repeatability, reproducibility and accuracy, and the combined uncertainty was quantified. Bottled mineral water samples, which mainly included Brazilian brands but also included international brands when they were available, were purchased locally.

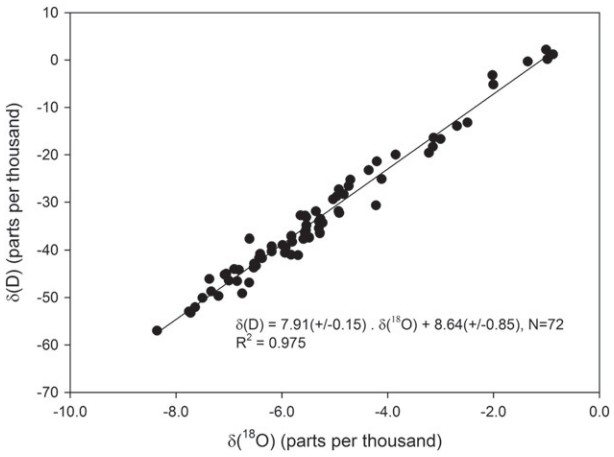

Fig. 4. Brazilian Meteoric Water Line based on the analyzed bottled mineral water samples.

Table 3
Published local meteoric lines for Brazilian cities and the national meteoric line obtained in the present study.

Local	Meteoric Line	Reference
Fortaleza, CE	$\delta(D) = 7.63(\pm 0.60)\ \delta(^{18}O) + 9.17(\pm 0.60)$	IAEA[a]
Salvador, BA	$\delta(D) = 7.81(\pm 0.33)\ \delta(^{18}O) + 10.44(\pm 0.64)$	IAEA[a]
Rio de Janeiro, RJ	$\delta(D) = 7.98(\pm 0.23)\ \delta(^{18}O) + 12.34(\pm 0.98)$	IAEA[a]
Porto Alegre, RS	$\delta(D) = 7.67(\pm 0.19)\ \delta(^{18}O) + 10.59(\pm 0.96)$	IAEA[a]
Brazil, all regions	$\delta(D) = 7.91(\pm 0.15)\ \delta(^{18}O) + 8.64(\pm 0.85)$	Present study

[a] IAEA (2009).

3. Results and discussion

To test for any memory effect when measuring $\delta(D)$ and $\delta(^{18}O)$, the reference materials were measured in the following sequence, SLAP-2, GISP, VSMOW-2, SLAP-2, VSMOW-2, GISP, and SLAP-2, with fifteen repeats of each one. For each measurement, the measured value/true value ratio and the mean value were calculated for each replicated sample. As shown in Fig. 2a, for δ(O-18), after six replicates, this ratio is randomly distributed around one. Additionally, the *z*-test (95%) applied to the mean value of this ratio, involving the injections 6–15, reveals that it is statistically equivalent to one, showing that there is not a need for memory effect correction for the δ(O-18) measurement when applying five injection as a cleaning step. For $\delta(D)$, Fig. 2b, it can be seen that this ratio tends asymptotically to one and, according to the derived equation (Fig. 2b), the correction factor is equivalent to 1.003 for the sixth and 1.002 for the eighth injections. Although each reported value represents a mean value of twelve isotopic measurements, the mean value of three injections (6th, 7th and 8th) was used; consequently, each sample represents eight injections, which takes about 70 minutes.

During 2011, the International Atomic Energy Agency (IAEA) promoted an inter-laboratory comparison exercise with four different samples; these samples were used to determine the accuracy of the method on a broad range of isotopic ratios (Choudhry et al., 2011). The results shown in Table 1 indicate that the obtained values are statically equivalent (at the 95% level) to the mean value obtained by the Isotopic Ratio Mass Spectrometry (IRMS) participant laboratories.

Eight vials were filled with the check sample and measured in sequence, the repeatability was calculated as 1.7% for the $\delta(D)$ and $\delta(^{18}O)$ determinations ($\delta(D) = -28.95‰$ (SD = 0.46‰, $N = 8$); $\delta(^{18}O) = -5.12‰$ (SD = 0.09‰, $N = 8$)). These values are comparable with the typical precision of the $\delta(D)$ and $\delta(^{18}O)$ determinations by IRMS, 1‰ and 0.1‰, respectively (Gat et al., 2000). The check sample results were collected over a four-month period and were used to build control charts for the $\delta(D)$ and $\delta(^{18}O)$ measurements (Fig. 3a and b), ($\delta(^{18}O) = -4.93‰$ (SD = 0.19‰, $N = 108$); $\delta(D) = -28.85‰$ (SD = 0.70‰, $N = 108$) and to determine the method reproducibility, which corresponds to 2.2% and 3.8% for $\delta(D)$ and $\delta(^{18}O)$, respectively. Comparing the calculated standard deviation with those observed in Table 1, it is possible to verify that the repeatability and the reproducibility for the $\delta(D)$ measurements are equal and independent of the magnitude. On the other hand, for $\delta(^{18}O)$, the reproducibility is about twice the repeatability but is independent of the magnitude. In both cases, the data follow a normal distribution (Kolmogorov–Smirnov test), and the number of measurements out of the 95% control lines, five cases for $\delta(^{18}O)$ and three cases for $\delta(D)$, is compatible with the number of data points ($N = 108$).

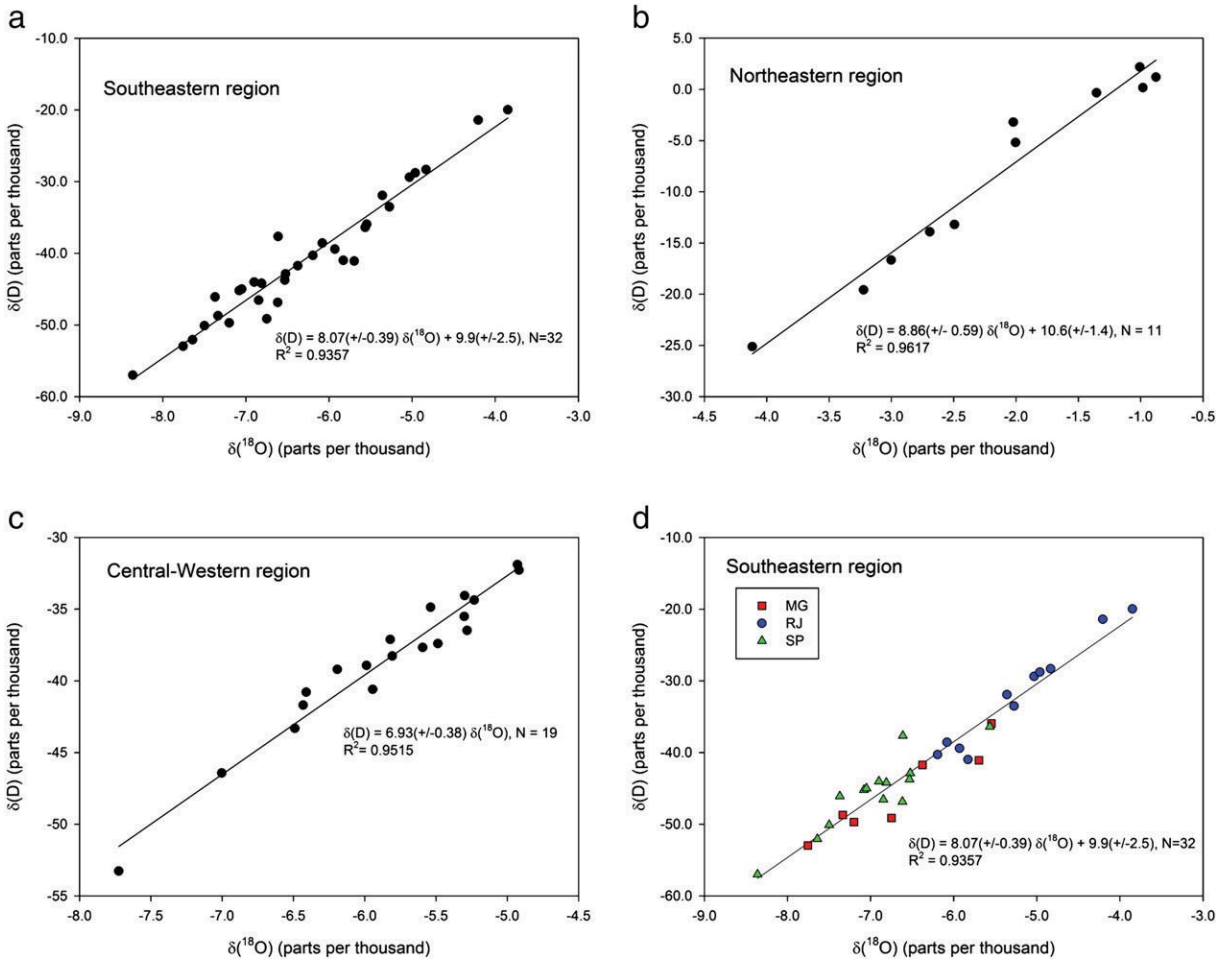

Fig. 5. Regional Meteoric Water Line: (a) Southeastern, (b) Northeastern, (c) Central-Western and (d) Southeastern region, divided up at the state level.

The combined uncertainty has two controlling factors: one related to the reproducibility, which is independent of the delta value (for $\delta(D) = 0.70‰$ and for $\delta(^{18}O) = 0.19‰$)), and the second related to the calibration curve. In our experience, the coefficient of determination of the calibration curve is generally higher than 0.99999, and therefore, the combined uncertainty does not differ significantly from the reproducibility.

The obtained data for the $\delta(D)$ and $\delta(^{18}O)$ isotopes from Brazilian bottled mineral water are presented in Table 2; samples from international brands found in the local market are also shown. The values for the Brazilian mineral waters follow a straight line (Fig. 4), with a slope similar to the values reported by the IAEA for four different Brazilian cities (IAEA, 2009) but with an axis intercept value lower than those values (Table 3). It is also possible to build a meteoric line for those geographical regions that have a large number of samples (CO, NE and SE). For the SE and NE regions, which have a large number of sampling locations close to the coast, the observed meteoric lines (Fig. 5a and b) are similar to the global meteoric line ($\delta(D) = 8\ \delta(^{18}O) + 10$). However, the CO regional meteoric line (Fig. 5c) differs markedly from the global line, perhaps because of the impact of the continental geography.

For the SE region, which is the region with the greatest mineral water consumption, most of the waters sampled in Rio de Janeiro have an isotopic signature that is distinct from those of the neighboring states (SP and MG). In particular, the more expensive brands (such as São Lourenço and Minalba) have a distinctive signature, which allows its use for authenticity testing (Fig. 5d). This type of distinction would also appear to be feasible for brands inside the NE region, where the mineral water from each state has a fairly unique isotopic signature.

Among the analyzed samples, published data for three of the brands were found (Bowen et al., 2005): Pellegrino ($\delta(D) = -63‰$ and $\delta(^{18}O) = -9.7‰$), Perrier ($\delta(D) = -42‰$ and $\delta(^{18}O) = -6.3‰$) and Lindóia ($\delta(D) = -43‰$ and $\delta(^{18}O) = -6.7‰$). These values are consistent with those listed in Table 3.

4. Conclusions

This study demonstrates that it is possible to obtain accurate and precise water isotope ratios directly, without any sample preparation, based on cavity ring-down spectrometry. Applying the method to Brazilian bottled mineral water showed that it is possible to identify the origin of bottled water at the state level, from within Brazilian geographical regions. A Brazilian meteoric water line was determined, which has coefficients similar to the Global Meteoric Water Line (GMWL). However, when smaller geographic regions are considered separately, larger deviations from the GMWL were observed for samples taken from the central Brazilian region.

Acknowledgements

The authors would like to acknowledge the anonymous reviewers which have helped to improve the original manuscript and also the Conselho Nacional de Desenvolvimento Cientifico e Tecnológico (CNPq), through the Instituto Nacional de Transferencia de Massa Continente Oceano (INCT-TMOceano), for the financial support of the present study.

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APPENDIX II

Completed Chain of Custody Forms

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Ship to: Danilino Licudine State Lab Division, Water Pollution Section 2725 Waimano Home Rd. Pearl City, Hawaii 96782		**Sampler Name:** Robert Whittier **Sampler Signature**	**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814
Carrier Hawaiian Air Freight	**Air Bill/Cert. Mail No.**		

Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	Analysis Required: NO2+NO3	NH4	Total Nitrogen	PO4	Total Phosphorus	Dissolved SiO2	comments
Pookela	7/17/17	09:10 a	Well	None	F, lt	X	X	X	X	X	X	
Kaupakulua	7/17/17	10:50a	Well	None	F, lt	X	X	X	X	X	X	
Hamkaupoko-1	7/17/17	09:45	Well	None	F. lt	X	X	X	X	X	X	
~~Hamkaupoko-2~~	~~7/17/17~~	~~10:10~~	~~Well~~	~~None~~	~~F, lt~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~Rm~~
~~Haiku~~	~~7/17/17~~	~~11:25~~	~~Well~~	~~None~~	~~F, lt~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~Rm~~
~~JS-1~~	~~7/17/17~~	~~12:05~~	~~Well~~	~~None~~	~~F, lt~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~Rm~~

Sample Condition Upon Receipt at Laboratory: 0.4°C R Sudi 7-18-17 9:45 am

Special Instructions/Comments:

#1 Released by (Sig.) Robert Whittier	Date 7/17/17	#2 Released by (Sig.) ~~NA~~	Date 7-18-17	Page: of
Organization Name: HDOH, SDWB	time ~~10:30~~ 1705	Organization Name: SDWB	time 10:05 am	
#2 Received by: (Sig.) Sealed	Date 7/17/17	#3 Received by: (Sig.)	Date 7-18-17	
Organization Name: Hawaiian Air Freight	Time	Organization Name: SLD	Time 10:05 am	

Ship to:	Danilino Licudine State Lab Division, Water Pollution Section 2725 Waimano Home Rd. Pearl City, Hawaii 96782	**Sampler Name:** Robert Whittier **Sampler Signature**	**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814
Carrier Hawaiian Air Freight	**Air Bill/Cert. Mail No.**		

Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	Analysis Required: NO2+NO3	NH4	Total Nitrogen	PO4	Total Phosphorus	Dissolved SiO2	comments
~~Pookela~~	~~7/17/17~~	~~09:10~~	~~Well~~	~~None~~	~~Filt~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~RR~~
~~Kaupakulua~~	~~7/17/17~~	~~10:50~~	~~Well~~	~~None~~	~~Filt~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~RBL~~
~~Hamkaupoko-1~~	~~7/17/17~~	~~09:45~~	~~Well~~	~~None~~	~~Filt~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~RR~~
Hamkaupoko-2	7/17/17	10:10	Well	None	Filt	X	X	X	X	X	X	
Haiku	7/17/17	11:25	Well	None	Filt	X	X	X	X	X	X	
JS-1	7/17/17	12:05	Well	None	Filt	X	X	X	X	X	X	

Sample Condition Upon Receipt at Laboratory: 0.6°C R Sno 7-18-17 9:45am

Special Instructions/Comments:

#1 Released by (Sig.) Robert Whittier	Date 7/17/17	#2 Released by (Sig.) ~~NA~~	Date 7-18-17	Page: 1 of 1
Organization Name: HDOH, SDWB	time 1700 ~~10:30~~	Organization Name: SPWB	time 10:05 am	
#2 Received by: (Sig.) Sealed	Date 7/17/17	#3 Received by: (Sig.)	Date 7-18-17	
Organization Name: Hawaiian Air Freight	Time	Organization Name: SLD	Time 10:05 am	

Ship to:	Danilino Licudine State Lab Division, Water Pollution Section 2725 Waimano Home Rd. Pearl City, Hawaii 96782	**Sampler Name:** Robert B Whittier **Sampler Signature**	**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814
Carrier Hawaiian Air Freight	**Air Bill/Cert. Mail No.**		

Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	Analysis Required: NO2+NO3	NH4	Total Nitrogen	PO4	Total Phosphorus	Dissolved SiO2	comments
Maunaolu-1	7/18/17	0834	Well	None	Filt	X	X	X	X	X	X	M17-7-7
Omaopio-Esty	7/18/17	0915	Well	None	Filt	X	X	X	X	X	X	-8
Kuiaha-Smith	7/18/17	0755	Well	None	Filt	X	X	X	X	X	X	-9
Keokea H-Land-2	7/18/17	1021	Well	None	Filt	X	X	X	X	X	X	-10

Sample Condition Upon Receipt at Laboratory:

Special Instructions/Comments: 1.4°C upon receipt

#1 Released by (Sig.) Robert Whittier	Date 7/18/17	#2 Released by (Sig.) NA Darrel Kawahara	Date 7/19/17	Page: of
Organization Name: HDOH, SDWB	time 1645 ~~10:30~~	Organization Name: SDWB	time 10:40AM	
#2 Received by: (Sig.)	Date 7/18/17	#3 Received by: (Sig.) Daniel Lange	Date 7/19/17	
Organization Name: Hawaiian Air Freight	Time 1645	Organization Name: SLD	Time 10:40am	

Ship to: Danilino Licudine State Lab Division, Water Pollution Section 2725 Waimano Home Rd. Pearl City, Hawaii 96782					**Sampler Name:** Robert B Whittier **Sampler Signature**							**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814	
Carrier Hawaiian Airlines ~~Hawaiian Air Freight~~		**Air Bill/Cert. Mail No.**				Analysis Required							comments
Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	NO2+NO3	NH4	Total Nitrogen	PO4	Total Phosphorus	Dissolved SiO2		
Pukalani-GC	7/19/17	0805	Well	None	F. lt	X	X	X	X	X	X		
BRE-1	7/19/17	1040	Grab	None	F. lt	X	X	X	X	X	X		
~~Waiohuli~~						~~X~~	~~X~~	~~X~~	~~X~~	~~X~~	~~X~~		CW
FJ-2	7/19/17	1205	Well	None	F. lt	X	X	X	X	X	X		
Sample Condition Upon Receipt at Laboratory:													
Special Instructions/Comments: Received by													
#1 Released by (Sig.) Robert B Whittier		Date 7/20/17			#2 ~~Released by~~ (Sig.) Robert Whittier NA							Date 7/20/17	Page: of
Organization Name: HDOH, SDWB		time 10:40 ~~10:30~~			Organization Name: DOH-SDWB							time 1255	
#2 Received by: (Sig.) Hawaiian Airlines as Luggage		Date 7/20/17			#3 Received by: (Sig.)							Date 7/20/17	
Organization Name: Hawaiian Air Lines		Time 10:40			Organization Name: SLD							Time 1255	

Ship to:	Natalie WalWallsgrove Biogeochemical Stable Isotope Facility 1680 East-West Rd., POST 726 Honolulu, Hi 96822				**Sampler Name:** Robert B. Whittie **Sampler Signature**							**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814	
Carrier Hawaiian Airline ~~Hawaiian Air Freight~~		**Air Bill/Cert. Mail No.**				Analysis Required						comments	
	Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	d15N of NO3	d18O of NO3	d2H of H2O	d18O of H2O			N species Conc (mg/L) NO_2	NO_3
X ✓	Pookela	7/17/17	09:07	Well	None	Filt	X	X	X	X			0.004	0.7
X ✓	Kaupakulua	7/17/17	10:52	Well	None	Filt	X	X	X	X			0.002	1.4
X ✓	Hamkaupoko-1	7/17/17	09:45	Well	None	Filt	X	X	X	X			0.013	3.2
X ✓	Hamkaupoko-2	7/17/17	10:10	Well	None	Filt	X	X	X	X			0.006	3.9
X ✓	Haiku	7/17/17	11:25	Well	None	Filt	X	X	X	X			0.003	1.6
X ✓	JS-1	7/17/17	12:05	Well	None	Filt	X	X	X	X			0.006	2.3
X ✓	Maunaolu-1	7/18/17	~~7:55~~ 09:14	Well	None	Filt	X	X	X	X				
X ✓	Omaopio-Esty	7/18/17	09:15	Well	None	Filt	X	X	X	X				
X ✓	Kuiaha-Smith	7/18/17	7:55	Well	None	Filt	X	X	X	X			gas	1.2
X ✓	Keokea H-Land-2	7/18/17	10:21	Well	None	Filt	X	X	X	X			0.001	0.9

Sample Condition Upon Receipt at Laboratory:

Special Instructions/Comments: d15N/d18O Samples frozer

#1 Released by (Sig.) Robert B. Whittie	Date 7/20/17	#2 ~~Released by~~ Received by (Sig.) R. Whittier ~~NA~~	Date 7/20/17
Organization Name: HDOH, SDWB	time 10:46 ~~10:30~~	Organization Name: ~~HDOH - SDWB~~	time 12:55
#2 Received by: (Sig.) Hawaiian Airlines as Luggage	Date 7/20/17	#3 Received by: (Sig.) Natalie Walsgrove	Date 7/20/17
Organization Name: Hawaiian Air Lines	Time 10:46	Organization Name: Kotopa Biogeochemistry Lab SOEST	Time 14:53

Page: of

Ship to: Natalie WalWallsgrove Biogeochemical Stable Isotope Facility 1680 East-West Rd., POST 726 Honolulu, Hi 96822		**Sampler Name:** Robert B. Whittier **Sampler Signature**	**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814
Carrier Hawaiian Air Lines ~~Hawaiian Air Freight~~	**Air Bill/Cert. Mail No.**		

						Analysis Required						comments
Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	d15N of NO3	d18O of NO3	d2H of H2O	d18O of H2O			
Pukalani-GC	7/19/17	08:05	Well	None	Filt	X	X	X	X			
BRE-1	7/19/17	10:40	Well	None	Filt	X	X	X	X			
~~Waiohuli~~						~~X~~	~~X~~	~~X~~	~~X~~		~~Can~~	
FJ-2	7/19/17	12:05	Well	None	Filt	X	X	X	X			

Sample Condition Upon Receipt at Laboratory:

Special Instructions/Comments: D15N/D18O Samples Frozen Received bp

#1 Released by (Sig.) Robert Whittier	Date 7/20/17	#2 ~~Released by~~ (Sig.) R. Whittier ~~NA~~	Date 7/20/17	Page: of
Organization Name: HDOH, SDWB	time 10:40 ~~10:30~~	Organization Name: HDOH-SDWB	time 1255	
#2 Received by: (Sig.) Hawaiian Air-lines air Luggag-	Date 7/20/17	#3 Received by: (Sig.) Natalie Walsgrove	Date 7/20/17	
Organization Name: Hawaiian Air Lines	Time 10:40	Organization Name: Isotope Biogeochemistry Lab SOEST	Time 14:53	

Ship to: Catherine Rong WRRC Water Quality Laboratory 2540 Dole St., Holmes Hall 283 Honolulu, Hi 96822		**Sampler Name:** Robert B. Whittier **Sampler Signature**	**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814
Carrier Hawaiian Airlines ~~Hawaiian Air Freight~~	**Air Bill/Cert. Mail No.**		

Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	Analysis Required: Anion Chomotragraphy	Canion Chomotragraphy					comments
Pookela	7/17/17	9:10	Well	None	F, I+	X	X					
Kaupakulua	7/17/17	10:52	Well	None	F, I+	X	X					
Hamkaupoko-1	7/17/17	9:45	Well	None	F, I+	X	X					
Hamkaupoko-2	7/17/17	10:10	Well	None	F, I+	X	X					
Haiku	7/17/17	11:25	Well	None	F, I+	X	X					
JS-1	7/17/17	12:05	Well	None	F, I+	X	X					
Maunaolu-1	7/18/17	8:34	Well	None	F, I+	X	X					
Omaopio-Esty	7/18/17	9:08	Well	None	F, I+	X	X					
Kuiaha-Smith	7/18/17	7:50	Well	None	F, I+	X	X					
Keokea H-Land-2	7/18/17	10:15	Well	None	F, I+	X	X					

Sample Condition Upon Receipt at Laboratory:

Special Instructions/Comments: Received

#1 Released by (Sig.) Robert Whittier	Date 7/20/17	#2 ~~Released~~ by (Sig.) Robert Whittier ~~NA~~	Date 7/20/17	Page: 1 of 1
Organization Name: HDOH, SDWB	time 10:40 ~~10:30~~	Organization Name: HDOH - SDWB	time 1255	
#2 Received by: (Sig.) Hawaiian Airlines as Luggage	Date 7/20/17	#3 Received by: (Sig.)	Date 7/20/2017	
Organization Name: Hawaiian Air	Time 10:40	Organization Name: WRRC	Time 2:45 pm	

Ship to: Catherine Rong WRRC Water Quality Laboratory 2540 Dole St., Holmes Hall 283 Honolulu, Hi 96822	**Sampler Name:** Robert B Whittier **Sampler Signature**	**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 919 Ala Moana Blvd Rm 308 Honolulu, Hawaii, 96814
Carrier Hawaiian Airlines ~~Hawaiian Air Freight~~ ~	**Air Bill/Cert. Mail No.**	

Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	Analysis Required: Anion Chomotragraphy	Canion Chomotragraphy					comments
Pukalani-GC	7/19/17	8:05	Well	None	F, lt	X	X					
BRE-1	7/19/17	10.40	Grab	None	F, lt	X	X					
~~Wajohuli~~						~~X~~	~~X~~	RA				
FJ-2	7/19/17	12:05	Well	None	F, lt	X	X					

Sample Condition Upon Receipt at Laboratory:

Special Instructions/Comments:

Received

#1 Released by (Sig.) Robert Whittier	Date 7/20/17	#2 ~~Released~~ by (Sig.) Robert Whittier ~~NA~~	Date 7/20/17	Page: 1 of 1
Organization Name: HDOH, SDWB	time 10:40 ~~10:30~~	Organization Name: ~HDOH. SDWB	time 12:55	
#2 Received by: (Sig.) Hawaiian Airlines as Luggage	Date 7/20/17	#3 Received by: (Sig.)	Date 7/20/2017	
Organization Name: Hawaiian Airlines	Time 10.40	Organization Name: WRRC	Time 2:45 pm	

Ship to: Danilino Licudine State Lab Division, Water Pollution Section 2725 Waimano Home Rd. Pearl City, Hawaii 96782		**Sampler Name:** Robert B. Whittier **Sampler Signature**	**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 2385 Waimano Home Rd. Uluakupu Bldg. #4 Pearl City, Hawaii 96782
Carrier Hawaiian Air as Luggage	**Air Bill/Cert. Mail No.**		

						Analysis Required						comments
Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	NO2+NO3	NH4	Total Nitrogen	PO4	Total Phosphorus	Dissolved SiO2	
Waiohuli	8/9/2019		Grab	None	Filt	X	X	X	X	X	X	

Sample Condition Upon Receipt at Laboratory:

Special Instructions/Comments:

#1 Released by (Sig.) Robert B Whittier	Date 8/9/17	#3 Received by (Sig.) R. Whittier	Date 8/9/17	Page: of
Organization Name: HDOH, SDWB	time 14:30	Organization Name: HDOH. SDWB	time 1645	**Other Comments**
#2 Received by: (Sig.) Hawaiian Air	Date 8/9/17	#3 Released by: (Sig.)	Date 8/10/17 ~~8/9/17~~	
Organization Name:	Time 1436	Organization Name: HDOH-SDWB	Time 1025	
#2Released by (Sig.) Hawaiian Air	Date 8/9/17	#4 Received by (Sig.) Danilo Licudine	Date 8/10/17	
Organization Name:	time 1645	Organization Name: DOH - EHASB	time 1025	

Ship to: Natalie WalWallsgrove Biogeochemical Stable Isotope Facility 1680 East-West Rd., POST 726 Honolulu, Hi 96822		**Sampler Name:** Robert B. Whittier **Sampler Signature**	**Send Results to:** Mr. Robert Whittier Hawaii Dept. of Health, SDWB 2385 Waimano Home Rd. Uluakupu Bldg. #4 Pearl City, Hawaii 96782
Carrier Hawaiian Air as Luggage	**Air Bill/Cert. Mail No.**		

						Analysis Required						comments
Field Sample ID	Sample Date	Sample Time	Type (composite or Grab)	Presvtn.	Filt - Unfilt	d15N of NO3	d18O of NO3	d2H of H2O	d18O of H2O			
Waiohuli	8/9/2019		Grab	None	Filt	X	X	X	X			

Sample Condition Upon Receipt at Laboratory:

Special Instructions/Comments:

#1 Released by (Sig.) Robert B. Whittier	Date 8/9/17	#3 Received by (Sig.) R. Whittier	Date 8/9/17	Page: of
Organization Name: HDOH, SDWB	time 14:30	Organization Name: HDOH-SDWB	time 1645	**Other Comments**
#2 Received by: (Sig.) Hawaiian Air	Date 8/9/17	#3 Released by: (Sig.) R. Whittier	Date 8/10/17	Field NO_2 0.005mg/L Field NO_3 3.3mg/L
Organization Name:	Time 14:30	Organization Name: HDOH-SDWB	Time 11:35	
#2Released by (Sig.) Hawaiian Air	Date 8/9/17	#4 Received by (Sig.)	Date 8/10/17	
Organization Name:	time 1645	Organization Name: University of Hawaii	time 11:35	

APPENDIX III

Determination of Total Nitrogen (as Nitrate + Nitrite)

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Determination of Total Nitrogen (as Nitrate + Nitrite) Modified SM 4500-N C, Alkaline Persulfate with Ultraviolet (UV) Digestion

1.0 Summary, Scope and Application

1.1 The purpose of this method is to provide a procedure for determining total nitrogen (as NO_3^- + NO_2^- nitrogen) concentration in brackish, ocean, and surface waters as well as industrial and domestic aqueous wastes.

1.2 The alkaline persulfate digestion procedure oxidizes all forms of inorganic and organic nitrogen to nitrate (NO_3^-). Nitrate is then quantitatively reduced to nitrite (NO_2^-) by passing the digested ample through a cadmium reduction column. The nitrite is then determined by diazotizing with sulfanilamide followed by coupling with N-(1-naphthyl) ethylenediamine hydrochloride. The resulting water-soluble dye has a magenta color that is read at 540 nm.

1.3 The applicable range is 25-2000 µg N/L. Measurements are made using a nutrient auto analyzer (Seal Analytical AA3) at 520 nm using a 10-mm flow cell. Concentrations below 25 µg N/L are reported as below the minimum reporting level (<MRL) of the method. Regardless of sample salinity, fresh, brackish, and oceanwater samples are analyzed together and quantitated using digested calibration standards prepared in deionized water.

2.0 References

2.1 "Standard Methods for the Examination of Water and Wastewater", American Public Health Association, American Water Works Association, Water Environment Federation, 21st edition, 2005, 4500-NO3 F. Automated Cadmium Reduction Method.

2.2 Seal Analytical AutoAnalyzer Applications. Nitrate and Nitrite in Water and Seawater, Total Nitrogen in Persulfate Digests, Method No. G-172-96 Rev. 12 (Multitest 19). July 2009.

2.3 EPA 353.2 Determination of Nitrate-Nitrite Nitrogen by Automated Colorimetry. Revision 2.0. August 1993. Environmental Monitoring Systems Laboratory. Office of Research and Development. US EPA. Cincinnati, Ohio 45268.

2.4 Ace Glass Inc. General Operating Instructions for Ace Photochemical U.V. Power Supplies and Mercury Vapor Lamps.

3.0 Definitions

3.1 Laboratory Reagent Blank (LRB) – An aliquot of reagent water that is treated exactly like a sample including exposure to all glassware, equipment, and reagents that are used with the other samples. It is used to determine whether method analytes or other interferences are present in the laboratory environment, glassware, reagents or equipment.

3.2 Calibration Blank (Cal Blank) – A volume of reagent water without the analytes.

3.3 Calibration Standard (CAL) – A solution prepared from the stock standard solution (SSS). The CAL solutions are used to calibrate the instrument with respect to analyte concentration.

3.4 Initial/Continuing Calibration Verification (ICV/CCV) – A solution of a known concentration of the analyte used to evaluate the performance of the instrument with respect to a defined set of criteria.

3.5 Laboratory Fortified Blank (LFB) – An aliquot of reagent water to which a known concentration of the analyte is added in the laboratory. It is analyzed exactly like a sample, and is used to determine whether the methodology is in control, and whether the laboratory can make accurate and precise measurements.

3.6 Linear Calibration Range (LCR) – The concentration range over which the instrument response is linear.

3.7 Matrix Spike (MS) – An aliquot of a sample to which known concentration of the analyte is added in the laboratory. It is analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results.

3.8 Quality Control Sample (QCS) – A solution of method analyte of known concentration that is used to fortify the LRB. The QCS is obtained from a source external to the laboratory and different from the source of the calibration standards. It is used to check laboratory performance with externally prepared materials.

3.9 Stock Standard Solution (SSS) – A concentrated solution (1000 mg N/L) of the method analyte purchased commercially.

4.0 Sampling and Storage

4.1 High-density polyethylene bottles are used for sample collection and storage. Samples for total nitrogen analysis are not pre-filtered.

4.2 Samples are frozen at ≤ -20°C for up to 31 days.

4.3 Prior to digestion or analysis, samples should be brought to room temperature.

5.0 Interferences

5.1 Solvents, reagents, glassware, and other sample-processing hardware may yield artifacts that affect results. All materials used in the analysis shall be demonstrated to be free from interferences by running laboratory blanks

6.0 Safety

Procedures shall be carried out in a manner that protects the health and safety of all DOH personnel. The following requirements must be met:

6.1 Good laboratory practices should be observed always when preparing reagents and while working in the laboratory. A laboratory coat, safety goggles, and appropriate gloves should be worn always especially when preparing acid solutions.

6.2 The health and safety hazards of many of the chemicals used in this procedure have not been fully defined. Additional health and safety information can be obtained from the MSDS files maintained in the laboratory.

6.3 Exposure to chemicals will be maintained as low as reasonably achievable.

7.0 Apparatus

7.1 Seal Analytical Auto Analyzer (AAIII) consisting of the following components:

7.1.1 Compact auto sampler.
7.1.2 Peristaltic pump
7.1.3 Analytical Cartridge.
7.1.4 Voltage Stabilizer.
7.1.5 Colorimeter (10mm x 1.5mm flow cell/ 520 nm filters).
7.1.6 AACE Software version 5.44G or higher
7.1.7 Data handler system

7.2 Ultra-violet (UV) light oxidation unit- Ace-Hanovia photochemical lamp (1200 W) and power supply (230 V, 60Hz) operational with spring-wound internal timer (Intermatic).

8.0 Reagents

8.1 Color Reagent

Sulfanilamide	9.1 g
Phosphoric Acid	185 mL
NEDD	0.71 g
DI H_2O	1000 mL
Brij-35, 30% solution (wetting agent)	3.0 mL

While stirring, add 185 mL of concentrated phosphoric acid and 9.1 g of sulfanilamide to 700 mL of DI water. Add 0.71 g of NEDD reagent and stir until dissolved. Dilute to 1L with DI water. Add approximately 3.0 mL of Brij-35 wetting agent. Store in amber container inside the refrigerator. Reagent is stable for a month.

8.2 Ammonium Chloride Reagent

Ammonium chloride	97.0 g
50% NaOH (w/w)	for pH adjustment
Disodium EDTA	0.23 g
Stock copper sulfate, 0.01M	2.0 mL
DI water	1000 mL
Brij-35 solution	3.0 mL

Dissolve 97.0 g of ammonium chloride and 0.23 g of EDTA in about 900 mL of DI water. Add 2.0 mL of the stock copper sulfate solution and mix. Dilute to 1L with DI water. Adjust the pH of the solution to 8.5 by adding drops of 50% NaOH. Add approximately 3.0 mL of Brij-35 solution. This reagent has to be prepared weekly.

8.3 2N HCl (to be prepared as needed)

Concentrated HCl	165 mL
DI water	1000 mL
Brij-35 solution	3.0 mL

Do this under the hood. While stirring, slowly add 165 mL of concentrated HCl to approximately 600 mL of DI water. Add 3.0 mL of Brij-35 and mix thoroughly. The solution remains stable as long as it remains clear.

8.4 Stock Copper Sulfate Solution "A" 0.01 M.

Cupric sulfate	2.5 g
DI water	1000 mL

Dissolve 2.5 g of cupric sulfate in 600 mL of DI water and dilute to a final volume of 1000 mL and mix thoroughly.

8.5 Nitrate-Nitrogen and Nitrite-Nitrogen Standard (1000 µg N/L) from HACH, ERA, Fisher Scientific or Environmental Express.

8.6 Copper Activating Solution

Stock Copper Sulfate "A" 0.01M	50 mL
DI water	100 mL
Brij-35	0.30 mL

Dilute 50 mL of stock copper sulfate solution to 100 mL with DI water. Add 0.30 mL of Brij-35 and mix thoroughly.

8.7 QC standard: Second source quality control standard purchased from Environmental Associates (ERA), RICCA, Fisher Scientific or SPEX CertiPrep, Inc. Since the concentration of purchased QC standard varies depending on the lot number, the QC standard is diluted appropriately to approximate the concentration of the middle calibration standard solution.

8.8 Potassium Persulfate Digestion Reagent

Dissolve 25.0 g low nitrogen (<0.001% N) recrystallized potassium persulfate, 7.5 g NaOH, and 15 g boric acid in DI water and dilute to 500 mL just before use. Prepare a fresh batch of digestion reagent every time.

9.0 Procedure

9.1 Ultra-violet (UV) Digestion

9.1.1 Measure 50 mL of calibration standards, blank, quality control standards, or samples and transfer to a quartz digestion tube.

9.1.2 Add 5 mL of potassium persulfate digestion solution to each tube. Cap and mix the contents of the tube by inverting three times.

9.1.3 Irradiate tube and its contents for 6 hours.

9.1.4 Quality control (QC) samples are included in each digestion batch to check for UV-digestion efficiency.

9.2 Analysis by AA3

9.2.1 Calibration standards are prepared as follows:

Standard Name	Concentration (mg N/L) of calibration standard	mL of Intermediate Standard (10.0 mg N/L) diluted to 50.0 mL
Calibration Blank	0.000	0.00
Standard 1	0.025	0.125
Standard 2	0.050	0.25
Standard 3	0.100	1.0
Standard 4	0.250	1.25
Standard 5	0.500	2.5
Standard 7	1.00 (2.00)	5.0 (10.0)

9.2.2 A standard calibration curve is performed for every sample run.

9.2.3 For the calibration curve to be acceptable the correlation coefficient (r) should be 0.995 or higher. After the last calibration standard is run, the calibration curve and its corresponding correlation coefficient value is shown on the monitor screen. If the calibration is acceptable, mid-level instrument calibration verification (ICV) standard is run. Otherwise, the run is aborted and a new set of calibration standards is run. Proceed with running samples, sample duplicates, matrix spikes, and quality control samples. Before the end of the run a continuing calibration verification (CCV) standard is analyzed.

9.2.4 A typical run sequence is as follows:

Baseline, Primer, Drift, High Standard, Low Standard, Low Standard, Calibration Standards, Baseline, Calibration Blank (Cal. Blank), Laboratory Reagent Blank (LRB), Laboratory Fortified Blank (LFB), ICV, QC Check Sample, Samples, Sample Duplicate, Sample Matrix Spike, Calibration Blank, CCV, Drift, Final Baseline.

10.0 Analysis/ Operation

10.1 Calibration and Maintenance

Refer to Seal Analytical AACE Software Operation Manual, Software version 5.46 or higher.

10.2 Checking the Baseline before a RUN

10.2.1 Switch on all Analyzer modules and pump deionized water plus wetting agent (Brij 35 solution) through all reagent lines.

N.B. Compact sampler wash solution does not contain wetting agent.

10.2.2 Check bubble pattern in all lines, especially flow cell waste line. Bubbles must be of the same size, shape, and distance apart. Desirable bubble shape in all plastic tubing must be round at the front and back. Irregular and misshapen bubbles could be due to insufficient wetting agent, contaminated or incorrect type of tubing.

10.2.3 Click on AACE software icon. Click Charting in the System window on the AACE desktop. Check the colorimeter Base, Gain, and Lamp settings. Make sure you are using the correct Analysis , which would show on the lower left corner of the Channel control block.

10.2.4 Check the baseline. It should be stable and almost flat. The software has a default value of 5% for baseline monitoring. If you observe noise, spikes or baseline drift, refer to the analyzer operation manual for possible causes and remedial action.

10.2.5 After obtaining a stable baseline with deionized water, replace reagent lines with reagents. Check bubble pattern with reagents going through all the lines. Check to make sure that the bubble pattern is still OK with reagents going through the system. When the reagents have reached the flow cell and the chart reading increases, check the baseline. It should still be stable and almost flat.

10.3 Adjusting Baseline and Sensitivity

10.3.1 Make sure the system is pumping reagents, the baseline is stable and Charting windows are displayed on the screen.

10.3.2 Aspirate your highest calibration standard for 1 minute. Wait until the standard reaches the flow cell.

10.3.3 To adjust the GAIN value, click the right mouse button in the chart and Set Gain from the local menu. This will adjust the reading to the Chart % entered in the Configure – Software (normally 95% for default value).

10.3.4 Return sample probe to the wash cup by clicking on Wash and then Cancel.

10.4 Starting a Run

10.4.1 With the system pumping reagents, observe the bubble pattern and make any other final checks, which might be necessary before starting the run.

10.4.2 When the analyzer is ready, select “Run” from the Main Menu. If the run name generator was used, the run name has been created automatically. Otherwise enter a run name. Settings for the run name generator can be changed in Run Settings in the *Configure-Software.*

10.5 Run in Progress

10.5.1 After a run is started a run chart will appear for each selected channel.

10.5.2 A run will stop automatically when all calibration standards and samples have been analyzed and the final baseline has been taken and a message saying that the run was completed will appear.

10.6 Stopping a Run

10.6.1 A whole run can also be stopped at any time before it has finished. Click Run in the Main Menu, then point to Stop and click the system you want to stop.

10.7 Retrieving the Results of a Run

11.7.1 To view the analysis results after a run is completed; select Retrieve – Report in the Main Menu. The run results can be displayed and printed after the end of a run.

11.0 Quality Control

11.1 Acceptance Criteria/ Method Validation

11.1.1 The following protocol must be followed for data to be acceptable.

QC Sample	Frequency	Criteria	Corrective Action
Initial calibration verification (ICV)	Immediately after calibration	90 - 110%	ICV/CCV can be re-run only once. Recalibrate and reanalyze all samples since last acceptable ICV/CCV.
Continuing calibration verification (CCV)	Every after 10 samples and before the end of a sample run	80 - 120%	
Laboratory reagent blank (LRB)	1 per sample run	< 0.025 mg N/L (less than the Minimum Reporting Limit)	Rerun LRB only once. If rerun fails, re-analyze all samples associated with unacceptable LRB.
Calibration Blank (Cal Blank)	1 for every ten samples	< 0.025 mg N/L	Rerun Cal Blank once. If rerun fails, re-analyze all samples associated with unacceptable LRB.
Laboratory Fortified Blank (LFB)	1 per sample run	90-110%	Rerun LFB only once. If rerun fails, re-analyze all samples associated with unacceptable LFB.
Quality control sample (QCS)	One per sample run	80% - 120%	Re-run QCS and if still fails, re-analyze all samples associated with unacceptable QCS
Matrix spike (MS)	One for every 10 samples	70% - 130%	If recovery is out of range but LRB, LFB, ICV/CCV and QCS are within range, flag result as possible sample matrix interference.

11.2 Initial Demonstration of Performance

11.2.1 The initial demonstration of performance is used to characterize instrument performance (determination of LCR and analysis of QCS) and laboratory performance (determination of MDL).

11.2.2 Linear Calibration Range (LCR) - An LCR study shall be done on an annual basis (usually at the beginning of the year) or whenever a significant change in instrument response is expected (e.g. replacing photometer, filter, or flow cell) or new instrument operator. The initial demonstration of linearity must use sufficient standards to ensure that the resulting curve is linear. The verification of linearity must use a minimum of a blank, and three standards (to include lowest and highest standards used in the actual analysis). If any data exceeds the initial values by ±10%, linearity must be re-established.

11.2.3 Quality Control Sample (QCS) – On an annual basis (at the beginning of the year), verify the calibration standards and acceptable instrument performance with the analysis of a QCS (preferably with a concentration at the mid-range of the calibration standards). The actual concentration should fall within ±20% of the expected value, and if not, the source of the problem must be identified and corrected.

11.2.4 Minimum Detection Limit (MDL) - An MDL study for total nitrogen shall be established on an annual basis or after any major instrument maintenance or modification. To prepare the MDL samples, use reagent water (blank) fortified at a concentration approximately 2-3 times the instrument detection limit. Take seven replicates of the fortified reagent water and analyze them through the entire analytical method. The MDL is calculated from the standard deviation and student's t-value as described in the Code of Federal Regulations CFR 40, Appendix B to part 136, DEFINITION AND PROCEDURE FOR THE DETERMINATION OF METHOD DETECTION LIMIT. Seven replicates are used with a 95% confidence limit.

The MDL is calculated as follows:

$$MDL = (t)\ (SD)$$

Where, SD = standard deviation of the replicate analyses

t= student's t value for n-1 degrees of freedom at the 99 % confidence limit; t = 3.143 for six degrees of freedom.

12.0 Calculations

12.1 The AACE software calculates standard calibration curve by plotting peak heights (expressed as digits) of processed standards against known standard concentrations.

12.2 The software will automatically compute concentration values for the samples.

12.3 The software allows for re-adjustment of the peak marker if the peak is incorrectly marked. If peak markers were re-adjusted or a calibration standard is deleted (nulled), a copy of the original run should be printed and included with the data package for that run. A rationale should be written to explain why peak markers were manually adjusted or why a calibration standard has been deleted.

13.0 Records Management/ Documentation

13.1 Analysis results are printed out and results are also automatically saved in the equipment computer's hard drive.

13.2 Records associated with a sample run are stored as follows:

13.2.1 Raw Data – Printout of results are stored in the WP section supervisor's office.

13.2.2 Completed summary of analytical results are sent to the different programs requesting for the analysis and copies are also filed in the Water Pollution Section supervisor's office.

13.2.3 Both electronic and hard copies of lab results are sent to the programs that requested for the analysis.

13.2.4 Hard copies of lab results summary kept in the lab are disposed of after 6 years of storage.

APPENDIX IV

Analytical Results of the Upcountry Maui Nitrate Investigation Sampling

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Table IV-1. Water Quality Analysis Results

WELL_NAME	WELL_NO	DATE	TIME	Temperature (oC)	Dissolved Oxygen percent saturation	Dissolved Oxygen mg/L	Specific Conductivity ms/cm	pH	Oxidation Reduction Potential millivolts	Field Nitrite mg/L as N	Field Nitrate mg/L as N
Baldwin Ranch Estates 1	6-5220-002	7/19/2017	10:10	-9999	-9999	-9999	428	7.77	124	0.056	5.3
Haiku Well	6-5419-001	7/17/2017	11:25	20.3	101	9.2	389	7.9	124	0.003	1.6
Hamakaupoko Well 1	6-5420-002	7/17/2017	9:45	21.1	101	9	291	7.65	110	0.013	3.2
Hamakaupoko Well 2	6-5320-001	7/17/2017	10:10	20.8	102	9.2	335	7.93	132	0.006	3.9
Kaupakulua Well	6-5317-001	7/17/2017	10:50	20.2	101	9.1	156	7.64	125	0.002	1.4
Maui Highlands Wells 2	6-4425-001	7/18/2017	10:15	19.1	-9999	-9999	1186	8.07	58	0.001	0.9
West Kuiaha Meadows Well	6-5418-002	7/18/2017	7:50	19.4	100	9.2	210	7.45	162	0.005	1.2
Maunaolu-Smith Well	6-5320-002	7/18/2017	8:28	21.8	94	8.3	367	7.82	134	0.022	4.3
Omaopio-Esty	6-4821-001	7/18/2017	9:08	21.6	97	8.5	1000	7.73	143	0.015	5.1
Pookela Well	6-5118-002	7/17/2017	8:57	19.1	100	9.5	89	7.9	105	0.004	0.7
Pukalani Golf Course	6-5021-001	7/19/2017	8:05	21	97	8.5	1458	7.14	184	0.022	5.8
Waiohuli Obs Well	6-4422-001	8/9/2017	10:00	-9999	32.5	2.7	435	8.62	74.3	0.005	3.3

Table IV-2. Nutrient Analysis Results

Well Name	Well Number	Date	Time	Nitrite mg/L as N	Ammonium mg/L as N	Nitrate Plus Nitrite mg/L as N	Total Nitrogen mg/L as N	Ortho-phosphate mg/L as P	Total Phosphorus mg/L as P	Silica mg/L as SiO_2
Baldwin Ranch Estates 1	6-5220-002	7/19/2017	10:10	0.004	0.145	3.99	9.05	0.177	0.168	36.4
Haiku Well	6-5419-001	7/17/2017	11:25	0.001	0.002	1.91	4.73	0.074	0.061	50.4
Hamakaupoko Well 1	6-5420-002	7/17/2017	9:45	0.001	0.003	2.38	5.39	0.089	0.074	50.5
Hamakaupoko Well 2	6-5320-001	7/17/2017	10:10	0.001	0.002	4.14	7.89	0.094	0.077	52.4
Kaupakulua Well	6-5317-001	7/17/2017	10:50	0.001	0.003	0.694	0.84	0.081	0.061	52.8
Maui Highlands Wells 2	6-4425-001	7/18/2017	10:15	0.001	0.002	0.896	1.18	0.051	0.035	34.5
West Kuiaha Meadows Well	6-5418-002	7/18/2017	7:50	0.001	0.002	0.67	0.744	0.068	0.053	43.1
Maunaolu-Smith Well	6-5320-002	7/18/2017	8:28	0.001	0.003	5.26	8.54	0.083	0.066	50.2
Omaopio-Esty	6-4821-001	7/18/2017	9:08	0.001	0.002	5.03	10.9	0.041	0.018	44.7
Pookela Well	6-5118-002	7/17/2017	8:57	0.002	0.003	0.412	0.87	0.057	0.041	38.9
Pukalani Golf Course	6-5021-001	7/19/2017	8:05	0.003	0.005	5.78	12.9	0.05	0.025	52.8
Waiohuli Obs Well	6-4422-001	8/9/2017	10:00	0.001	0.014	2.5	27	0.01	0.01	12.6
Haiku Well (duplicate)	*6-5419-001*	*7/17/2017*	*12:05*	*0.001*	*0.002*	*1.91*	*3.73*	*0.076*	*0.060*	*50.1*
Pukalani Golf Course (duplicate)	*6-5021-001*	*7/19/2017*	*12:05*	*0.003*	*0.002*	*6.10*	*13.70*	*0.050*	*0.025*	*52.8*
Haiku Well	Relative Percent Difference			*0%*	*0%*	*0%*	*6%*	*1%*	*0%*	*0%*
Pukalani Golf Course				*0%*	*21%*[1]	*1%*	*2%*	*0%*	*0%*	*0%*

1 The relative percent difference for Ammonium duplicate sample for the Pukalani Golf Couse Well was out side of the acceptable range of +/10%. However, both results were near limit of detection of 0.001 mg/L and the absolute difference was 0.003 mg/L.

Table IV-3. Nitrate, Total Nitrogen, and Stable Isotope Results

										Standard Deviation	
Well Name	Well Number	Date	Time	Nitrate Plus Nitrite	Total Nitrogen	$\delta^{15}N$ of Nitrate	$\delta^{18}O$ of Nitrate	$\delta^{18}O$ of Water	$\delta^{2}H$ of Water	**$\delta^{18}O$**	**$\delta^{2}H$**
				mg/L as N	mg/L as N	‰	‰	‰	‰	‰	‰
Baldwin Ranch Estates 1	6-5220-002	7/19/17	10:10	3.99	9.05	4.1	4.5	-4.4	-21.9	0.02	0.10
Haiku Well	6-5419-001	7/17/17	11:25	1.91	4.73	4	5.5	-4.1	-17.6	0.04	0.09
Hamakaupoko Well 1	6-5420-002	7/17/17	9:45	2.38	5.39	3.4	5.2	-3.7	-14.5	0.02	0.00
Hamakaupoko Well 2	6-5320-001	7/17/17	10:10	4.14	7.89	3.3	4.8	-3.8	-15.6	0.01	0.07
Kaupakulua Well	6-5317-001	7/17/17	10:50	0.694	0.84	4.1	5.6	-3.5	-12.6	0.01	0.18
Maui Highlands Wells 2	6-4425-001	7/18/17	10:15	0.896	1.18	4	1.2	-7.5	-48.4	0.01	0.02
West Kuiaha Meadows Well	6-5418-002	7/18/17	7:50	0.67	0.744	4.5	6.1	-3.8	-15	0.01	0.11
Maunaolu-Smith Well	6-5320-002	7/18/17	8:28	5.26	8.54	4	4.6	-4.4	-20.9	0.03	0.02
Omaopio-Esty	6-4821-001	7/18/17	9:08	5.03	10.9	6.5	3.3	-5.7	-33.5	0.02	0.08
Pookela Well	6-5118-002	7/17/17	8:57	0.412	0.87	2.9	1.8	-5.3	-27.5	0.01	0.08
Pukalani Golf Course	6-5021-001	7/19/17	8:05	5.78	12.9	8.1	3.6	-5.3	-30.3	0.02	0.07
Waiohuli Obs Well	6-4422-001	8/9/17	10:00	2.5	27	4.8	1.5	-6.1	-37.1	0.03	0.09
Haiku Well (duplicate)	*6-5419-001*	*7/17/17*	*12:05*	*1.91*	*3.73*	*4.3*	*6.6*	*-4.1*	*-17.7*	0.04	0.08
Pukalani Golf Course (duplicate)	*6-5021-001*	*7/19/17*	*12:05*	*6.10*	*13.70*	*8.2*	*3.3*	*-5.3*	*-30.5*	0.02	0.07
Haiku Well	Relative Percent Difference			*0%*	*6%*	*2%*	*5%*	*0%*	*0%*		
Pukalani Golf Course				*1%*	*2%*	*0%*	*2%*	*0%*	*0%*		

Comments:

Analyzed by: N. Wallsgrove - Biogeochemical Stable Isotope Facility (BSIF)

Analysis of water samples for nitrogen and oxygen isotopic composition of nitrate, including sample prep

Instrumentation: ThermoFinnigan Gasbench II/Finnigan MAT 252

Isotopic corrections are calculated using standards prepared by BSIF and run along with the samples

Duplicate analysis of procedural blanks were below the limit of detection

Oxygen, Hydrogen isotopic analysis of waters

Instrumentation: Picarro L2130-i

Isotopic corrections were calculated using standards prepared by BSIF and run along with the samples. All samples were analyzed in at least triplicate, and isotopic values are reported in δ-notation relative to V-Standard Mean Ocean Water

Table IV-4. Ion Concentrations in Up Country Maui Wells

Well Name	Well Number	Date	Time	Calcium mg/L	Magnesium mg/L	Sodium mg/L	Potassium mg/L	Alkalinity mg/L	Chloride mg/L	Sulfate mg/L	Ammonium mg/L as N	Nitrite mg/L as N	Nitrate mg/L as N	Phosphate mg/L as P	Fluoride mg/L	Bromide mg/L as N
Baldwin Ranch Estates 1	6-5220-002	7/19/17	10:10	18.9	21.9	75	9	40	134	27.4	<0.1	<0.1	5.8	<0.1	0.27	0.6
Haiku Well	6-5419-001	7/17/17	11:25	17	13.6	61	6	51	99	17	<0.1	<0.1	2.4	<0.1	0.12	0.4
Hamakaupoko Well 1	6-5420-002	7/17/17	9:45	13.9	9.8	48	5	57	55	13.5	<0.1	<0.1	3.5	0.1	0.16	0.2
Hamakaupoko Well 2	6-5320-001	7/17/17	10:10	16.3	10	60	6	34	75	16	<0.1	<0.1	5.1	0.2	0.18	0.3
Kaupakulua Well	6-5317-001	7/17/17	10:50	15.8	8.5	13	3	65	12	3.4	<0.1	<0.1	0.8	0.2	0.1	0.05
Maui Highlands Wells 2	6-4425-001	7/18/17	10:15	22.3	37.8	191	20	41	359	51.3	<0.1	<0.1	1.0	<0.1	0.1	1.2
West Kuiaha Meadows Well	6-5418-002	7/18/17	7:50	14.5	8.8	24	3	52	36	6.4	<0.1	<0.1	0.9	<0.1	0.09	0.1
Maunaolu-Smith Well	6-5320-002	7/18/17	8:28	13.3	11.7	56	6	46	76	17.8	<0.1	<0.1	5.4	0.2	0.14	0.4
Omaopio-Esty	6-4821-001	7/18/17	9:08	50.8	54.8	91	15	86	272	37.8	<0.1	<0.1	6.2	<0.1	0.1	1.1
Pookela Well	6-5118-002	7/17/17	8:57	11.9	4.1	9	3	49	5	2.2	<0.1	<0.1	0.6	<0.1	0.1	<0.1
Pukalani Golf Course	6-5021-001	7/19/17	8:05	81.3	116	126	22	68	495	59.6	<0.1	<0.1	7.5	<0.1	0.16	1.7
Waiohuli Obs Well	6-4422-001	8/9/17	10:00	17.1	20.7	37	9	48	100	17.4	<0.1	<0.1	3.1	<0.1	0.04	0.4
Haiku Well (duplicate)	*6-5419-001*			*16.8*	*13*	*61*	*6*	*48*	*99*	*16.1*	<0.1	<0.1	*2.4*	0.2	*0.12*	*0.3*
Pukalani Golf Course (duplicate)	*6-5021-001*			*72*	*106*	*127*	*17*	*59*	*498*	*60*	<0.1	<0.1	*7.5*	<0.1	*0.16*	*1.8*
Haiku Well	Relative Percent Difference			*0%*	*1%*	*0%*	*0%*	*2%*	*0%*	*1%*	*NA*	*NA*	*0%*	*NA*	*0%*	*7%*
Pukalani Golf Course				*3%*	*2%*	*0%*	*6%*	*4%*	*0%*	*0%*	*NA*	*NA*	*0%*	*NA*	*0%*	*1%*

NA Not applicable due to none detection in either the primary or duplicated sample

APPENDIX V

Laboratory Reports for the Upcountry Maui Pharmaceutical and Personal Care Products (PPCP) Sampling

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750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

ilac-MRA

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY AT-1807

Laboratory Report

for

State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attention: Joanna Seto

Date of Issue
10/11/2017

EUROFINS EATON ANALYTICAL, INC.

NELAP ACCREDITED TNI LABORATORY
ORELAP 4034

Report: 686568
Project: PPCP-HAWAII
Group: Maui

RCZ: Rick Zimmer

Project Manager

* Accredited in accordance with TNI 2009 and ISO/IEC 17025:2005.
* Laboratory certifies that the test results meet all **TNI 2009 and ISO/IEC 17025:2005** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.

STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	**Michigan**	9906
Arizona	AZ0778	**Mississippi**	Certified
Arkansas	Certified	**Montana**	Cert 0035
California-Monrovia-ELAP	2813	**Nebraska**	Certified
California-Colton- ELAP	2812	**Nevada**	CA00006-2016
California-Folsom- ELAP	2820	**New Hampshire ***	2959
California-Fresno- ELAP	2966	**New Jersey ***	CA 008
Colorado	Certified	**New Mexico**	Certified
Connecticut	PH-0107	**New York ***	11320
Delaware	CA 006	**North Carolina**	06701
Florida *	E871024	**North Dakota**	R-009
Georgia	947	**Oregon (Primary AB) ***	**ORELAP 4034**
Guam	17-005R	**Pennsylvania ***	68-565
Hawaii	Certified	**Puerto Rico**	Certified
Idaho	Certified	**Rhode Island**	LAO00326
Illinois *	200033	**South Carolina**	87016
Indiana	C-CA-01	**South Dakota**	Certified
Iowa - Asbestos	413	**Tennessee**	TN02839
Kansas *	E-10268	**Texas ***	T104704230-16-11
Kentucky	90107	**Utah ***	CA000062017-11
Louisiana *	LA170009	**Vermont**	VT0114
Maine	CA0006	**Virginia ***	460260
Maryland	224	**Washington**	C838
Commonwealth of Northern Marianas Is.	MP0004	**EPA Region 5**	Certified
Massachusetts	M-CA006	**Los Angeles County Sanitation Districts**	10264

* NELAP/TNI Recognized Accreditation Bodies

ISO 17025 Accredited Method List

The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB.

Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environ-mental (Drinking Water)	Environ-mental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
1,4-Dioxane	EPA 522	x		x
2,3,7,8-TCDD	Modified EPA 1613B	x		x
Acrylamide	In House Method (2440)	x		x
Alkalinity	SM 2320B	x	x	x
Ammonia	EPA 350.1		x	x
Ammonia	SM 4500-NH3 H		x	x
Anions and DBPs by IC	EPA 300.0	x	x	x
Anions and DBPs by IC	EPA 300.1	x		x
Asbestos	EPA 100.2	x	x	
Bicarbonate Alkalinity as HCO3	SM 2320B	x	x	x
BOD / CBOD	SM 5210B		x	x
Bromate	In House Method (2447)	x		x
Carbamates	EPA 531.2	x		x
Carbonate as CO3	SM 2330B	x	x	x
Carbonyls	EPA 556	x		x
COD	EPA 410.4 / SM 5220D		x	
Chloramines	SM 4500-CL G	x	x	x
Chlorinated Acids	EPA 515.4	x		x
Chlorinated Acids	EPA 555	x		x
Chlorine Dioxide	SM 4500-CLO2 D	x		x
Chlorine -Total/Free/ Combined Residual	SM 4500-Cl G	x	x	x
Conductivity	EPA 120.1		x	
Conductivity	SM 2510B	x	x	x
Corrosivity (Langelier Index)	SM 2330B	x		x
Cryptosporidium	EPA 1623	x		x
Cyanide, Amenable	SM 4500-CN G	x	x	
Cyanide, Free	SM 4500CN F	x	x	x
Cyanide, Total	EPA 335.4	x	x	x
Cyanogen Chloride (screen)	In House Method (2470)	x		x
Diquat and Paraquat	EPA 549.2	x		x
DBP/HAA	SM 6251B	x		x
Dissolved Oxygen	SM 4500-O G		x	x
DOC	SM 5310C	x		x
E. Coli	(MTF/EC+MUG)	x		x
E. Coli	CFR 141.21(f)(6)(i)	x		x
E. Coli	SM 9223		x	
E. Coli (Enumeration)	SM 9221B.1/ SM 9221F	x		x
E. Coli (Enumeration)	SM 9223B	x		x
EDB/DCBP	EPA 504.1	x		
EDB/DBCP and DBP	EPA 551.1	x		x
EDTA and NTA	In House Method (2454)	x		x
Endothall	EPA 548.1	x		x
Endothall	In-house Method (2445)	x		x
Enterococci	SM 9230B	x	x	
Fecal Coliform	SM 9221 E (MTF/EC)	x		
Fecal Coliform	SM 9221C, E (MTF/EC)		x	
Fecal Coliform (Enumeration)	SM 9221E (MTF/EC)	x		x
Fecal Coliform with Chlorine Present	SM 9221E		x	
Fecal Streptococci	SM 9230B	x	x	
Fluoride	SM 4500-F C	x	x	x
Giardia	EPA 1623	x		x
Glyphosate	EPA 547	x		x
Gross Alpha/Beta	EPA 900.0	x	x	x
Gross Alpha Coprecipitation	SM 7110 C	x	x	x
Hardness	SM 2340B	x	x	x
Heterotrophic Bacteria	In House Method (2439)	x		x
Heterotrophic Bacteria	SM 9215 B	x		x
Hexavalent Chromium	EPA 218.6	x	x	x
Hexavalent Chromium	EPA 218.7	x		x
Hexavalent Chromium	SM 3500-Cr B		x	
Hormones	EPA 539	x		x
Hydroxide as OH Calc.	SM 2330B	x		x
Kjeldahl Nitrogen	EPA 351.2		x	
Legionella	CDC Legionella	x		x
Mercury	EPA 245.1	x	x	x
Metals	EPA 200.7 / 200.8	x	x	x
Microcystin LR	ELISA (2360)	x		x
NDMA	EPA 521	x		x
NDMA	TQ In house method based on EPA 521 (2425)	x		x
Nitrate/Nitrite Nitrogen	EPA 353.2	x	x	x
OCL, Pesticides/PCB	EPA 505	x		x
Ortho Phosphate	EPA 365.1	x	x	x
Ortho Phosphate	SM 4500P E			x
Ortho Phosphorous	SM 4500P E	x		
Oxyhalides Disinfection Byproducts	EPA 317.0	x		x
Perchlorate	EPA 331.0	x		x
Perchlorate (low and high)	EPA 314.0	x		x
Perfluorinated Alkyl Acids	EPA 537	x		x
pH	EPA 150.1	x		
pH	SM 4500-H+B	x	x	x
Phenylurea Pesticides/ Herbicides	In House Method, based on EPA 532 (2448)	x		x
Pseudomonas	IDEXX Pseudalert (2461)	x		x
Radium-226	GA Institute of Tech	x		x
Radium-228	GA Institute of Tech	x		x
Radon-222	SM 7500RN	x		x
Residue, Filterable	SM 2540C	x	x	x
Residue, Non-filterable	SM 2540D		x	
Residue, Total	SM 2540B		x	x
Residue, Volatile	EPA 160.4		x	
Semi-VOC	EPA 525.2	x		x
Semi-VOC	EPA 625		x	x
Silica	SM 4500-Si D	x	x	
Silica	SM 4500-SiO2 C	x	x	
Sulfide	SM 4500-$S^{=}$ D		x	
Sulfite	SM 4500-SO^{3}B	x	x	x
Surfactants	SM 5540C	x	x	x
Taste and Odor Analytes	SM 6040E	x		x
Total Coliform (P/A)	SM 9221 A, B	x		x
Total Coliform (Enumeration)	SM 9221 A, B, C	x		x
Total Coliform / E. coli	Colisure SM 9223	x		x
Total Coliform	SM 9221B		x	
Total Coliform with Chlorine Present	SM 9221B		x	
Total Coliform / E.coli (P/A and Enumeration)	SM 9223	x		x
TOC	SM 5310C	x	x	x
TOX	SM 5320B		x	
Total Phenols	EPA 420.1		x	
Total Phenols	EPA 420.4	x	x	x
Total Phosphorous	SM 4500 P E		x	
Turbidity	EPA 180.1	x	x	x
Turbidity	SM 2130B	x	x	
Uranium by ICP/MS	EPA 200.8	x		x
UV 254	SM 5910B	x		
VOC	EPA 524.2/EPA 524.3	x		x
VOC	EPA 624		x	x
VOC	EPA SW 846 8260	x		x
VOC	In House Method (2411)	x		x
Yeast and Mold	SM 9610	x		x

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Acknowledgement of Samples Received

Addr: **State of Hawaii DOH**
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attn: Joanna Seto
Phone: 808-586-4258

Client ID: HAWAII-DOH
Folder #: 686568
Project: PPCP-HAWAII
Sample Group: Maui

Project Manager: Rick Zimmer
Phone: 626-386-1157

The following samples were received from you on **September 14, 2017** at **1232**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical, Inc..

Sample #	Sample ID	Sample Date
201709141149	Pukalani WWRF Influent	09/12/2017 0940
	Static ID: 091217-H017	
	@DX_ABI_NEG @DX_ABI_POS	

Test Description

@DX_ABI_NEG -- Endocrine Disruptors Negative Mode - SPE

@DX_ABI_POS -- Endocrine Disruptors Positive Mode - SPE

CHAIN OF CUSTODY RECORD

L086568

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750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY:

LOGIN COMMENTS: _____

SAMPLES CHECKED AGAINST COC BY: _____

SAMPLES LOGGED IN BY: _____

SAMPLE TEMP RECEIVED AT:

SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

☐ _____ (Other) IR Gun ID = _____ (Observation= _____ °C) (Corr.Factor _____ °C) (Final = _____ °C)

☑ Monrovia IR Gun ID = 520A (Observation= 4.8 °C) (Corr.Factor +.2 °C) (Final = 5.0 °C)

Compliance Acceptance Criteria: (Chemistry: 4 ± 2 °C) (Microbiology: < 10°C)

TYPE OF ICE: Real ____ Synthetic ✓ No Ice ____ **CONDITION OF ICE:** Frozen ✓ Partially Frozen ____ Thawed ____ N/A ____

METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: _____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME: HI DEPT OF HEALTH - SAFE DRINKING WATER BRANCH		**PROJECT CODE:** PPCP-HAWAII	**COMPLIANCE SAMPLES** (check for yes) ☐ - Requires state forms ☐ Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION
EEA CLIENT CODE: HAWAII-DOH	**COC ID:**	**SAMPLE GROUP:** BASELINE	**NON-COMPLIANCE SAMPLES** (check for yes) ☒ REGULATION INVOLVED: _____ (eg. SDWA, NPDES, etc.)
TAT requested: rush by adv notice only STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___			***SEE ATTACHED KIT ORDER FOR ANALYSES*** ☒ (check for yes), ***OR*** **List ALL ANALYSES REQUIRED** (enter number of bottles sent for each test for each sample)

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA	PPCP	SAMPLER COMMENTS
9/12/17	9:40	PUKALANI WWRF		WW			2	SAMPLE STORED IN SDWB MONITORING SECTION REFRIDG/ LOCKED STORAGE ROOM UNTIL PACKED FOR FEDEX SHIPMENT ON 9/13/17.
		RAW INFLUENT WASTEWATER						
		091217-H017						
		pH. - 7.48						
		Temp. - 30.3						
		Cond. - 685 µS						
		TDS - 485 ppt						
		Salinity - 0.34 ppt						
		Turbidity - 86.9 NTU						

*** MATRIX TYPES:** **RSW** = Raw Surface Water; **RGW** = Raw Ground Water; **CFW** = Chlor(am)inated Finished Water; **FW** = Other Finished Water; **SEAW** = Sea Water; **WW** = Waste Water; **BW** = Bottled Water; **SW** = Storm Water; **SO** = Soil; **SL** = Sludge; **O** = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	Daniel Chang	DANIEL CHANG	HI DEPT OF HEALTH - SAFE DRINKNG WATER	9/12/17	9:40 PM
RELINQUISHED BY:	Daniel Chang	DANIEL CHANG	HI DOH - SAFE DRINKING WATER	9/13/17	10:00AM
RECEIVED BY:		Chris Cash	EEA	9-14-17	1232
RELINQUISHED BY:					
RECEIVED BY:					

QA FO 0029.2 (Version 2) (08/28/2014)

PAGE _____ OF _____

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1 800 566 LABS (1 800 566 5227)

Laboratory Hits

Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201709141149	**Pukalani WWRF Influent**				
10/05/2017 18:42	1,7-Dimethylxanthine		5100		ng/L	100
10/05/2017 18:42	Acesulfame-K		44000		ng/L	200
10/05/2017 07:23	Acetaminophen		110000		ng/L	5000
10/05/2017 18:42	Amoxicillin (semi-quantitative)		3000		ng/L	200
10/05/2017 18:42	Atenolol		1600		ng/L	50
10/05/2017 18:42	BPA		280		ng/L	100
10/05/2017 18:42	Butalbital		810		ng/L	50
10/05/2017 07:23	Caffeine		150000		ng/L	5000
10/05/2017 18:42	Cotinine		2700		ng/L	100
10/05/2017 18:42	DEET		1100		ng/L	100
10/05/2017 18:42	Diltiazem		480		ng/L	50
10/05/2017 18:42	Ethinyl Estradiol - 17 alpha		1100		ng/L	50
10/05/2017 18:42	Ethylparaben		460		ng/L	200
10/05/2017 18:42	Gemfibrozil		4300		ng/L	50
10/05/2017 18:42	Ibuprofen		15000		ng/L	100
10/05/2017 18:42	Iohexal		3200		ng/L	100
10/05/2017 18:42	Ketorolac		110		ng/L	50
10/05/2017 18:42	Lidocaine		270		ng/L	50
10/05/2017 18:42	Lopressor		1500		ng/L	200
10/05/2017 18:42	Meprobamate		270		ng/L	50
10/05/2017 18:42	Methylparaben		2500		ng/L	200
10/05/2017 18:42	Naproxen		10000		ng/L	100
10/05/2017 18:42	Propylparaben		1200		ng/L	50
10/05/2017 18:42	Quinoline		860		ng/L	50
10/05/2017 18:42	Sucralose		56000		ng/L	1000
10/05/2017 18:42	Sulfamethoxazole		1400		ng/L	50
10/05/2017 07:23	Theobromine		27000		ng/L	10000
10/05/2017 07:23	Theophylline (semi-quantitative)		24000		ng/L	20000
10/05/2017 18:42	Trimethoprim		680		ng/L	50

SUMMARY OF POSITIVE DATA ONLY

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Laboratory Data

Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Pukalani WWRF Influent (201709141149) — **Sampled on 09/12/2017 0940**

Static ID: 091217-H017

LC-MS-MS - Endocrine Disruptors Positive Mode - SPE

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/05/17 18:42		1031674	(LC-MS-MS)	1,7-Dimethylxanthine	5100	ng/L	34	100	10
	10/05/17 07:23		1031674	(LC-MS-MS)	Acetaminophen	110000	ng/L	3000	5000	1000
	10/05/17 18:42		1031674	(LC-MS-MS)	Albuterol	ND	ng/L	24	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Amoxicillin (semi-quantitative)	3000	ng/L	64	200	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Andorostenedione	ND	ng/L	17	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Atenolol	1600	ng/L	39	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Atrazine	ND	ng/L	23	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Bezafibrate	ND	ng/L	35	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Bromacil	ND	ng/L	32	50	10
	10/05/17 07:23		1031674	(LC-MS-MS)	Caffeine	150000	ng/L	4300	5000	1000
	10/05/17 18:42		1031674	(LC-MS-MS)	Carbadox	ND	ng/L	42	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Carbamazepine	ND	ng/L	12	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Carisoprodol	ND	ng/L	12	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Chloridazon	ND	ng/L	16	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Chlorotoluron	ND	ng/L	8.9	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Cimetidine (semi quantitative)	ND	ng/L	27	50	10
	09/27/17 06:43		1030288	(LC-MS-MS)	Ciprofloxacin - Cipro	ND	ng/L	20	100	1
	10/05/17 18:42		1031674	(LC-MS-MS)	Cotinine	2700	ng/L	48	100	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Cyanazine	ND	ng/L	17	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	DACT	ND	ng/L	39	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	DEA	21J	ng/L	15	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	DEET	1100	ng/L	11	100	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Dehydronifedipine	ND	ng/L	14	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	DIA	ND	ng/L	24	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Diazepam	ND	ng/L	21	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Dilantin	ND	ng/L	130	200	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Diltiazem	480	ng/L	30	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Diuron	ND	ng/L	18	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Erythromycin	ND	ng/L	40	100	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Flumeqine	ND	ng/L	71	100	10

Rounding on totals after summation.
(c) - Indicates calculated results.
ND - Analyte was not detected at the calculated MDL.
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the required QC criteria.

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Laboratory Data

Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/05/17 18:42		1031674	(LC-MS-MS)	Fluoxetine	ND	ng/L	100	100	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Isoproturon	ND	ng/L	120	1000	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Ketoprofen	ND	ng/L	26	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Ketorolac	110	ng/L	21	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Lidocaine	270	ng/L	11	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Lincomycin	ND	ng/L	17	100	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Linuron	ND	ng/L	28	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Lopressor	1500	ng/L	51	200	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Meclofenamic Acid	ND	ng/L	47	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Meprobamate	270	ng/L	20	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Metazachlor	ND	ng/L	13	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Metolachlor	ND	ng/L	31	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Nifedipine (semi quantitative)	ND	ng/L	120	200	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Norethisterone	ND	ng/L	23	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Oxolinic acid	ND	ng/L	25	100	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Pentoxifylline	ND (R7)	ng/L	15	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Phenazone	ND	ng/L	50	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Primidone	ND	ng/L	48	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Progesterone	ND	ng/L	29	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Propazine	ND	ng/L	18	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Quinoline	860	ng/L	25	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Simazine	ND	ng/L	12	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Sulfachloropyridazine	ND	ng/L	21	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Sulfadiazine	ND	ng/L	39	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Sulfadimethoxine	ND	ng/L	16	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Sulfamerazine	ND	ng/L	46	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Sulfamethazine	ND	ng/L	15	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Sulfamethizole	ND	ng/L	32	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Sulfamethoxazole	1400	ng/L	28	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	Sulfathiazole	ND	ng/L	24	50	10
	10/05/17 18:42		1031674	(LC-MS-MS)	TCEP	88J (R7)	ng/L	32	100	10
	10/05/17 18:42		1031674	(LC-MS-MS)	TCPP	ND	ng/L	200	1000	10
	10/05/17 18:42		1031674	(LC-MS-MS)	TDCPP	ND (R7)	ng/L	200	1000	10

Rounding on totals after summation.
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Laboratory Data

Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/05/17 18:42		1031674	(LC-MS-MS)	Testosterone	44J (R7)	ng/L	25	50	10
	10/05/17 07:23		1031674	(LC-MS-MS)	Theobromine	27000	ng/L	3200	10000	1000
	10/05/17 07:23		1031674	(LC-MS-MS)	Theophylline (semi-quantitative)	24000	ng/L	4800	20000	1000
	10/05/17 18:42		1031674	(LC-MS-MS)	Trimethoprim	680	ng/L	18	50	10
	LC-MS-MS - Endocrine Disruptors Negative Mode - SPE									
	10/05/17 18:42		1031671	(LC-MS-MS)	2,4-D	ND	ng/L	50	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	4-nonylphenol - semi quantitative	580J	ng/L	500	1000	10
	10/05/17 18:42		1031671	(LC-MS-MS)	4-tert-Octylphenol	150J	ng/L	69	500	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Acesulfame-K	44000	ng/L	200	200	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Bendroflumethiazide	ND	ng/L	44	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	BPA	280	ng/L	72	100	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Butalbital	810	ng/L	29	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Butylparaben	ND	ng/L	33	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Chloramphenicol	ND	ng/L	31	100	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Clofibric Acid	ND	ng/L	50	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Diclofenac	40J	ng/L	33	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Estradiol	ND	ng/L	44	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Estrone	ND	ng/L	39	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Ethinyl Estradiol - 17 alpha	1100	ng/L	33	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Ethylparaben	460	ng/L	110	200	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Gemfibrozil	4300	ng/L	25	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Ibuprofen	15000	ng/L	86	100	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Iohexal	3200	ng/L	77	100	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Iopromide	ND	ng/L	16	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Isobutylparaben	ND	ng/L	42	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Lipitor (Atorvastatin)	ND	ng/L	500	1000	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Methylparaben	2500	ng/L	110	200	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Naproxen	10000	ng/L	85	100	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Propylparaben	1200	ng/L	29	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Salicylic Acid	ND	ng/L	500	1000	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Sucralose	56000	ng/L	420	1000	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Triclocarban	ND	ng/L	25	50	10
	10/05/17 18:42		1031671	(LC-MS-MS)	Triclosan	ND	ng/L	63	100	10

Rounding on totals after summation.
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Laboratory Data

Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/05/17 18:42		1031671	(LC-MS-MS)	Warfarin	ND	ng/L	41	50	10

Rounding on totals after summation.
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Laboratory Comments

Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Folder Comments

Sample results at both the MDL and MRL are included in this report to indicate estimated concentrations for diluted samples below the elevated MRL.

RPD calculation for Pentoxifyline, TCEP, TDCPP and Testosterone were high. However, data is acceptable based on passing LCS and other QC.

Flags Legend:

R7 - LFB/LFBD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.

The Comments Report may be blank if there are no comments for this report.

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Laboratory QC Summary

Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 1030288 **Analysis Date: 09/27/2017**

201709141149 Pukalani WWRF Influent Analyzed by: ALI

Endocrine Disruptors Negative Mode - SPE

Analytical Batch: 1031671 **Analysis Date: 10/05/2017**

201709141149 Pukalani WWRF Influent Analyzed by: ARH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 1031674 **Analysis Date: 10/05/2017**

201709141149 Pukalani WWRF Influent Analyzed by: ARH

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Laboratory QC

Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Endocrine Disruptors Positive Mode - SPE by LC-MS-MS									
Analytical Batch: 1030288							**Analysis Date: 09/27/2017**		
LCS1	Ciprofloxacin - Cipro		2000	2030	ng/L	101	(40-160)		
LCS2	Ciprofloxacin - Cipro		2000	2130	ng/L	107	(40-160)	30	4.8
MBLK	Ciprofloxacin - Cipro			<100	ng/L				
MRL_CHK	Ciprofloxacin - Cipro		100	52.5	ng/L	53	(50-150)		
MS_201709141150	Ciprofloxacin - Cipro	ND	2000	371	ng/L	**19**	(40-160)		
MSD_201709141150	Ciprofloxacin - Cipro	ND	2000	278	ng/L	**14**	(40-160)	60	29
Endocrine Disruptors Negative Mode - SPE by LC-MS-MS									
Analytical Batch: 1031671							**Analysis Date: 10/05/2017**		
LCS1	2,4-D		100	98.2	ng/L	98	(60-140)		
LCS2	2,4-D		100	101	ng/L	101	(60-140)	40	2.8
MBLK	2,4-D			<5	ng/L				
MRL_CHK	2,4-D		5	4.83	ng/L	97	(50-150)		
MS_201709141145	2,4-D	150	100	253	ng/L	106	(60-140)		
MSD_201709141145	2,4-D	150	100	242	ng/L	96	(60-140)	40	4.0
LCS1	4-nonylphenol - semi quantitative		200	219	ng/L	109	(60-140)		
LCS2	4-nonylphenol - semi quantitative		200	197	ng/L	98	(60-140)	40	11
MBLK	4-nonylphenol - semi quantitative			<100	ng/L				
MRL_CHK	4-nonylphenol - semi quantitative		10	8.31	ng/L	83	(50-150)		
MS_201709141145	4-nonylphenol - semi quantitative	1200	200	1340	ng/L	78	(60-140)		
MSD_201709141145	4-nonylphenol - semi quantitative	1200	200	1430	ng/L	123	(60-140)	40	6.5
LCS1	4-tert-octylphenol		100	117	ng/L	117	(60-140)		
LCS2	4-tert-octylphenol		100	98.8	ng/L	99	(60-140)	40	17
MBLK	4-tert-octylphenol			<100	ng/L				
MRL_CHK	4-tert-octylphenol		5	4.36	ng/L	87	(50-150)		
MS_201709141145	4-tert-octylphenol	120	100	294	ng/L	**169**	(60-140)		
MSD_201709141145	4-tert-octylphenol	120	100	286	ng/L	**160**	(60-140)	40	2.8
LCS1	Acesulfame-K		400	384	ng/L	96	(60-140)		
LCS2	Acesulfame-K		400	370	ng/L	92	(60-140)	40	3.7
MBLK	Acesulfame-K			<20	ng/L				
MRL_CHK	Acesulfame-K		20	20.4	ng/L	102	(50-150)		
MS_201709141145	Acesulfame-K	70	400	549	ng/L	120	(60-140)		
MSD_201709141145	Acesulfame-K	70	400	529	ng/L	115	(60-140)	40	3.7
LCS1	Bendroflumethiazide		100	102	ng/L	102	(60-140)		
LCS2	Bendroflumethiazide		100	97.6	ng/L	98	(60-140)	40	4.4

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Bendroflumethiazide			<5	ng/L				
MRL_CHK	Bendroflumethiazide		5	6.08	ng/L	122	(50-150)		
MS_201709141145	Bendroflumethiazide	ND	100	57.9	ng/L	**58**	(60-140)		
MSD_201709141145	Bendroflumethiazide	ND	100	52.9	ng/L	**53**	(60-140)	40	9.0
LCS1	BPA		100	98.1	ng/L	98	(60-140)		
LCS2	BPA		100	94.1	ng/L	94	(60-140)	40	4.2
MBLK	BPA			<10	ng/L				
MRL_CHK	BPA		5	4.22	ng/L	85	(50-150)		
MS_201709141145	BPA	ND	100	113	ng/L	104	(60-140)		
MSD_201709141145	BPA	ND	100	115	ng/L	106	(60-140)	40	1.8
LCS1	Butalbital		100	98.1	ng/L	98	(60-140)		
LCS2	Butalbital		100	106	ng/L	106	(60-140)	40	7.7
MBLK	Butalbital			<5	ng/L				
MRL_CHK	Butalbital		5	5.24	ng/L	105	(50-150)		
MS_201709141145	Butalbital	ND	100	134	ng/L	134	(60-140)		
MSD_201709141145	Butalbital	ND	100	128	ng/L	128	(60-140)	40	4.6
LCS1	Butylparben		100	104	ng/L	104	(60-140)		
LCS2	Butylparben		100	85.8	ng/L	86	(60-140)	40	19
MBLK	Butylparben			<5	ng/L				
MRL_CHK	Butylparben		5	3.85	ng/L	77	(50-150)		
MS_201709141145	Butylparben	ND	100	158	ng/L	**158**	(60-140)		
MSD_201709141145	Butylparben	ND	100	165	ng/L	**165**	(60-140)	40	4.3
LCS1	Chloramphenicol		100	99.1	ng/L	99	(60-140)		
LCS2	Chloramphenicol		100	103	ng/L	103	(60-140)	40	3.9
MBLK	Chloramphenicol			<10	ng/L				
MRL_CHK	Chloramphenicol		5	5.93	ng/L	119	(50-150)		
MS_201709141145	Chloramphenicol	ND	100	53.3	ng/L	**53**	(60-140)		
MSD_201709141145	Chloramphenicol	ND	100	47.1	ng/L	**47**	(60-140)	40	12
LCS1	Clofibric Acid		100	100	ng/L	100	(60-140)		
LCS2	Clofibric Acid		100	98.3	ng/L	98	(60-140)	40	1.7
MBLK	Clofibric Acid			<5	ng/L				
MRL_CHK	Clofibric Acid		5	4.94	ng/L	99	(50-150)		
MS_201709141145	Clofibric Acid	ND	100	220	ng/L	**220**	(60-140)		
MSD_201709141145	Clofibric Acid	ND	100	225	ng/L	**225**	(60-140)	40	2.3
LCS1	Diclofenac		100	101	ng/L	101	(60-140)		
LCS2	Diclofenac		100	98.3	ng/L	98	(60-140)	40	2.7
MBLK	Diclofenac			<5	ng/L				
MRL_CHK	Diclofenac		5	4.65	ng/L	93	(50-150)		

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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709141145	Diclofenac	16	100	160	ng/L	**144**	(60-140)		
MSD_201709141145	Diclofenac	16	100	161	ng/L	**144**	(60-140)	40	0.62
LCS1	Estradiol		100	107	ng/L	107	(60-140)		
LCS2	Estradiol		100	94.6	ng/L	95	(60-140)	40	12
MBLK	Estradiol			<5	ng/L				
MRL_CHK	Estradiol		5	4.21	ng/L	84	(50-150)		
MS_201709141145	Estradiol	ND	100	119	ng/L	119	(60-140)		
MSD_201709141145	Estradiol	ND	100	113	ng/L	113	(60-140)	40	5.2
LCS1	Estrone		100	106	ng/L	106	(60-140)		
LCS2	Estrone		100	102	ng/L	102	(60-140)	40	3.9
MBLK	Estrone			<5	ng/L				
MRL_CHK	Estrone		5	3.91	ng/L	78	(50-150)		
MS_201709141145	Estrone	ND	100	137	ng/L	133	(60-140)		
MSD_201709141145	Estrone	ND	100	134	ng/L	130	(60-140)	40	2.2
LCS1	Ethinyl Estradiol - 17 alpha		100	96.7	ng/L	97	(60-140)		
LCS2	Ethinyl Estradiol - 17 alpha		100	87.9	ng/L	88	(60-140)	40	9.5
MBLK	Ethinyl Estradiol - 17 alpha			<5	ng/L				
MRL_CHK	Ethinyl Estradiol - 17 alpha		5	7.40	ng/L	148	(50-150)		
MS_201709141145	Ethinyl Estradiol - 17 alpha	ND	100	122	ng/L	123	(60-140)		
MSD_201709141145	Ethinyl Estradiol - 17 alpha	ND	100	118	ng/L	118	(60-140)	40	4.2
LCS1	Ethylparaben		400	393	ng/L	98	(60-140)		
LCS2	Ethylparaben		400	383	ng/L	96	(60-140)	40	2.6
MBLK	Ethylparaben			<20	ng/L				
MRL_CHK	Ethylparaben		20	19.0	ng/L	95	(50-150)		
MS_201709141145	Ethylparaben	ND	400	449	ng/L	110	(60-140)		
MSD_201709141145	Ethylparaben	ND	400	409	ng/L	100	(60-140)	40	9.3
LCS1	Gemfibrozil		100	101	ng/L	101	(60-140)		
LCS2	Gemfibrozil		100	96.0	ng/L	96	(60-140)	40	5.1
MBLK	Gemfibrozil			<5	ng/L				
MRL_CHK	Gemfibrozil		5	3.07	ng/L	61	(50-150)		
MS_201709141145	Gemfibrozil	270	100	359	ng/L	88	(60-140)		
MSD_201709141145	Gemfibrozil	270	100	346	ng/L	76	(60-140)	40	3.7
LCS1	Ibuprofen		200	213	ng/L	106	(60-140)		
LCS2	Ibuprofen		200	187	ng/L	93	(60-140)	40	13
MBLK	Ibuprofen			<15	ng/L				
MRL_CHK	Ibuprofen		10	11.0	ng/L	110	(50-150)		
MS_201709141145	Ibuprofen	ND	200	249	ng/L	125	(60-140)		
MSD_201709141145	Ibuprofen	ND	200	269	ng/L	135	(60-140)	40	7.7

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Iohexal		200	189	ng/L	95	(60-140)		
LCS2	Iohexal		200	185	ng/L	93	(60-140)	40	2.1
MBLK	Iohexal			<10	ng/L				
MRL_CHK	Iohexal		10	12.0	ng/L	120	(50-150)		
MS_201709141145	Iohexal	ND	200	65.5	ng/L	**33**	(50-150)		
MSD_201709141145	Iohexal	ND	200	96.6	ng/L	**48**	(50-150)	50	38
LCS1	Iopromide		100	113	ng/L	113	(60-140)		
LCS2	Iopromide		100	86.3	ng/L	86	(60-140)	40	27
MBLK	Iopromide			<5	ng/L				
MRL_CHK	Iopromide		5	6.82	ng/L	136	(50-150)		
MS_201709141145	Iopromide	2000	100	2020	ng/L	**16**	(50-150)		
MSD_201709141145	Iopromide	2000	100	1970	ng/L	**-32.8**	(50-150)	50	2.5
LCS1	Isobutylparaben		100	104	ng/L	105	(60-140)		
LCS2	Isobutylparaben		100	85.8	ng/L	86	(60-140)	40	20
MBLK	Isobutylparaben			<5	ng/L				
MRL_CHK	Isobutylparaben		5	3.74	ng/L	75	(50-150)		
MS_201709141145	Isobutylparaben	ND	100	158	ng/L	**158**	(60-140)		
MSD_201709141145	Isobutylparaben	ND	100	165	ng/L	**165**	(60-140)	40	4.3
LCS1	Lipitor (Atorvastain)		100	128	ng/L	128	(60-140)		
LCS2	Lipitor (Atorvastain)		100	105	ng/L	105	(60-140)	40	20
MBLK	Lipitor (Atorvastain)			<5	ng/L				
MRL_CHK	Lipitor (Atorvastain)		5	6.35	ng/L	127	(50-150)		
MS_201709141145	Lipitor (Atorvastain)	ND	100	125	ng/L	125	(60-140)		
MSD_201709141145	Lipitor (Atorvastain)	ND	100	134	ng/L	134	(60-140)	40	7.0
LCS1	Methylparaben		400	400	ng/L	100	(60-140)		
LCS2	Methylparaben		400	385	ng/L	96	(60-140)	40	3.8
MBLK	Methylparaben			<20	ng/L				
MRL_CHK	Methylparaben		20	19.9	ng/L	99	(50-150)		
MS_201709141145	Methylparaben	ND	400	359	ng/L	86	(60-140)		
MSD_201709141145	Methylparaben	ND	400	334	ng/L	80	(60-140)	40	6.9
LCS1	Naproxen		200	182	ng/L	91	(60-140)		
LCS2	Naproxen		200	185	ng/L	92	(60-140)	40	1.6
MBLK	Naproxen			<10	ng/L				
MRL_CHK	Naproxen		10	6.92	ng/L	69	(50-150)		
MS_201709141145	Naproxen	ND	200	52.6	ng/L	**26**	(60-140)		
MSD_201709141145	Naproxen	ND	200	45.2	ng/L	**23**	(60-140)	40	15
LCS1	Propylparaben		100	101	ng/L	101	(60-140)		
LCS2	Propylparaben		100	86.4	ng/L	86	(60-140)	40	16

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Propylparaben			<5	ng/L				
MRL_CHK	Propylparaben		5	2.63	ng/L	53	(50-150)		
MS_201709141145	Propylparaben	ND	100	133	ng/L	133	(60-140)		
MSD_201709141145	Propylparaben	ND	100	128	ng/L	128	(60-140)	40	3.8
LCS1	Salicylic Acid		2000	1980	ng/L	99	(60-140)		
LCS2	Salicylic Acid		2000	2080	ng/L	104	(60-140)	40	4.9
MBLK	Salicylic Acid			<100	ng/L				
MRL_CHK	Salicylic Acid		100	136	ng/L	137	(50-150)		
MS_201709141145	Salicylic Acid	ND	2000	2380	ng/L	119	(60-140)		
MSD_201709141145	Salicylic Acid	ND	2000	1700	ng/L	85	(60-140)	40	33
LCS1	Sucralose		2000	1900	ng/L	95	(60-140)		
LCS2	Sucralose		2000	1780	ng/L	89	(60-140)	40	7.0
MBLK	Sucralose			<100	ng/L				
MRL_CHK	Sucralose		100	124	ng/L	124	(50-150)		
MS_201709141145	Sucralose	52000	2000	70500	ng/L	**943**	(60-140)		
MSD_201709141145	Sucralose	52000	2000	52200	ng/L	**28**	(60-140)	40	30
LCS1	Triclocarban		100	122	ng/L	122	(60-140)		
LCS2	Triclocarban		100	128	ng/L	129	(60-140)	40	5.6
MBLK	Triclocarban			<5	ng/L				
MRL_CHK	Triclocarban		5	6.10	ng/L	122	(50-150)		
MS_201709141145	Triclocarban	7.9	100	92.8	ng/L	85	(60-140)		
MSD_201709141145	Triclocarban	7.9	100	102	ng/L	94	(60-140)	40	9.4
LCS1	Triclosan		200	199	ng/L	100	(60-140)		
LCS2	Triclosan		200	201	ng/L	100	(60-140)	40	1.0
MBLK	Triclosan			<10	ng/L				
MRL_CHK	Triclosan		10	8.08	ng/L	81	(50-150)		
MS_201709141145	Triclosan	22	200	256	ng/L	117	(60-140)		
MSD_201709141145	Triclosan	22	200	244	ng/L	111	(60-140)	40	4.8
LCS1	Warfarin		100	91.5	ng/L	92	(60-140)		
LCS2	Warfarin		100	114	ng/L	114	(60-140)	40	22
MBLK	Warfarin			<5	ng/L				
MRL_CHK	Warfarin		5	6.16	ng/L	123	(50-150)		
MS_201709141145	Warfarin	ND	100	109	ng/L	107	(60-140)		
MSD_201709141145	Warfarin	ND	100	81.2	ng/L	79	(60-140)	40	29

Endocrine Disruptors Positive Mode - SPE by LC-MS-MS

Analytical Batch: 1031674 **Analysis Date: 10/05/2017**

LCS1	1,7-Dimethylxanthine		100	103	ng/L	103	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	1,7-Dimethylxanthine		100	98.5	ng/L	99	(60-140)	30	4.5
MBLK	1,7-Dimethylxanthine			<5	ng/L				
MRL_CHK	1,7-Dimethylxanthine		5	4.85	ng/L	97	(50-150)		
MS_201709141145	1,7-Dimethylxanthine	39	100	103	ng/L	64	(60-140)		
MSD_201709141145	1,7-Dimethylxanthine	39	100	116	ng/L	77	(60-140)	40	12
LCS1	Acetaminophen		100	97.4	ng/L	97	(60-140)		
LCS2	Acetaminophen		100	93.5	ng/L	94	(60-140)	30	4.1
MBLK	Acetaminophen			<5	ng/L				
MRL_CHK	Acetaminophen		5	4.96	ng/L	99	(50-150)		
MS_201709141145	Acetaminophen	32	100	146	ng/L	113	(60-140)		
MSD_201709141145	Acetaminophen	32	100	120	ng/L	88	(60-140)	40	20
LCS1	Albuterol		100	93.6	ng/L	94	(60-140)		
LCS2	Albuterol		100	84.7	ng/L	85	(60-140)	30	10
MBLK	Albuterol			<5	ng/L				
MRL_CHK	Albuterol		5	2.70	ng/L	54	(50-150)		
MS_201709141145	Albuterol	ND	100	110	ng/L	110	(60-140)		
MSD_201709141145	Albuterol	ND	100	110	ng/L	111	(60-140)	40	0.91
LCS1	Amoxicillin (semi-quantitative)		400	363	ng/L	91	(60-140)		
LCS2	Amoxicillin (semi-quantitative)		400	377	ng/L	94	(60-140)	30	3.8
MBLK	Amoxicillin (semi-quantitative)			<20	ng/L				
MRL_CHK	Amoxicillin (semi-quantitative)		20	20.8	ng/L	104	(50-150)		
MS_201709141145	Amoxicillin (semi-quantitative)	1100	400	1450	ng/L	93	(60-140)		
MSD_201709141145	Amoxicillin (semi-quantitative)	1100	400	1240	ng/L	**40**	(60-140)	40	16
LCS1	Andorostenedione		100	77.7	ng/L	78	(60-140)		
LCS2	Andorostenedione		100	85.7	ng/L	86	(60-140)	30	9.8
MBLK	Andorostenedione			<5	ng/L				
MRL_CHK	Andorostenedione		5	5.55	ng/L	111	(50-150)		
MS_201709141145	Andorostenedione	ND	100	115	ng/L	115	(60-140)		
MSD_201709141145	Andorostenedione	ND	100	158	ng/L	**158**	(60-140)	40	32
LCS1	Atenolol		100	93.8	ng/L	94	(60-140)		
LCS2	Atenolol		100	76.7	ng/L	77	(60-140)	30	20
MBLK	Atenolol			<5	ng/L				
MRL_CHK	Atenolol		5	4.55	ng/L	91	(50-150)		
MS_201709141145	Atenolol	17	100	152	ng/L	135	(60-140)		
MSD_201709141145	Atenolol	17	100	178	ng/L	**161**	(60-140)	40	16
LCS1	Atrazine		100	101	ng/L	101	(60-140)		
LCS2	Atrazine		100	122	ng/L	122	(60-140)	30	19
MBLK	Atrazine			<5	ng/L				

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Atrazine		5	3.89	ng/L	78	(50-150)		
MS_201709141145	Atrazine	ND	100	113	ng/L	113	(60-140)		
MSD_201709141145	Atrazine	ND	100	125	ng/L	125	(60-140)	40	10
LCS1	Bezafibrate		100	98.3	ng/L	98	(60-140)		
LCS2	Bezafibrate		100	97.6	ng/L	98	(60-140)	30	0.72
MBLK	Bezafibrate			<5	ng/L				
MRL_CHK	Bezafibrate		5	4.32	ng/L	87	(50-150)		
MS_201709141145	Bezafibrate	ND	100	130	ng/L	130	(60-140)		
MSD_201709141145	Bezafibrate	ND	100	131	ng/L	131	(60-140)	40	0.77
LCS1	Bromacil		100	98.7	ng/L	99	(60-140)		
LCS2	Bromacil		100	95.1	ng/L	95	(60-140)	30	3.7
MBLK	Bromacil			<5	ng/L				
MRL_CHK	Bromacil		5	5.56	ng/L	111	(50-150)		
MS_201709141145	Bromacil	ND	100	91.9	ng/L	92	(60-140)		
MSD_201709141145	Bromacil	ND	100	86.1	ng/L	86	(60-140)	40	6.5
LCS1	Caffeine		100	85.2	ng/L	85	(60-140)		
LCS2	Caffeine		100	94.7	ng/L	95	(60-140)	30	11
MBLK	Caffeine			<5	ng/L				
MRL_CHK	Caffeine		5	5.44	ng/L	109	(50-150)		
MS_201709141145	Caffeine	37	100	126	ng/L	89	(60-140)		
MSD_201709141145	Caffeine	37	100	127	ng/L	90	(60-140)	40	0.79
LCS1	Carbadox		100	92.6	ng/L	93	(60-140)		
LCS2	Carbadox		100	93.4	ng/L	93	(60-140)	30	0.86
MBLK	Carbadox			<5	ng/L				
MRL_CHK	Carbadox		5	4.46	ng/L	89	(50-150)		
MS_201709141145	Carbadox	ND	100	65.0	ng/L	65	(60-140)		
MSD_201709141145	Carbadox	ND	100	69.0	ng/L	69	(60-140)	40	6.1
LCS1	Carbamazepine		100	101	ng/L	101	(60-140)		
LCS2	Carbamazepine		100	134	ng/L	134	(60-140)	30	28
MBLK	Carbamazepine			<5	ng/L				
MRL_CHK	Carbamazepine		5	7.41	ng/L	148	(50-150)		
MS_201709141145	Carbamazepine	110	100	249	ng/L	138	(60-140)		
MSD_201709141145	Carbamazepine	110	100	188	ng/L	77	(60-140)	40	27
LCS1	Carisoprodol		100	94.9	ng/L	95	(60-140)		
LCS2	Carisoprodol		100	98.9	ng/L	99	(60-140)	30	4.1
MBLK	Carisoprodol			<5	ng/L				
MRL_CHK	Carisoprodol		5	6.30	ng/L	126	(50-150)		
MS_201709141145	Carisoprodol	ND	100	0	ng/L	**0**	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709141145	Carisoprodol	ND	100	0	ng/L	**0**	(60-140)	40	**1000**
LCS1	Chloridazon		100	102	ng/L	102	(60-140)		
LCS2	Chloridazon		100	104	ng/L	104	(60-140)	30	1.9
MBLK	Chloridazon			<5	ng/L				
MRL_CHK	Chloridazon		5	5.39	ng/L	108	(50-150)		
MS_201709141145	Chloridazon	ND	100	18.5	ng/L	**19**	(60-140)		
MSD_201709141145	Chloridazon	ND	100	17.4	ng/L	**18**	(60-140)	40	5.6
LCS1	Chlorotoluron		100	101	ng/L	101	(60-140)		
LCS2	Chlorotoluron		100	98.6	ng/L	99	(60-140)	30	2.4
MBLK	Chlorotoluron			<5	ng/L				
MRL_CHK	Chlorotoluron		5	5.56	ng/L	111	(50-150)		
MS_201709141145	Chlorotoluron	ND	100	112	ng/L	112	(60-140)		
MSD_201709141145	Chlorotoluron	ND	100	97.9	ng/L	98	(60-140)	40	13
LCS1	Cimetidine		100	99.6	ng/L	100	(60-140)		
LCS2	Cimetidine		100	88.0	ng/L	88	(60-140)	30	12
MBLK	Cimetidine			<5	ng/L				
MRL_CHK	Cimetidine		5	3.86	ng/L	77	(50-150)		
MS_201709141145	Cimetidine	ND	100	130	ng/L	130	(60-140)		
MSD_201709141145	Cimetidine	ND	100	87.9	ng/L	88	(60-140)	40	39
LCS1	Cotinine		200	201	ng/L	100	(60-140)		
LCS2	Cotinine		200	195	ng/L	98	(60-140)	30	3.0
MBLK	Cotinine			<10	ng/L				
MRL_CHK	Cotinine		10	9.69	ng/L	97	(50-150)		
MS_201709141145	Cotinine	25	200	219	ng/L	97	(60-140)		
MSD_201709141145	Cotinine	25	200	198	ng/L	87	(60-140)	40	10
LCS1	Cyanazine		100	88.2	ng/L	88	(60-140)		
LCS2	Cyanazine		100	118	ng/L	118	(60-140)	30	29
MBLK	Cyanazine			<5	ng/L				
MRL_CHK	Cyanazine		5	5.79	ng/L	116	(50-150)		
MS_201709141145	Cyanazine	ND	100	63.6	ng/L	64	(60-140)		
MSD_201709141145	Cyanazine	ND	100	63.8	ng/L	64	(60-140)	40	0.31
LCS1	DACT		100	95.8	ng/L	96	(60-140)		
LCS2	DACT		100	93.0	ng/L	93	(60-140)	30	3.1
MBLK	DACT			<5	ng/L				
MRL_CHK	DACT		5	5.80	ng/L	116	(50-150)		
MS_201709141145	DACT	ND	100	121	ng/L	121	(60-140)		
MSD_201709141145	DACT	ND	100	70.7	ng/L	71	(60-140)	40	**53**
LCS1	DEA		100	104	ng/L	104	(60-140)		

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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	DEA		100	99.0	ng/L	99	(60-140)	30	4.9
MBLK	DEA			<5	ng/L				
MRL_CHK	DEA		5	5.91	ng/L	118	(50-150)		
MS_201709141145	DEA	8.4	100	17.1	ng/L	**8.7**	(60-140)		
MSD_201709141145	DEA	8.4	100	10.4	ng/L	**2**	(60-140)	40	**48**
LCS1	DEET		40	38.4	ng/L	96	(60-140)		
LCS2	DEET		40	31.1	ng/L	78	(60-140)	30	21
MBLK	DEET			<10	ng/L				
MRL_CHK	DEET		2	1.93	ng/L	97	(50-150)		
MS_201709141145	DEET	150	40	234	ng/L	**199**	(60-140)		
MSD_201709141145	DEET	150	40	161	ng/L	**18**	(60-140)	40	37
LCS1	Dehydronifedipine		100	96.8	ng/L	97	(60-140)		
LCS2	Dehydronifedipine		100	96.3	ng/L	96	(60-140)	30	0.52
MBLK	Dehydronifedipine			<5	ng/L				
MRL_CHK	Dehydronifedipine		5	5.80	ng/L	116	(50-150)		
MS_201709141145	Dehydronifedipine	ND	100	55.8	ng/L	**52**	(60-140)		
MSD_201709141145	Dehydronifedipine	ND	100	57.1	ng/L	**54**	(60-140)	40	2.3
LCS1	DIA		100	102	ng/L	102	(60-140)		
LCS2	DIA		100	97.8	ng/L	98	(60-140)	30	4.1
MBLK	DIA			<5	ng/L				
MRL_CHK	DIA		5	4.34	ng/L	87	(50-150)		
MS_201709141145	DIA	ND	100	96.0	ng/L	96	(60-140)		
MSD_201709141145	DIA	ND	100	86.0	ng/L	86	(60-140)	40	11
LCS1	Diazepam		100	110	ng/L	110	(60-140)		
LCS2	Diazepam		100	106	ng/L	106	(60-140)	30	3.7
MBLK	Diazepam			<5	ng/L				
MRL_CHK	Diazepam		5	4.83	ng/L	97	(50-150)		
MS_201709141145	Diazepam	ND	100	136	ng/L	136	(60-140)		
MSD_201709141145	Diazepam	ND	100	107	ng/L	107	(60-140)	40	24
LCS1	Dilantin		400	385	ng/L	96	(60-140)		
LCS2	Dilantin		400	340	ng/L	85	(60-140)	30	12
MBLK	Dilantin			<20	ng/L				
MRL_CHK	Dilantin		20	19.8	ng/L	99	(50-150)		
MS_201709141145	Dilantin	ND	400	394	ng/L	99	(60-140)		
MSD_201709141145	Dilantin	ND	400	430	ng/L	108	(60-140)	40	8.7
LCS1	Diltiazem		100	102	ng/L	102	(60-140)		
LCS2	Diltiazem		100	96.0	ng/L	96	(60-140)	30	6.1
MBLK	Diltiazem			<5	ng/L				

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Diltiazem		5	5.14	ng/L	103	(50-150)		
MS_201709141145	Diltiazem	120	100	248	ng/L	131	(60-140)		
MSD_201709141145	Diltiazem	120	100	282	ng/L	**166**	(60-140)	40	13
LCS1	Diuron		100	99.1	ng/L	99	(60-140)		
LCS2	Diuron		100	96.8	ng/L	97	(60-140)	30	2.2
MBLK	Diuron			<5	ng/L				
MRL_CHK	Diuron		5	5.24	ng/L	105	(50-150)		
MS_201709141145	Diuron	90	100	194	ng/L	103	(60-140)		
MSD_201709141145	Diuron	90	100	181	ng/L	91	(60-140)	40	6.9
LCS1	Erythromycin		200	204	ng/L	102	(60-140)		
LCS2	Erythromycin		200	192	ng/L	96	(60-140)	30	6.1
MBLK	Erythromycin			<10	ng/L				
MRL_CHK	Erythromycin		10	11.1	ng/L	111	(50-150)		
MS_201709141145	Erythromycin	12	200	251	ng/L	120	(60-140)		
MSD_201709141145	Erythromycin	12	200	285	ng/L	137	(60-140)	40	13
LCS1	Flumeqine		200	206	ng/L	103	(60-140)		
LCS2	Flumeqine		200	197	ng/L	99	(60-140)	30	5.0
MBLK	Flumeqine			<10	ng/L				
MRL_CHK	Flumeqine		10	12.3	ng/L	123	(50-150)		
MS_201709141145	Flumeqine	ND	200	96.5	ng/L	**48**	(60-140)		
MSD_201709141145	Flumeqine	ND	200	91.9	ng/L	**46**	(60-140)	40	4.9
LCS1	Fluoxetine		100	80.7	ng/L	81	(60-140)		
LCS2	Fluoxetine		100	102	ng/L	102	(60-140)	30	23
MBLK	Fluoxetine			<10	ng/L				
MRL_CHK	Fluoxetine		5	3.61	ng/L	72	(50-150)		
MS_201709141145	Fluoxetine	ND	100	84.5	ng/L	85	(60-140)		
MSD_201709141145	Fluoxetine	ND	100	69.2	ng/L	69	(60-140)	40	20
LCS1	Isoproturon		400	417	ng/L	104	(60-140)		
LCS2	Isoproturon		400	410	ng/L	102	(60-140)	30	1.7
MBLK	Isoproturon			<20	ng/L				
MRL_CHK	Isoproturon		20	19.0	ng/L	95	(50-150)		
MS_201709141145	Isoproturon	ND	400	265	ng/L	66	(60-140)		
MSD_201709141145	Isoproturon	ND	400	284	ng/L	71	(60-140)	40	6.9
LCS1	Ketoprofen		100	119	ng/L	119	(60-140)		
LCS2	Ketoprofen		100	108	ng/L	108	(60-140)	30	9.7
MBLK	Ketoprofen			<5	ng/L				
MRL_CHK	Ketoprofen		5	5.38	ng/L	108	(50-150)		
MS_201709141145	Ketoprofen	ND	100	89.2	ng/L	89	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709141145	Ketoprofen	ND	100	67.5	ng/L	68	(60-140)	40	28
LCS1	Ketorolac		100	107	ng/L	107	(60-140)		
LCS2	Ketorolac		100	104	ng/L	104	(60-140)	30	2.8
MBLK	Ketorolac			<5	ng/L				
MRL_CHK	Ketorolac		5	5.83	ng/L	117	(50-150)		
MS_201709141145	Ketorolac	ND	100	69.9	ng/L	70	(60-140)		
MSD_201709141145	Ketorolac	ND	100	54.3	ng/L	**54**	(60-140)	40	25
LCS1	Lidocaine		100	103	ng/L	103	(60-140)		
LCS2	Lidocaine		100	93.1	ng/L	93	(60-140)	30	10
MBLK	Lidocaine			<5	ng/L				
MRL_CHK	Lidocaine		5	4.70	ng/L	94	(50-150)		
MS_201709141145	Lidocaine	390	100	454	ng/L	64	(60-140)		
MSD_201709141145	Lidocaine	390	100	460	ng/L	70	(60-140)	40	1.3
LCS1	Lincomycin		200	205	ng/L	103	(60-140)		
LCS2	Lincomycin		200	199	ng/L	99	(60-140)	30	3.0
MBLK	Lincomycin			<10	ng/L				
MRL_CHK	Lincomycin		10	12.1	ng/L	121	(50-150)		
MS_201709141145	Lincomycin	ND	200	0	ng/L	**0**	(60-140)		
MSD_201709141145	Lincomycin	ND	200	0	ng/L	**0**	(60-140)	40	**1000**
LCS1	Linuron		100	104	ng/L	104	(60-140)		
LCS2	Linuron		100	92.6	ng/L	93	(60-140)	30	12
MBLK	Linuron			<5	ng/L				
MRL_CHK	Linuron		5	4.65	ng/L	93	(50-150)		
MS_201709141145	Linuron	ND	100	142	ng/L	**142**	(60-140)		
MSD_201709141145	Linuron	ND	100	136	ng/L	136	(60-140)	40	4.3
LCS1	Lopressor		400	390	ng/L	98	(60-140)		
LCS2	Lopressor		400	333	ng/L	83	(60-140)	30	16
MBLK	Lopressor			<20	ng/L				
MRL_CHK	Lopressor		20	19.0	ng/L	95	(50-150)		
MS_201709141145	Lopressor	370	400	691	ng/L	79	(60-140)		
MSD_201709141145	Lopressor	370	400	651	ng/L	69	(60-140)	40	6.0
LCS1	Meclofenamic Acid		100	102	ng/L	102	(60-140)		
LCS2	Meclofenamic Acid		100	98.6	ng/L	99	(60-140)	30	3.4
MBLK	Meclofenamic Acid			<5	ng/L				
MRL_CHK	Meclofenamic Acid		5	4.77	ng/L	95	(50-150)		
MS_201709141145	Meclofenamic Acid	16	100	151	ng/L	135	(60-140)		
MSD_201709141145	Meclofenamic Acid	16	100	148	ng/L	131	(60-140)	40	2.0
LCS1	Meprobamate		100	111	ng/L	111	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Meprobamate		100	89.0	ng/L	89	(60-140)	30	22
MBLK	Meprobamate			<5	ng/L				
MRL_CHK	Meprobamate		5	4.91	ng/L	98	(50-150)		
MS_201709141145	Meprobamate	15	100	54.2	ng/L	**39**	(60-140)		
MSD_201709141145	Meprobamate	15	100	40.2	ng/L	**25**	(60-140)	40	30
LCS1	Metazachlor		100	94.8	ng/L	95	(60-140)		
LCS2	Metazachlor		100	127	ng/L	127	(60-140)	30	29
MBLK	Metazachlor			<5	ng/L				
MRL_CHK	Metazachlor		5	2.55	ng/L	51	(50-150)		
MS_201709141145	Metazachlor	ND	100	61.0	ng/L	61	(60-140)		
MSD_201709141145	Metazachlor	ND	100	75.0	ng/L	75	(60-140)	40	21
LCS1	Metolachlor		100	102	ng/L	102	(60-140)		
LCS2	Metolachlor		100	93.4	ng/L	93	(60-140)	30	8.8
MBLK	Metolachlor			<5	ng/L				
MRL_CHK	Metolachlor		5	5.62	ng/L	112	(50-150)		
MS_201709141145	Metolachlor	ND	100	106	ng/L	106	(60-140)		
MSD_201709141145	Metolachlor	ND	100	104	ng/L	104	(60-140)	40	1.9
LCS1	Nifedipine		400	261	ng/L	65	(60-140)		
LCS2	Nifedipine		400	278	ng/L	70	(60-140)	30	6.3
MBLK	Nifedipine			<20	ng/L				
MRL_CHK	Nifedipine		20	13.4	ng/L	67	(50-150)		
MS_201709141145	Nifedipine	ND	400	497	ng/L	124	(60-140)		
MSD_201709141145	Nifedipine	ND	400	546	ng/L	136	(60-140)	40	9.4
LCS1	Norethisterone		100	89.8	ng/L	90	(60-140)		
LCS2	Norethisterone		100	106	ng/L	107	(60-140)	30	18
MBLK	Norethisterone			<5	ng/L				
MRL_CHK	Norethisterone		5	4.31	ng/L	86	(50-150)		
MS_201709141145	Norethisterone	ND	100	107	ng/L	107	(60-140)		
MSD_201709141145	Norethisterone	ND	100	133	ng/L	133	(60-140)	40	22
LCS1	Oxolinic acid		100	103	ng/L	103	(60-140)		
LCS2	Oxolinic acid		100	118	ng/L	118	(60-140)	30	14
MBLK	Oxolinic acid			<5	ng/L				
MRL_CHK	Oxolinic acid		5	4.20	ng/L	84	(50-150)		
MS_201709141145	Oxolinic acid	ND	100	140	ng/L	140	(60-140)		
MSD_201709141145	Oxolinic acid	ND	100	152	ng/L	**152**	(60-140)	40	8.2
LCS1	Pentoxifylline		100	86.2	ng/L	86	(60-140)		
LCS2	Pentoxifylline		100	127	ng/L	127	(60-140)	30	**38**
MBLK	Pentoxifylline			<5	ng/L				

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Report: 686568
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Pentoxifylline		5	6.52	ng/L	130	(50-150)		
MS_201709141145	Pentoxifylline	6.8	100	156	ng/L	**150**	(60-140)		
MSD_201709141145	Pentoxifylline	6.8	100	118	ng/L	111	(60-140)	40	28
LCS1	Phenazone		100	101	ng/L	101	(60-140)		
LCS2	Phenazone		100	97.8	ng/L	98	(60-140)	30	3.2
MBLK	Phenazone			<5	ng/L				
MRL_CHK	Phenazone		5	5.99	ng/L	120	(50-150)		
MS_201709141145	Phenazone	ND	100	77.2	ng/L	77	(60-140)		
MSD_201709141145	Phenazone	ND	100	79.0	ng/L	79	(60-140)	40	2.3
LCS1	Primidone		100	109	ng/L	109	(60-140)		
LCS2	Primidone		100	82.8	ng/L	83	(60-140)	30	27
MBLK	Primidone			<5	ng/L				
MRL_CHK	Primidone		5	3.06	ng/L	61	(50-150)		
MS_201709141145	Primidone	93	100	163	ng/L	70	(60-140)		
MSD_201709141145	Primidone	93	100	179	ng/L	86	(60-140)	40	9.4
LCS1	Progesterone		100	108	ng/L	109	(60-140)		
LCS2	Progesterone		100	98.9	ng/L	99	(60-140)	30	9.7
MBLK	Progesterone			<5	ng/L				
MRL_CHK	Progesterone		5	4.68	ng/L	94	(50-150)		
MS_201709141145	Progesterone	ND	100	134	ng/L	134	(60-140)		
MSD_201709141145	Progesterone	ND	100	123	ng/L	123	(60-140)	40	8.6
LCS1	Propazine		100	94.8	ng/L	95	(60-140)		
LCS2	Propazine		100	83.1	ng/L	83	(60-140)	30	13
MBLK	Propazine			<5	ng/L				
MRL_CHK	Propazine		5	4.86	ng/L	97	(50-150)		
MS_201709141145	Propazine	ND	100	124	ng/L	124	(60-140)		
MSD_201709141145	Propazine	ND	100	113	ng/L	113	(60-140)	40	9.3
LCS1	Quinoline		100	104	ng/L	104	(60-140)		
LCS2	Quinoline		100	96.3	ng/L	96	(60-140)	30	7.7
MBLK	Quinoline			<5	ng/L				
MRL_CHK	Quinoline		5	6.64	ng/L	133	(50-150)		
MS_201709141145	Quinoline	36	100	169	ng/L	133	(60-140)		
MSD_201709141145	Quinoline	36	100	172	ng/L	136	(60-140)	40	1.8
LCS1	Simazine		100	100	ng/L	100	(60-140)		
LCS2	Simazine		100	96.2	ng/L	96	(60-140)	30	3.9
MBLK	Simazine			<5	ng/L				
MRL_CHK	Simazine		5	5.62	ng/L	112	(50-150)		
MS_201709141145	Simazine	ND	100	135	ng/L	135	(60-140)		

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Report: 686568
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Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709141145	Simazine	ND	100	140	ng/L	140	(60-140)	40	3.6
LCS1	Sulfachloropyridazine		100	94.5	ng/L	95	(60-140)		
LCS2	Sulfachloropyridazine		100	82.8	ng/L	83	(60-140)	30	13
MBLK	Sulfachloropyridazine			<5	ng/L				
MRL_CHK	Sulfachloropyridazine		5	3.93	ng/L	79	(50-150)		
MS_201709141145	Sulfachloropyridazine	ND	100	13.4	ng/L	**13**	(60-140)		
MSD_201709141145	Sulfachloropyridazine	ND	100	11.5	ng/L	**12**	(60-140)	40	15
LCS1	Sulfadiazine		100	97.2	ng/L	97	(60-140)		
LCS2	Sulfadiazine		100	96.7	ng/L	97	(60-140)	30	0.52
MBLK	Sulfadiazine			<5	ng/L				
MRL_CHK	Sulfadiazine		5	3.42	ng/L	68	(50-150)		
MS_201709141145	Sulfadiazine	ND	100	220	ng/L	**220**	(60-140)		
MSD_201709141145	Sulfadiazine	ND	100	227	ng/L	**227**	(60-140)	40	3.1
LCS1	Sulfadimethoxine		100	102	ng/L	102	(60-140)		
LCS2	Sulfadimethoxine		100	94.5	ng/L	95	(60-140)	30	7.6
MBLK	Sulfadimethoxine			<5	ng/L				
MRL_CHK	Sulfadimethoxine		5	3.36	ng/L	67	(50-150)		
MS_201709141145	Sulfadimethoxine	ND	100	109	ng/L	109	(60-140)		
MSD_201709141145	Sulfadimethoxine	ND	100	126	ng/L	127	(60-140)	40	15
LCS1	Sulfamerazine		100	106	ng/L	107	(60-140)		
LCS2	Sulfamerazine		100	140	ng/L	140	(60-140)	30	27
MBLK	Sulfamerazine			<5	ng/L				
MRL_CHK	Sulfamerazine		5	5.17	ng/L	103	(50-150)		
MS_201709141145	Sulfamerazine	ND	100	69.9	ng/L	70	(60-140)		
MSD_201709141145	Sulfamerazine	ND	100	65.1	ng/L	65	(60-140)	40	7.1
LCS1	Sulfamethazine		100	107	ng/L	107	(60-140)		
LCS2	Sulfamethazine		100	104	ng/L	104	(60-140)	30	2.8
MBLK	Sulfamethazine			<5	ng/L				
MRL_CHK	Sulfamethazine		5	5.73	ng/L	115	(50-150)		
MS_201709141145	Sulfamethazine	ND	100	20.9	ng/L	**21**	(60-140)		
MSD_201709141145	Sulfamethazine	ND	100	15.3	ng/L	**15**	(60-140)	40	31
LCS1	Sulfamethizole		100	94.8	ng/L	95	(60-140)		
LCS2	Sulfamethizole		100	95.8	ng/L	96	(60-140)	30	1.1
MBLK	Sulfamethizole			<5	ng/L				
MRL_CHK	Sulfamethizole		5	5.34	ng/L	107	(50-150)		
MS_201709141145	Sulfamethizole	ND	100	8.64	ng/L	**8.6**	(60-140)		
MSD_201709141145	Sulfamethizole	ND	100	20.4	ng/L	**20**	(60-140)	40	**81**
LCS1	Sulfamethoxazole		100	95.6	ng/L	96	(60-140)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Sulfamethoxazole		100	94.5	ng/L	95	(60-140)	30	1.2
MBLK	Sulfamethoxazole			<5	ng/L				
MRL_CHK	Sulfamethoxazole		5	5.37	ng/L	107	(50-150)		
MS_201709141145	Sulfamethoxazole	460	100	377	ng/L	**-86.2**	(60-140)		
MSD_201709141145	Sulfamethoxazole	460	100	352	ng/L	**-110**	(60-140)	40	6.9
LCS1	Sulfathiazole		100	96.7	ng/L	97	(60-140)		
LCS2	Sulfathiazole		100	95.3	ng/L	95	(60-140)	30	1.5
MBLK	Sulfathiazole			<5	ng/L				
MRL_CHK	Sulfathiazole		5	5.90	ng/L	118	(50-150)		
MS_201709141145	Sulfathiazole	ND	100	134	ng/L	134	(60-140)		
MSD_201709141145	Sulfathiazole	ND	100	104	ng/L	104	(60-140)	40	25
LCS1	TCEP		100	92.4	ng/L	92	(60-140)		
LCS2	TCEP		100	138	ng/L	138	(60-140)	30	**40**
MBLK	TCEP			<10	ng/L				
MRL_CHK	TCEP		5	4.59	ng/L	92	(50-150)		
MS_201709141145	TCEP	330	100	412	ng/L	84	(60-140)		
MSD_201709141145	TCEP	330	100	374	ng/L	**47**	(60-140)	40	9.7
LCS1	TCPP		100	102	ng/L	102	(40-160)		
LCS2	TCPP		100	113	ng/L	113	(40-160)	30	10
MBLK	TCPP			<100	ng/L				
MRL_CHK	TCPP		5	3.19	ng/L	64	(40-160)		
MS_201709141145	TCPP	620	100	719	ng/L	93	(40-160)		
MSD_201709141145	TCPP	620	100	753	ng/L	128	(40-160)	60	4.6
LCS1	TDCPP		400	484	ng/L	121	(40-160)		
LCS2	TDCPP		400	292	ng/L	73	(40-160)	30	**50**
MBLK	TDCPP			<100	ng/L				
MRL_CHK	TDCPP		20	30.6	ng/L	153	(40-160)		
MS_201709141145	TDCPP	500	400	905	ng/L	102	(40-160)		
MSD_201709141145	TDCPP	500	400	1110	ng/L	154	(40-160)	60	20
LCS1	Testosterone		100	110	ng/L	111	(60-140)		
LCS2	Testosterone		100	70.1	ng/L	70	(60-140)	30	**45**
MBLK	Testosterone			<5	ng/L				
MRL_CHK	Testosterone		5	5.05	ng/L	101	(50-150)		
MS_201709141145	Testosterone	ND	100	132	ng/L	131	(60-140)		
MSD_201709141145	Testosterone	ND	100	139	ng/L	138	(60-140)	40	5.2
LCS1	Theobromine		100	83.0	ng/L	83	(60-140)		
LCS2	Theobromine		100	78.1	ng/L	78	(60-140)	30	6.1
MBLK	Theobromine			<5	ng/L				

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Theobromine		5	3.90	ng/L	78	(50-150)		
MS_201709141145	Theobromine	140	100	263	ng/L	128	(60-140)		
MSD_201709141145	Theobromine	140	100	243	ng/L	108	(60-140)	40	7.9
LCS1	Theophylline		200	200	ng/L	100	(60-140)		
LCS2	Theophylline		200	185	ng/L	93	(60-140)	30	7.8
MBLK	Theophylline			<10	ng/L				
MRL_CHK	Theophylline		10	13.3	ng/L	133	(50-150)		
MS_201709141145	Theophylline	32	200	24.8	ng/L	**-3.48**	(60-140)		
MSD_201709141145	Theophylline	32	200	67.5	ng/L	**18**	(60-140)	40	**93**
LCS1	Trimethoprim		100	103	ng/L	103	(60-140)		
LCS2	Trimethoprim		100	99.1	ng/L	99	(60-140)	30	3.9
MBLK	Trimethoprim			<5	ng/L				
MRL_CHK	Trimethoprim		5	4.84	ng/L	97	(50-150)		
MS_201709141145	Trimethoprim	110	100	254	ng/L	**142**	(60-140)		
MSD_201709141145	Trimethoprim	110	100	222	ng/L	110	(60-140)	40	13

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ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY
AT-1807

Laboratory Report

for

State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attention: Joanna Seto

Date of Issue
10/21/2017

EUROFINS EATON ANALYTICAL, INC.

NELAP ACCREDITED TNI LABORATORY
ORELAP 4034

Report: 688070
Project: PPCP-HAWAII
Group: Maui

RCZ: Rick Zimmer

Project Manager

* Accredited in accordance with TNI 2009 and ISO/IEC 17025:2005.
* Laboratory certifies that the test results meet all **TNI 2009 and ISO/IEC 17025:2005** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.

STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	**Michigan**	9906
Arizona	AZ0778	**Mississippi**	Certified
Arkansas	Certified	**Montana**	Cert 0035
California-Monrovia-ELAP	2813	**Nebraska**	Certified
California-Colton- ELAP	2812	**Nevada**	CA00006-2016
California-Folsom- ELAP	2820	**New Hampshire ***	2959
California-Fresno- ELAP	2966	**New Jersey ***	CA 008
Colorado	Certified	**New Mexico**	Certified
Connecticut	PH-0107	**New York ***	11320
Delaware	CA 006	**North Carolina**	06701
Florida *	E871024	**North Dakota**	R-009
Georgia	947	**Oregon (Primary AB) ***	**ORELAP 4034**
Guam	17-005R	**Pennsylvania ***	68-565
Hawaii	Certified	**Puerto Rico**	Certified
Idaho	Certified	**Rhode Island**	LAO00326
Illinois *	200033	**South Carolina**	87016
Indiana	C-CA-01	**South Dakota**	Certified
Iowa - Asbestos	413	**Tennessee**	TN02839
Kansas *	E-10268	**Texas ***	T104704230-16-11
Kentucky	90107	**Utah ***	CA000062017-11
Louisiana *	LA170009	**Vermont**	VT0114
Maine	CA0006	**Virginia ***	460260
Maryland	224	**Washington**	C838
Commonwealth of Northern Marianas Is.	MP0004	**EPA Region 5**	Certified
Massachusetts	M-CA006	**Los Angeles County Sanitation Districts**	10264

* NELAP/TNI Recognized Accreditation Bodies

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ISO 17025 Accredited Method List

The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB.

Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environ-mental (Drinking Water)	Environ-mental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
1,4-Dioxane	EPA 522	x		x
2,3,7,8-TCDD	Modified EPA 1613B	x		x
Acrylamide	In House Method (2440)	x		x
Alkalinity	SM 2320B	x	x	x
Ammonia	EPA 350.1		x	x
Ammonia	SM 4500-NH3 H		x	x
Anions and DBPs by IC	EPA 300.0	x	x	x
Anions and DBPs by IC	EPA 300.1	x		x
Asbestos	EPA 100.2	x	x	
Bicarbonate Alkalinity as HCO3	SM 2320B	x	x	x
BOD / CBOD	SM 5210B		x	x
Bromate	In House Method (2447)	x		x
Carbamates	EPA 531.2	x		x
Carbonate as CO3	SM 2330B	x	x	x
Carbonyls	EPA 556	x		x
COD	EPA 410.4 / SM 5220D		x	
Chloramines	SM 4500-CL G	x	x	x
Chlorinated Acids	EPA 515.4	x		x
Chlorinated Acids	EPA 555	x		x
Chlorine Dioxide	SM 4500-CLO2 D	x		x
Chlorine -Total/Free/ Combined Residual	SM 4500-Cl G	x	x	x
Conductivity	EPA 120.1		x	
Conductivity	SM 2510B	x	x	x
Corrosivity (Langelier Index)	SM 2330B	x		x
Cryptosporidium	EPA 1623	x		x
Cyanide, Amenable	SM 4500-CN G	x	x	
Cyanide, Free	SM 4500CN F	x	x	x
Cyanide, Total	EPA 335.4	x	x	x
Cyanogen Chloride (screen)	In House Method (2470)	x		x
Diquat and Paraquat	EPA 549.2	x		x
DBP/HAA	SM 6251B	x		x
Dissolved Oxygen	SM 4500-O G		x	x
DOC	SM 5310C	x		x
E. Coli	(MTF/EC+MUG)	x		x
E. Coli	CFR 141.21(f)(6)(i)	x		x
E. Coli	SM 9223		x	
E. Coli (Enumeration)	SM 9221B.1/ SM 9221F	x		x
E. Coli (Enumeration)	SM 9223B	x		x
EDB/DCBP	EPA 504.1	x		
EDB/DBCP and DBP	EPA 551.1	x		x
EDTA and NTA	In House Method (2454)	x		x
Endothall	EPA 548.1	x		x
Endothall	In-house Method (2445)	x		x
Enterococci	SM 9230B	x	x	
Fecal Coliform	SM 9221 E (MTF/EC)	x		
Fecal Coliform	SM 9221C, E (MTF/EC)		x	
Fecal Coliform (Enumeration)	SM 9221E (MTF/EC)	x		x
Fecal Coliform with Chlorine Present	SM 9221E		x	
Fecal Streptococci	SM 9230B	x	x	
Fluoride	SM 4500-F C	x	x	x
Giardia	EPA 1623	x		x
Glyphosate	EPA 547	x		x
Gross Alpha/Beta	EPA 900.0	x	x	x
Gross Alpha Coprecipitation	SM 7110 C	x	x	x
Hardness	SM 2340B	x	x	x
Heterotrophic Bacteria	In House Method (2439)	x		x
Heterotrophic Bacteria	SM 9215 B	x		x
Hexavalent Chromium	EPA 218.6	x	x	x
Hexavalent Chromium	EPA 218.7	x		x
Hexavalent Chromium	SM 3500-Cr B		x	
Hormones	EPA 539	x		x
Hydroxide as OH Calc.	SM 2330B	x		x
Kjeldahl Nitrogen	EPA 351.2		x	
Legionella	CDC Legionella	x		x
Mercury	EPA 245.1	x	x	x
Metals	EPA 200.7 / 200.8	x	x	x
Microcystin LR	ELISA (2360)	x		x
NDMA	EPA 521	x		x
NDMA	TQ In house method based on EPA 521 (2425)	x		x
Nitrate/Nitrite Nitrogen	EPA 353.2	x	x	x
OCL, Pesticides/PCB	EPA 505	x		x
Ortho Phosphate	EPA 365.1	x	x	x
Ortho Phosphate	SM 4500P E			x
Ortho Phosphorous	SM 4500P E	x		
Oxyhalides Disinfection Byproducts	EPA 317.0	x		x
Perchlorate	EPA 331.0	x		x
Perchlorate (low and high)	EPA 314.0	x		x
Perfluorinated Alkyl Acids	EPA 537	x		x
pH	EPA 150.1	x		
pH	SM 4500-H+B	x	x	x
Phenylurea Pesticides/ Herbicides	In House Method, based on EPA 532 (2448)	x		x
Pseudomonas	IDEXX Pseudalert (2461)	x		x
Radium-226	GA Institute of Tech	x		x
Radium-228	GA Institute of Tech	x		x
Radon-222	SM 7500RN	x		x
Residue, Filterable	SM 2540C	x	x	x
Residue, Non-filterable	SM 2540D		x	
Residue, Total	SM 2540B		x	x
Residue, Volatile	EPA 160.4		x	
Semi-VOC	EPA 525.2	x		x
Semi-VOC	EPA 625		x	x
Silica	SM 4500-Si D	x	x	
Silica	SM 4500-SiO2 C	x	x	
Sulfide	SM 4500-$S^{=}$ D		x	
Sulfite	SM 4500-SO^{3}B	x	x	x
Surfactants	SM 5540C	x	x	x
Taste and Odor Analytes	SM 6040E	x		x
Total Coliform (P/A)	SM 9221 A, B	x		x
Total Coliform (Enumeration)	SM 9221 A, B, C	x		x
Total Coliform / E. coli	Colisure SM 9223	x		x
Total Coliform	SM 9221B		x	
Total Coliform with Chlorine Present	SM 9221B		x	
Total Coliform / E.coli (P/A and Enumeration)	SM 9223	x		x
TOC	SM 5310C	x	x	x
TOX	SM 5320B		x	
Total Phenols	EPA 420.1		x	
Total Phenols	EPA 420.4	x	x	x
Total Phosphorous	SM 4500 P E		x	
Turbidity	EPA 180.1	x	x	x
Turbidity	SM 2130B	x	x	
Uranium by ICP/MS	EPA 200.8	x		x
UV 254	SM 5910B	x		
VOC	EPA 524.2/EPA 524.3	x		x
VOC	EPA 624		x	x
VOC	EPA SW 846 8260	x		x
VOC	In House Method (2411)	x		x
Yeast and Mold	SM 9610	x		x

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Acknowledgement of Samples Received

Addr: **State of Hawaii DOH**
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attn: Joanna Seto
Phone: 808-586-4258

Client ID: HAWAII-DOH
Folder #: 688070
Project: PPCP-HAWAII
Sample Group: Maui

Project Manager: Rick Zimmer
Phone: 626-386-1157

The following samples were received from you on **September 21, 2017** at **1250**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical, Inc..

Sample #	Sample ID	Sample Date
201709210377	Pukalani WWRF Influent	09/18/2017 0920
	Static ID: 091817-H022	
	@DX_ABI_NEG @DX_ABI_POS	

Test Description

@DX_ABI_NEG -- Endocrine Disruptors Negative Mode - SPE

@DX_ABI_POS -- Endocrine Disruptors Positive Mode - SPE

CHAIN OF CUSTODY RECORD

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750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY: 688570

LOGIN COMMENTS: _____ SAMPLES CHECKED AGAINST COC BY: _____

SAMPLES LOGGED IN BY: _____

SAMPLE TEMP RECEIVED AT: SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

☐ _____ (Other) IR Gun ID = _____ (Observation= _____ °C) (Corr.Factor _____ °C) (Final = _____ °C)

☒ Monrovia IR Gun ID = 570A (Observation= 4.2 °C) (Corr.Factor +.2 °C) (Final = 4.4 °C)

Compliance Acceptance Criteria: (Chemistry: 4 ± 2 °C) (Microbiology: < 10°C)

TYPE OF ICE: Real ____ Synthetic X No Ice ____ CONDITION OF ICE: Frozen X Partially Frozen ____ Thawed ____ N/A ____

METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: _____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME:	PROJECT CODE:
HI DEPT OF HEALTH - SAFE DRINKING WATER BRANCH	PPCP-HAWAII

EEA CLIENT CODE:	COC ID:	SAMPLE GROUP:
HAWAII-DOH		Baseline

COMPLIANCE SAMPLES (check for yes) ☐ - Requires state forms ☐

NON-COMPLIANCE SAMPLES (check for yes) X

REGULATION INVOLVED: _____ (eg. SDWA, NPDES, etc.)

Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION

SEE ATTACHED KIT ORDER FOR ANALYSES X (check for yes), *OR*

List ALL ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

TAT requested: rush by adv notice only STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA	PPCP	SAMPLER COMMENTS
9/18/17	9:20	PUKALANI		WW			2	SAMPLE STORED IN
		RAW INFLUENT WASTEWATER						SDWB MONITORING
		091817-H022						SECTION REFRIG/
								LOCKED STORAGE
		pH - 7.47						ROOM UNTIL PACKED
		Temp. - 30.8						FOR FEDEX
		Cond. - 823 MS						SHIPMENT ON 9/20/17
		TDS - 586 ppm	(586)					
		SALINITY - 0.43 ppt	(0.43)					
		TURBIDITY - 334 NTU						

* **MATRIX TYPES:** **RSW** = Raw Surface Water; **RGW** = Raw Ground Water; **CFW** = Chlor(am)inated Finished Water; **FW** = Other Finished Water; **SEAW** = Sea Water; **WW** = Waste Water; **BW** = Bottled Water; **SW** = Storm Water; **SO** = Soil; **SL** = Sludge; **O** = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	Daniel Chang	DANIEL CHANG	HI DEPT OF HEALTH - SAFE DRINKNG WATER	9/18/17	9:20AM
RELINQUISHED BY:	Daniel Chang	DANIEL CHANG	HI DOH - SAFE DRINKING WATER	9/18/17	5:30PM
RECEIVED BY:	[signature]	DAVID KATAHARA	"	9/18/17	5:30PM
RELINQUISHED BY:	[signature]	DAVID KATAHARA	"	9/20/17	10AM
RECEIVED BY:	[signature]	CHRIS AVILA	EEA	9/21/17	1250

QA FO 0029.2 (Version 2) (08/28/2014)

PAGE 3 OF 5

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Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

Laboratory Hits

Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201709210377	**Pukalani WWRF Influent**				
10/06/2017 18:32	1,7-Dimethylxanthine		8800		ng/L	100
10/06/2017 18:32	4-nonylphenol - semi quantitative		3900		ng/L	1000
10/06/2017 18:32	Acesulfame-K		39000		ng/L	200
10/06/2017 13:24	Acetaminophen		460000		ng/L	2500
10/06/2017 18:32	Albuterol		110		ng/L	50
10/06/2017 13:24	Amoxicillin (semi-quantitative)		13000		ng/L	10000
10/06/2017 18:32	Andorostenedione		1200		ng/L	50
10/06/2017 18:32	Atenolol		1500		ng/L	50
10/06/2017 18:32	Bezafibrate		120		ng/L	50
10/06/2017 18:32	Butalbital		1400		ng/L	50
10/06/2017 13:24	Caffeine		150000		ng/L	2500
10/06/2017 18:32	Carisoprodol		150		ng/L	50
10/06/2017 18:32	Cimetidine (semi quantitative)		8300		ng/L	50
10/06/2017 18:32	Cotinine		4500		ng/L	100
10/06/2017 18:32	Cyanazine		460		ng/L	50
10/06/2017 18:32	DEET		300		ng/L	100
10/06/2017 18:32	Diclofenac		130		ng/L	50
10/06/2017 18:32	Diltiazem		850		ng/L	50
10/06/2017 18:32	Diuron		220		ng/L	50
10/06/2017 18:32	Estrone		75		ng/L	50
10/06/2017 18:32	Gemfibrozil		3000		ng/L	50
10/06/2017 18:32	Ibuprofen		23000		ng/L	100
10/06/2017 18:32	Iohexal		230		ng/L	100
10/06/2017 18:32	Lidocaine		3500		ng/L	50
10/06/2017 18:32	Lipitor (Atorvastatin)		2100		ng/L	1000
10/06/2017 18:32	Lopressor		2700		ng/L	200
10/06/2017 18:32	Meclofenamic Acid		120		ng/L	50
10/06/2017 18:32	Meprobamate		1200		ng/L	50
10/06/2017 18:32	Methylparaben		1200		ng/L	200
10/06/2017 18:32	Naproxen		9200		ng/L	100
10/06/2017 18:32	Pentoxifylline		100		ng/L	50
10/06/2017 18:32	Primidone		400		ng/L	50
10/06/2017 18:32	Progesterone		180		ng/L	50
10/06/2017 18:32	Propylparaben		840		ng/L	50
10/06/2017 18:32	Quinoline		50		ng/L	50

SUMMARY OF POSITIVE DATA ONLY

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Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

Laboratory Hits

Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
10/06/2017 18:32	Sucralose		89000		ng/L	1000
10/06/2017 18:32	Sulfadiazine		150		ng/L	50
10/06/2017 18:32	Sulfadimethoxine		60		ng/L	50
10/06/2017 18:32	Sulfamethoxazole		550		ng/L	50
10/06/2017 18:32	TCEP		120		ng/L	100
10/06/2017 18:32	Testosterone		120		ng/L	50
10/06/2017 13:24	Theobromine		41000		ng/L	5000
10/06/2017 18:32	Theophylline (semi-quantitative)		8900		ng/L	200
10/06/2017 18:32	Triclocarban		57		ng/L	50
10/06/2017 18:32	Triclosan		1000		ng/L	100
10/06/2017 18:32	Trimethoprim		430		ng/L	50

SUMMARY OF POSITIVE DATA ONLY

eurofins | Eaton Analytical

Tel: (626) 386-1100
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1 800 566 LABS (1 800 566 5227)

Laboratory Data

Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Pukalani WWRF Influent (201709210377) — **Sampled on 09/18/2017 0920**

Static ID: 091817-H022

LC-MS-MS - Endocrine Disruptors Positive Mode - SPE

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/06/17 18:32		1034287	(LC-MS-MS)	1,7-Dimethylxanthine	8800	ng/L	34	100	10
	10/06/17 13:24		1034287	(LC-MS-MS)	Acetaminophen	460000	ng/L	1500	2500	500
	10/06/17 18:32		1034287	(LC-MS-MS)	Albuterol	110	ng/L	24	50	10
	10/06/17 13:24		1034287	(LC-MS-MS)	Amoxicillin (semi-Nuantitative)	13000	ng/L	3200	10000	500
	10/06/17 18:32		1034287	(LC-MS-MS)	Andorostenedione	1200	ng/L	17	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Atenolol	1500	ng/L	39	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Atrazine	q D	ng/L	23	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Bezafibrate	120	ng/L	35	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Bromacil	q D	ng/L	32	50	10
	10/06/17 13:24		1034287	(LC-MS-MS)	Caffeine	150000	ng/L	2200	2500	500
	10/06/17 18:32		1034287	(LC-MS-MS)	Carbadox	q D	ng/L	42	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Carbamazepine	q D	ng/L	12	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Carisoprodol	150	ng/L	12	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Chloridazon	q D	ng/L	16	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Chlorotoluron	q D	ng/L	8.9	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Cimetidine (semi Nuantitative)	8300	ng/L	27	50	10
	09/27/17 09:56		1030288	(LC-MS-MS)	Ciprofloxacin - Cipro	q D	ng/L	20	100	1
	10/06/17 18:32		1034287	(LC-MS-MS)	Cotinine	4500	ng/L	48	100	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Cyanazine	460	ng/L	17	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	DACT	q D	ng/L	39	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	DEA	q D	ng/L	15	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	DEET	300	ng/L	11	100	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Dehydronifedipine	q D	ng/L	14	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	DIA	q D	ng/L	24	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Diazepam	q D	ng/L	21	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Dilantin	q D	ng/L	130	200	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Diltiazem	850	ng/L	30	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Diuron	220	ng/L	18	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Erythromycin	q D	ng/L	40	100	10
	10/06/17 18:32		1034287	(LC-MS-MS)	FlumeNine	q D	ng/L	71	100	10

Rounding on totals after summation.
(c) - Indicates calculated results.
q D - Analyte was not detected at the calculated MDL.
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the reNuired QC criteria.

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Tel: (626) 386-1100
Fax: (866) 988-3757
1 800 566 LABS (1 800 566 5227)

Laboratory Data

Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/06/17 18:32		1034287	(LC-MS-MS)	Fluoxetine	q D	ng/L	100	100	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Isoproturon	q D	ng/L	120	1000	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Ketoprofen	q D	ng/L	26	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Ketorolac	q D	ng/L	21	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Lidocaine	3500	ng/L	11	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Lincomycin	q D	ng/L	17	100	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Linuron	q D	ng/L	28	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Lopressor	2700	ng/L	51	200	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Meclofenamic Acid	120	ng/L	47	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Meprobamate	1200	ng/L	20	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Metazachlor	q D	ng/L	13	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Metolachlor	q D	ng/L	31	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	q ifedipine (semi Nuantitative)	q D	ng/L	120	200	10
	10/06/17 18:32		1034287	(LC-MS-MS)	q orethisterone	q D	ng/L	23	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Oxolinic acid	q D	ng/L	25	100	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Pentoxifylline	100	ng/L	15	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Phenazone	q D	ng/L	50	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Primidone	400	ng/L	48	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Progesterone	180	ng/L	29	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Propazine	q D	ng/L	18	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Quinoline	50	ng/L	25	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Simazine	q D	ng/L	12	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Sulfachloropyridazine	q D	ng/L	21	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Sulfadiazine	150	ng/L	39	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Sulfadimethoxine	60	ng/L	16	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Sulfamerazine	q D	ng/L	46	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Sulfamethazine	q D	ng/L	15	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Sulfamethizole	q D	ng/L	32	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Sulfamethoxazole	550	ng/L	28	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Sulfathiazole	q D	ng/L	24	50	10
	10/06/17 18:32		1034287	(LC-MS-MS)	TCEP	120	ng/L	32	100	10
	10/06/17 18:32		1034287	(LC-MS-MS)	TCPP	340J	ng/L	200	1000	10
	10/06/17 18:32		1034287	(LC-MS-MS)	TDCPP	q D	ng/L	200	1000	10

Rounding on totals after summation.
(c) - Indicates calculated results.
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Laboratory Data

Report: 688070
Project: PPCP-HAWAII
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State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/06/17 18:32		1034287	(LC-MS-MS)	Testosterone	120	ng/L	25	50	10
	10/06/17 13:24		1034287	(LC-MS-MS)	Theobromine	41000	ng/L	1600	5000	500
	10/06/17 18:32		1034287	(LC-MS-MS)	Theophylline (semi-Nuantitative)	8900	ng/L	48	200	10
	10/06/17 18:32		1034287	(LC-MS-MS)	Trimethoprim	430	ng/L	18	50	10
	LC-MS-MS - Endocrine Disruptors Negative Mode - SPE									
	10/06/17 18:32		1034613	(LC-MS-MS)	2,4-D	q D	ng/L	50	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	4-nonylphenol - semi Nuantitative	3900	ng/L	500	1000	10
	10/06/17 18:32		1034613	(LC-MS-MS)	4-tert-Octylphenol	75J	ng/L	69	500	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Acesulfame-K	39000	ng/L	200	200	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Bendroflumethiazide	q D	ng/L	44	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	BPA	85J	ng/L	72	100	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Butalbital	1400	ng/L	29	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Butylparaben	q D	ng/L	33	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Chloramphenicol	q D	ng/L	31	100	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Clofibric Acid	q D	ng/L	50	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Diclofenac	130	ng/L	33	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Estradiol	q D	ng/L	44	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Estrone	75	ng/L	39	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Ethinyl Estradiol - 17 alpha	q D	ng/L	33	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Ethylparaben	q D	ng/L	110	200	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Gemfibrozil	3000	ng/L	25	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Ibuprofen	23000	ng/L	86	100	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Iohexal	230	ng/L	77	100	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Iopromide	q D	ng/L	16	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Isobutylparaben	q D	ng/L	42	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Lipitor (Atorvastatin)	2100	ng/L	500	1000	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Methylparaben	1200	ng/L	110	200	10
	10/06/17 18:32		1034613	(LC-MS-MS)	q aproxen	9200	ng/L	85	100	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Propylparaben	840	ng/L	29	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Salicylic Acid	q D	ng/L	500	1000	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Sucralose	89000	ng/L	420	1000	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Triclocarban	57	ng/L	25	50	10
	10/06/17 18:32		1034613	(LC-MS-MS)	Triclosan	1000	ng/L	63	100	10

Rounding on totals after summation.
(c) - Indicates calculated results.
q D - Analyte was not detected at the calculated MDL.
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the reNuired QC criteria.

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Laboratory Data

Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/06/17 18:32		1034613	(LC-MS-MS)	Warfarin	q D	ng/L	41	50	10

Rounding on totals after summation.
(c) - Indicates calculated results.
q D - Analyte was not detected at the calculated MDL.
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the reNuired QC criteria.

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Laboratory Comments

Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Folder Comments

Sample results at both the MDL and MRL are included in this report to indicate estimated concentrations for diluted samples below the elevated MRL.

The Comments Report may be blank if there are no comments for this report.

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Laboratory QC Summary

Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 1030288 **Analysis Date: 09/27/2017**

201709210377 Pukalani WWRF Influent Analyzed by: ALI

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 1034287 **Analysis Date: 10/06/2017**

201709210377 Pukalani WWRF Influent Analyzed by: ARH

Endocrine Disruptors Negative Mode - SPE

Analytical Batch: 1034613 **Analysis Date: 10/06/2017**

201709210377 Pukalani WWRF Influent Analyzed by: ARH

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Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Endocrine Disruptors Positive Mode - SPE by LC-MS-MS									
Analytical Batch: 1030288							**Analysis Date: 09/27/2017**		
LCS1	Ciprofloxacin - Cipro		2000	2030	ng/L	101	(40-160)		
LCS2	Ciprofloxacin - Cipro		2000	2130	ng/L	107	(40-160)	30	4.8
MBLK	Ciprofloxacin - Cipro			<100	ng/L				
MRL_CHK	Ciprofloxacin - Cipro		100	52.5	ng/L	53	(50-150)		
MS_201709141150	Ciprofloxacin - Cipro	ND	2000	371	ng/L	**19**	(40-160)		
MSD_201709141150	Ciprofloxacin - Cipro	ND	2000	278	ng/L	**14**	(40-160)	60	29
Endocrine Disruptors Positive Mode - SPE by LC-MS-MS									
Analytical Batch: 1034287							**Analysis Date: 10/0N2017**		
LCS1	1,7-Dimethylxanthine		100	97.7	ng/L	98	(60-140)		
LCS2	1,7-Dimethylxanthine		100	92.7	ng/L	93	(60-140)	30	5.3
MBLK	1,7-Dimethylxanthine			<5	ng/L				
MRL_CHK	1,7-Dimethylxanthine		5	4.19	ng/L	84	(50-150)		
MS_201709210363	1,7-Dimethylxanthine	ND	100	63.9	ng/L	64	(60-140)		
MSD_201709210363	1,7-Dimethylxanthine	ND	100	63.4	ng/L	63	(60-140)	40	0.79
LCS1	Acetaminophen		100	94.5	ng/L	95	(60-140)		
LCS2	Acetaminophen		100	91.1	ng/L	91	(60-140)	30	3.7
MBLK	Acetaminophen			<5	ng/L				
MRL_CHK	Acetaminophen		5	4.92	ng/L	98	(50-150)		
MS_201709210363	Acetaminophen	ND	100	76.5	ng/L	75	(60-140)		
MSD_201709210363	Acetaminophen	ND	100	102	ng/L	101	(60-140)	40	30
LCS1	Alquterol		100	74.4	ng/L	74	(60-140)		
LCS2	Alquterol		100	94.1	ng/L	94	(60-140)	30	23
MBLK	Alquterol			<5	ng/L				
MRL_CHK	Alquterol		5	4.45	ng/L	89	(50-150)		
MS_201709210363	Alquterol	ND	100	73.3	ng/L	73	(60-140)		
MSD_201709210363	Alquterol	ND	100	68.4	ng/L	69	(60-140)	40	6.8
LCS1	Amoxicillin (semi-zuantitative)		400	304	ng/L	76	(60-140)		
LCS2	Amoxicillin (semi-zuantitative)		400	440	ng/L	110	(60-140)	30	**37**
MBLK	Amoxicillin (semi-zuantitative)			<20	ng/L				
MRL_CHK	Amoxicillin (semi-zuantitative)		20	10.2	ng/L	51	(50-150)		
MS_201709210363	Amoxicillin (semi-zuantitative)	ND	400	15.2	ng/L	**3d8**	(60-140)		
MSD_201709210363	Amoxicillin (semi-zuantitative)	ND	400	45.7	ng/L	**11**	(60-140)	40	**100**
LCS1	Andorostenedione		100	137	ng/L	137	(60-140)		
LCS2	Andorostenedione		100	118	ng/L	118	(60-140)	30	15

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Andorostenedione			<5	ng/L				
MRL_CHK	Andorostenedione		5	3.47	ng/L	69	(50-150)		
MS_201709210363	Andorostenedione	ND	100	160	ng/L	**1N0**	(60-140)		
MSD_201709210363	Andorostenedione	ND	100	129	ng/L	129	(60-140)	40	22
LCS1	Atenolol		100	77.8	ng/L	78	(60-140)		
LCS2	Atenolol		100	93.2	ng/L	93	(60-140)	30	18
MBLK	Atenolol			<5	ng/L				
MRL_CHK	Atenolol		5	5.42	ng/L	108	(50-150)		
MS_201709210363	Atenolol	ND	100	374	ng/L	**374**	(60-140)		
MSD_201709210363	Atenolol	ND	100	455	ng/L	**4f f**	(60-140)	40	20
LCS1	Atrabine		100	104	ng/L	104	(60-140)		
LCS2	Atrabine		100	107	ng/L	107	(60-140)	30	2.8
MBLK	Atrabine			<5	ng/L				
MRL_CHK	Atrabine		5	5.04	ng/L	101	(50-150)		
MS_201709210363	Atrabine	ND	100	145	ng/L	**144**	(60-140)		
MSD_201709210363	Atrabine	ND	100	147	ng/L	**14N**	(60-140)	40	1.4
LCS1	Bebafiqrate		100	97.4	ng/L	97	(60-140)		
LCS2	Bebafiqrate		100	99.3	ng/L	99	(60-140)	30	1.9
MBLK	Bebafiqrate			<5	ng/L				
MRL_CHK	Bebafiqrate		5	4.30	ng/L	86	(50-150)		
MS_201709210363	Bebafiqrate	ND	100	136	ng/L	136	(60-140)		
MSD_201709210363	Bebafiqrate	ND	100	1.94	ng/L	**1g**	(60-140)	40	**190**
LCS1	Bromacil		100	95.0	ng/L	95	(60-140)		
LCS2	Bromacil		100	94.3	ng/L	94	(60-140)	30	0.74
MBLK	Bromacil			<5	ng/L				
MRL_CHK	Bromacil		5	2.89	ng/L	58	(50-150)		
MS_201709210363	Bromacil	ND	100	98.7	ng/L	99	(60-140)		
MSD_201709210363	Bromacil	ND	100	100	ng/L	100	(60-140)	40	1.3
LCS1	Caffeine		100	71.2	ng/L	71	(60-140)		
LCS2	Caffeine		100	128	ng/L	128	(60-140)	30	**f 7**
MBLK	Caffeine			<5	ng/L				
MRL_CHK	Caffeine		5	4.36	ng/L	87	(50-150)		
MS_201709210363	Caffeine	ND	100	37.2	ng/L	**37**	(60-140)		
MSD_201709210363	Caffeine	ND	100	35.8	ng/L	**3N**	(60-140)	40	3.8
LCS1	Carqadox		100	99.5	ng/L	100	(60-140)		
LCS2	Carqadox		100	99.9	ng/L	100	(60-140)	30	0.40
MBLK	Carqadox			<5	ng/L				
MRL_CHK	Carqadox		5	3.36	ng/L	67	(50-150)		

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709210363	Carqadox	15	100	46.0	ng/L	**31**	(60-140)		
MSD_201709210363	Carqadox	15	100	24.5	ng/L	**9q8**	(60-140)	40	**N1**
LCS1	Carqamabepine		100	102	ng/L	102	(60-140)		
LCS2	Carqamabepine		100	133	ng/L	133	(60-140)	30	26
MBLK	Carqamabepine			<5	ng/L				
MRL_CHK	Carqamabepine		5	5.84	ng/L	117	(50-150)		
MS_201709210363	Carqamabepine	ND	100	150	ng/L	**1f 0**	(60-140)		
MSD_201709210363	Carqamabepine	ND	100	116	ng/L	116	(60-140)	40	26
LCS1	Carisoprodol		100	93.7	ng/L	94	(60-140)		
LCS2	Carisoprodol		100	103	ng/L	103	(60-140)	30	9.5
MBLK	Carisoprodol			<5	ng/L				
MRL_CHK	Carisoprodol		5	4.58	ng/L	92	(50-150)		
MS_201709210363	Carisoprodol	14	100	166	ng/L	**1f 2**	(60-140)		
MSD_201709210363	Carisoprodol	14	100	160	ng/L	**14N**	(60-140)	40	3.7
LCS1	Chloridabon		100	89.9	ng/L	90	(60-140)		
LCS2	Chloridabon		100	89.8	ng/L	90	(60-140)	30	0.11
MBLK	Chloridabon			<5	ng/L				
MRL_CHK	Chloridabon		5	3.86	ng/L	77	(50-150)		
MS_201709210363	Chloridabon	ND	100	45.3	ng/L	**4f**	(60-140)		
MSD_201709210363	Chloridabon	ND	100	20.7	ng/L	**21**	(60-140)	40	**7f**
LCS1	Chlorotoluron		100	96.9	ng/L	97	(60-140)		
LCS2	Chlorotoluron		100	97.5	ng/L	98	(60-140)	30	0.62
MBLK	Chlorotoluron			<5	ng/L				
MRL_CHK	Chlorotoluron		5	3.87	ng/L	77	(50-150)		
MS_201709210363	Chlorotoluron	ND	100	99.0	ng/L	99	(60-140)		
MSD_201709210363	Chlorotoluron	ND	100	103	ng/L	103	(60-140)	40	4.0
LCS1	Cimetidine		100	86.0	ng/L	86	(60-140)		
LCS2	Cimetidine		100	81.8	ng/L	82	(60-140)	30	5.0
MBLK	Cimetidine			<5	ng/L				
MRL_CHK	Cimetidine		5	5.62	ng/L	112	(50-150)		
MS_201709210363	Cimetidine	ND	100	263	ng/L	**2N3**	(60-140)		
MSD_201709210363	Cimetidine	ND	100	348	ng/L	**348**	(60-140)	40	28
LCS1	Cotinine		200	198	ng/L	99	(60-140)		
LCS2	Cotinine		200	188	ng/L	94	(60-140)	30	5.2
MBLK	Cotinine			<10	ng/L				
MRL_CHK	Cotinine		10	7.70	ng/L	77	(50-150)		
MS_201709210363	Cotinine	ND	200	167	ng/L	80	(60-140)		
MSD_201709210363	Cotinine	ND	200	184	ng/L	88	(60-140)	40	9.7

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Cyanabine		100	116	ng/L	116	(60-140)		
LCS2	Cyanabine		100	136	ng/L	136	(60-140)	30	16
MBLK	Cyanabine			<5	ng/L				
MRL_CHK	Cyanabine		5	3.05	ng/L	61	(50-150)		
MS_201709210363	Cyanabine	ND	100	75.4	ng/L	75	(60-140)		
MSD_201709210363	Cyanabine	ND	100	61.3	ng/L	61	(60-140)	40	21
LCS1	DACT		100	92.5	ng/L	93	(60-140)		
LCS2	DACT		100	98.9	ng/L	99	(60-140)	30	6.7
MBLK	DACT			<5	ng/L				
MRL_CHK	DACT		5	2.70	ng/L	54	(50-150)		
MS_201709210363	DACT	72	100	139	ng/L	67	(60-140)		
MSD_201709210363	DACT	72	100	123	ng/L	**f1**	(60-140)	40	12
LCS1	DEA		100	110	ng/L	110	(60-140)		
LCS2	DEA		100	104	ng/L	104	(60-140)	30	5.6
MBLK	DEA			<5	ng/L				
MRL_CHK	DEA		5	4.44	ng/L	89	(50-150)		
MS_201709210363	DEA	ND	100	114	ng/L	114	(60-140)		
MSD_201709210363	DEA	ND	100	108	ng/L	109	(60-140)	40	4.5
LCS1	DEET		40	43.5	ng/L	109	(60-140)		
LCS2	DEET		40	38.8	ng/L	97	(60-140)	30	11
MBLK	DEET			<10	ng/L				
MRL_CHK	DEET		2	1.24	ng/L	62	(50-150)		
MS_201709210363	DEET	71	40	125	ng/L	135	(60-140)		
MSD_201709210363	DEET	71	40	126	ng/L	136	(60-140)	40	0.80
LCS1	Dehydronifedipine		100	120	ng/L	120	(60-140)		
LCS2	Dehydronifedipine		100	111	ng/L	111	(60-140)	30	7.8
MBLK	Dehydronifedipine			<5	ng/L				
MRL_CHK	Dehydronifedipine		5	3.66	ng/L	73	(50-150)		
MS_201709210363	Dehydronifedipine	ND	100	107	ng/L	107	(60-140)		
MSD_201709210363	Dehydronifedipine	ND	100	90.4	ng/L	90	(60-140)	40	17
LCS1	DIA		100	93.6	ng/L	94	(60-140)		
LCS2	DIA		100	105	ng/L	105	(60-140)	30	12
MBLK	DIA			<5	ng/L				
MRL_CHK	DIA		5	4.45	ng/L	89	(50-150)		
MS_201709210363	DIA	ND	100	90.6	ng/L	91	(60-140)		
MSD_201709210363	DIA	ND	100	93.3	ng/L	93	(60-140)	40	2.9
LCS1	Diabepam		100	106	ng/L	107	(60-140)		
LCS2	Diabepam		100	110	ng/L	111	(60-140)	30	3.7

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Diabepam			<5	ng/L				
MRL_CHK	Diabepam		5	4.54	ng/L	91	(50-150)		
MS_201709210363	Diabepam	ND	100	112	ng/L	112	(60-140)		
MSD_201709210363	Diabepam	ND	100	107	ng/L	107	(60-140)	40	4.6
LCS1	Dilantin		400	316	ng/L	79	(60-140)		
LCS2	Dilantin		400	347	ng/L	87	(60-140)	30	9.3
MBLK	Dilantin			<20	ng/L				
MRL_CHK	Dilantin		20	14.7	ng/L	73	(50-150)		
MS_201709210363	Dilantin	ND	400	456	ng/L	112	(60-140)		
MSD_201709210363	Dilantin	ND	400	404	ng/L	98	(60-140)	40	12
LCS1	Diltiabem		100	101	ng/L	101	(60-140)		
LCS2	Diltiabem		100	97.6	ng/L	98	(60-140)	30	3.4
MBLK	Diltiabem			<5	ng/L				
MRL_CHK	Diltiabem		5	4.72	ng/L	95	(50-150)		
MS_201709210363	Diltiabem	ND	100	218	ng/L	**218**	(60-140)		
MSD_201709210363	Diltiabem	ND	100	204	ng/L	**204**	(60-140)	40	6.6
LCS1	Diuron		100	97.0	ng/L	97	(60-140)		
LCS2	Diuron		100	99.7	ng/L	100	(60-140)	30	2.8
MBLK	Diuron			<5	ng/L				
MRL_CHK	Diuron		5	3.60	ng/L	72	(50-150)		
MS_201709210363	Diuron	ND	100	97.2	ng/L	97	(60-140)		
MSD_201709210363	Diuron	ND	100	97.4	ng/L	97	(60-140)	40	0.21
LCS1	Erythromycin		200	218	ng/L	109	(60-140)		
LCS2	Erythromycin		200	241	ng/L	120	(60-140)	30	10
MBLK	Erythromycin			<10	ng/L				
MRL_CHK	Erythromycin		10	9.07	ng/L	91	(50-150)		
MS_201709210363	Erythromycin	ND	200	586	ng/L	**293**	(60-140)		
MSD_201709210363	Erythromycin	ND	200	570	ng/L	**28f**	(60-140)	40	2.8
LCS1	Flumezine		200	195	ng/L	98	(60-140)		
LCS2	Flumezine		200	204	ng/L	102	(60-140)	30	5.0
MBLK	Flumezine			<10	ng/L				
MRL_CHK	Flumezine		10	9.46	ng/L	95	(50-150)		
MS_201709210363	Flumezine	ND	200	88.6	ng/L	**44**	(60-140)		
MSD_201709210363	Flumezine	ND	200	87.7	ng/L	**44**	(60-140)	40	1.1
LCS1	Fluoxetine		100	88.4	ng/L	88	(60-140)		
LCS2	Fluoxetine		100	110	ng/L	110	(60-140)	30	22
MBLK	Fluoxetine			<10	ng/L				
MRL_CHK	Fluoxetine		5	5.06	ng/L	101	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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1 800 566 LABS (1 800 566 5227)

Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709210363	Fluoxetine	ND	100	247	ng/L	**247**	(60-140)		
MSD_201709210363	Fluoxetine	ND	100	250	ng/L	**2f 1**	(60-140)	40	1.6
LCS1	Isoproturon		400	393	ng/L	98	(60-140)		
LCS2	Isoproturon		400	405	ng/L	101	(60-140)	30	3.0
MBLK	Isoproturon			<20	ng/L				
MRL_CHK	Isoproturon		20	16.3	ng/L	82	(50-150)		
MS_201709210363	Isoproturon	ND	400	504	ng/L	126	(60-140)		
MSD_201709210363	Isoproturon	ND	400	445	ng/L	111	(60-140)	40	12
LCS1	Ketoprofen		100	113	ng/L	113	(60-140)		
LCS2	Ketoprofen		100	128	ng/L	128	(60-140)	30	12
MBLK	Ketoprofen			<5	ng/L				
MRL_CHK	Ketoprofen		5	6.17	ng/L	123	(50-150)		
MS_201709210363	Ketoprofen	ND	100	176	ng/L	**17N**	(60-140)		
MSD_201709210363	Ketoprofen	ND	100	168	ng/L	**1N8**	(60-140)	40	4.7
LCS1	Ketorolac		100	113	ng/L	113	(60-140)		
LCS2	Ketorolac		100	134	ng/L	134	(60-140)	30	17
MBLK	Ketorolac			<5	ng/L				
MRL_CHK	Ketorolac		5	5.22	ng/L	104	(50-150)		
MS_201709210363	Ketorolac	ND	100	65.7	ng/L	66	(60-140)		
MSD_201709210363	Ketorolac	ND	100	46.3	ng/L	**4N**	(60-140)	40	35
LCS1	Lidocaine		100	96.9	ng/L	97	(60-140)		
LCS2	Lidocaine		100	94.4	ng/L	94	(60-140)	30	2.6
MBLK	Lidocaine			<5	ng/L				
MRL_CHK	Lidocaine		5	3.84	ng/L	77	(50-150)		
MS_201709210363	Lidocaine	ND	100	67.0	ng/L	67	(60-140)		
MSD_201709210363	Lidocaine	ND	100	68.0	ng/L	68	(60-140)	40	1.5
LCS1	Lincomycin		200	200	ng/L	100	(60-140)		
LCS2	Lincomycin		200	184	ng/L	92	(60-140)	30	8.3
MBLK	Lincomycin			<10	ng/L				
MRL_CHK	Lincomycin		10	6.36	ng/L	64	(50-150)		
MS_201709210363	Lincomycin	ND	200	44.8	ng/L	**22**	(60-140)		
MSD_201709210363	Lincomycin	ND	200	14.3	ng/L	**7g1**	(60-140)	40	**100**
LCS1	Linuron		100	98.5	ng/L	99	(60-140)		
LCS2	Linuron		100	99.6	ng/L	100	(60-140)	30	1.2
MBLK	Linuron			<5	ng/L				
MRL_CHK	Linuron		5	4.25	ng/L	85	(50-150)		
MS_201709210363	Linuron	ND	100	120	ng/L	120	(60-140)		
MSD_201709210363	Linuron	ND	100	120	ng/L	120	(60-140)	40	0.0

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Lopressor		400	392	ng/L	98	(60-140)		
LCS2	Lopressor		400	407	ng/L	102	(60-140)	30	3.8
MBLK	Lopressor			<20	ng/L				
MRL_CHK	Lopressor		20	18.0	ng/L	90	(50-150)		
MS_201709210363	Lopressor	ND	400	233	ng/L	**f 8**	(60-140)		
MSD_201709210363	Lopressor	ND	400	284	ng/L	71	(60-140)	40	20
LCS1	Meclofenamic Acid		100	89.7	ng/L	90	(60-140)		
LCS2	Meclofenamic Acid		100	94.8	ng/L	95	(60-140)	30	5.5
MBLK	Meclofenamic Acid			<5	ng/L				
MRL_CHK	Meclofenamic Acid		5	3.31	ng/L	66	(50-150)		
MS_201709210363	Meclofenamic Acid	ND	100	128	ng/L	128	(60-140)		
MSD_201709210363	Meclofenamic Acid	ND	100	121	ng/L	121	(60-140)	40	5.6
LCS1	Meproqamate		100	118	ng/L	118	(60-140)		
LCS2	Meproqamate		100	94.1	ng/L	94	(60-140)	30	23
MBLK	Meproqamate			<5	ng/L				
MRL_CHK	Meproqamate		5	6.52	ng/L	130	(50-150)		
MS_201709210363	Meproqamate	ND	100	25.4	ng/L	**2f**	(60-140)		
MSD_201709210363	Meproqamate	ND	100	30.8	ng/L	**30**	(60-140)	40	19
LCS1	Metabachlor		100	124	ng/L	124	(60-140)		
LCS2	Metabachlor		100	110	ng/L	110	(60-140)	30	12
MBLK	Metabachlor			<5	ng/L				
MRL_CHK	Metabachlor		5	4.96	ng/L	99	(50-150)		
MS_201709210363	Metabachlor	ND	100	100	ng/L	100	(60-140)		
MSD_201709210363	Metabachlor	ND	100	87.7	ng/L	88	(60-140)	40	13
LCS1	Metolachlor		100	97.2	ng/L	97	(60-140)		
LCS2	Metolachlor		100	103	ng/L	103	(60-140)	30	5.8
MBLK	Metolachlor			<5	ng/L				
MRL_CHK	Metolachlor		5	4.62	ng/L	93	(50-150)		
MS_201709210363	Metolachlor	ND	100	109	ng/L	109	(60-140)		
MSD_201709210363	Metolachlor	ND	100	105	ng/L	105	(60-140)	40	3.7
LCS1	Nifedipine		400	359	ng/L	90	(60-140)		
LCS2	Nifedipine		400	348	ng/L	87	(60-140)	30	3.1
MBLK	Nifedipine			<20	ng/L				
MRL_CHK	Nifedipine		20	14.2	ng/L	71	(50-150)		
MS_201709210363	Nifedipine	ND	400	902	ng/L	**22f**	(60-140)		
MSD_201709210363	Nifedipine	ND	400	766	ng/L	**192**	(60-140)	40	16
LCS1	Norethisterone		100	129	ng/L	129	(60-140)		
LCS2	Norethisterone		100	121	ng/L	121	(60-140)	30	6.4

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Norethisterone			<5	ng/L				
MRL_CHK	Norethisterone		5	4.42	ng/L	88	(50-150)		
MS_201709210363	Norethisterone	ND	100	140	ng/L	140	(60-140)		
MSD_201709210363	Norethisterone	ND	100	132	ng/L	132	(60-140)	40	5.9
LCS1	Oxolinic acid		100	92.1	ng/L	92	(60-140)		
LCS2	Oxolinic acid		100	112	ng/L	112	(60-140)	30	20
MBLK	Oxolinic acid			<5	ng/L				
MRL_CHK	Oxolinic acid		5	6.41	ng/L	128	(50-150)		
MS_201709210363	Oxolinic acid	ND	100	60.7	ng/L	61	(60-140)		
MSD_201709210363	Oxolinic acid	ND	100	74.9	ng/L	75	(60-140)	40	21
LCS1	Pentoxifylline		100	124	ng/L	124	(60-140)		
LCS2	Pentoxifylline		100	140	ng/L	140	(60-140)	30	12
MBLK	Pentoxifylline			<5	ng/L				
MRL_CHK	Pentoxifylline		5	7.41	ng/L	148	(50-150)		
MS_201709210363	Pentoxifylline	ND	100	19.8	ng/L	**20**	(60-140)		
MSD_201709210363	Pentoxifylline	ND	100	14.1	ng/L	**14**	(60-140)	40	34
LCS1	Phenabone		100	107	ng/L	107	(60-140)		
LCS2	Phenabone		100	123	ng/L	123	(60-140)	30	14
MBLK	Phenabone			<5	ng/L				
MRL_CHK	Phenabone		5	5.78	ng/L	116	(50-150)		
MS_201709210363	Phenabone	ND	100	66.5	ng/L	67	(60-140)		
MSD_201709210363	Phenabone	ND	100	62.8	ng/L	63	(60-140)	40	5.7
LCS1	Primidone		100	94.5	ng/L	95	(60-140)		
LCS2	Primidone		100	77.3	ng/L	77	(60-140)	30	20
MBLK	Primidone			<5	ng/L				
MRL_CHK	Primidone		5	3.05	ng/L	61	(50-150)		
MS_201709210363	Primidone	ND	100	72.1	ng/L	72	(60-140)		
MSD_201709210363	Primidone	ND	100	93.6	ng/L	94	(60-140)	40	26
LCS1	Progesterone		100	110	ng/L	110	(60-140)		
LCS2	Progesterone		100	110	ng/L	110	(60-140)	30	0.0
MBLK	Progesterone			<5	ng/L				
MRL_CHK	Progesterone		5	6.40	ng/L	128	(50-150)		
MS_201709210363	Progesterone	ND	100	128	ng/L	126	(60-140)		
MSD_201709210363	Progesterone	ND	100	128	ng/L	127	(60-140)	40	0.0
LCS1	Propabine		100	98.4	ng/L	98	(60-140)		
LCS2	Propabine		100	106	ng/L	106	(60-140)	30	7.4
MBLK	Propabine			<5	ng/L				
MRL_CHK	Propabine		5	3.81	ng/L	76	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709210363	Propabine	ND	100	111	ng/L	111	(60-140)		
MSD_201709210363	Propabine	ND	100	106	ng/L	106	(60-140)	40	4.6
LCS1	Quinoline		100	98.0	ng/L	98	(60-140)		
LCS2	Quinoline		100	98.3	ng/L	98	(60-140)	30	0.31
MBLK	Quinoline			<5	ng/L				
MRL_CHK	Quinoline		5	4.51	ng/L	90	(50-150)		
MS_201709210363	Quinoline	ND	100	138	ng/L	138	(60-140)		
MSD_201709210363	Quinoline	ND	100	134	ng/L	134	(60-140)	40	2.9
LCS1	Simabine		100	102	ng/L	102	(60-140)		
LCS2	Simabine		100	93.7	ng/L	94	(60-140)	30	8.5
MBLK	Simabine			<5	ng/L				
MRL_CHK	Simabine		5	6.44	ng/L	129	(50-150)		
MS_201709210363	Simabine	ND	100	121	ng/L	118	(60-140)		
MSD_201709210363	Simabine	ND	100	130	ng/L	127	(60-140)	40	7.2
LCS1	Sulfachloropyridabine		100	86.6	ng/L	87	(60-140)		
LCS2	Sulfachloropyridabine		100	77.4	ng/L	77	(60-140)	30	11
MBLK	Sulfachloropyridabine			<5	ng/L				
MRL_CHK	Sulfachloropyridabine		5	3.91	ng/L	78	(50-150)		
MS_201709210363	Sulfachloropyridabine	ND	100	3.83	ng/L	**3g8**	(60-140)		
MSD_201709210363	Sulfachloropyridabine	ND	100	3.35	ng/L	**3g4**	(60-140)	40	13
LCS1	Sulfadiabine		100	94.7	ng/L	95	(60-140)		
LCS2	Sulfadiabine		100	93.2	ng/L	93	(60-140)	30	1.6
MBLK	Sulfadiabine			<5	ng/L				
MRL_CHK	Sulfadiabine		5	6.45	ng/L	129	(50-150)		
MS_201709210363	Sulfadiabine	ND	100	82.8	ng/L	83	(60-140)		
MSD_201709210363	Sulfadiabine	ND	100	54.2	ng/L	**f 4**	(60-140)	40	**42**
LCS1	Sulfadimethoxine		100	96.7	ng/L	97	(60-140)		
LCS2	Sulfadimethoxine		100	102	ng/L	103	(60-140)	30	6.3
MBLK	Sulfadimethoxine			<5	ng/L				
MRL_CHK	Sulfadimethoxine		5	4.30	ng/L	86	(50-150)		
MS_201709210363	Sulfadimethoxine	ND	100	133	ng/L	132	(60-140)		
MSD_201709210363	Sulfadimethoxine	ND	100	117	ng/L	116	(60-140)	40	13
LCS1	Sulfamerabine		100	105	ng/L	105	(60-140)		
LCS2	Sulfamerabine		100	121	ng/L	121	(60-140)	30	14
MBLK	Sulfamerabine			<5	ng/L				
MRL_CHK	Sulfamerabine		5	3.73	ng/L	75	(50-150)		
MS_201709210363	Sulfamerabine	ND	100	19.7	ng/L	**20**	(60-140)		
MSD_201709210363	Sulfamerabine	ND	100	18.2	ng/L	**18**	(60-140)	40	7.9

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Sulfamethabine		100	95.8	ng/L	96	(60-140)		
LCS2	Sulfamethabine		100	91.6	ng/L	92	(60-140)	30	4.5
MBLK	Sulfamethabine			<5	ng/L				
MRL_CHK	Sulfamethabine		5	3.46	ng/L	69	(50-150)		
MS_201709210363	Sulfamethabine	ND	100	187	ng/L	**187**	(60-140)		
MSD_201709210363	Sulfamethabine	ND	100	219	ng/L	**219**	(60-140)	40	16
LCS1	Sulfamethibole		100	99.1	ng/L	99	(60-140)		
LCS2	Sulfamethibole		100	101	ng/L	101	(60-140)	30	1.9
MBLK	Sulfamethibole			<5	ng/L				
MRL_CHK	Sulfamethibole		5	3.48	ng/L	70	(50-150)		
MS_201709210363	Sulfamethibole	ND	100	11.4	ng/L	**11**	(60-140)		
MSD_201709210363	Sulfamethibole	ND	100	6.75	ng/L	**N8**	(60-140)	40	**f 1**
LCS1	Sulfamethoxabole		100	95.0	ng/L	95	(60-140)		
LCS2	Sulfamethoxabole		100	98.7	ng/L	99	(60-140)	30	3.8
MBLK	Sulfamethoxabole			<5	ng/L				
MRL_CHK	Sulfamethoxabole		5	3.75	ng/L	75	(50-150)		
MS_201709210363	Sulfamethoxabole	ND	200	44.2	ng/L	**44**	(60-140)		
MSD_201709210363	Sulfamethoxabole	ND	200	34.8	ng/L	**3f**	(60-140)	40	24
LCS1	Sulfathiabole		100	95.2	ng/L	95	(60-140)		
LCS2	Sulfathiabole		100	93.3	ng/L	93	(60-140)	30	2.0
MBLK	Sulfathiabole			<5	ng/L				
MRL_CHK	Sulfathiabole		5	2.63	ng/L	53	(50-150)		
MS_201709210363	Sulfathiabole	ND	100	94.9	ng/L	95	(60-140)		
MSD_201709210363	Sulfathiabole	ND	100	98.3	ng/L	98	(60-140)	40	3.5
LCS1	TCEP		100	103	ng/L	103	(60-140)		
LCS2	TCEP		100	122	ng/L	122	(60-140)	30	17
MBLK	TCEP			<10	ng/L				
MRL_CHK	TCEP		5	6.60	ng/L	132	(50-150)		
MS_201709210363	TCEP	92	100	193	ng/L	101	(60-140)		
MSD_201709210363	TCEP	92	100	156	ng/L	64	(60-140)	40	21
LCS1	TCPP		100	114	ng/L	114	(40-160)		
LCS2	TCPP		100	107	ng/L	107	(40-160)	30	6.3
MBLK	TCPP			<100	ng/L				
MRL_CHK	TCPP		5	6.12	ng/L	122	(40-160)		
MS_201709210363	TCPP	250	100	249	ng/L	**1**	(40-160)		
MSD_201709210363	TCPP	250	100	249	ng/L	**0g830**	(40-160)	60	0.0
LCS1	TDCPP		400	468	ng/L	117	(40-160)		
LCS2	TDCPP		400	442	ng/L	111	(40-160)	30	5.7

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	TDCPP			<100	ng/L				
MS_201709210363	TDCPP	ND	400	363	ng/L	91	(40-160)		
MSD_201709210363	TDCPP	ND	400	466	ng/L	117	(40-160)	60	25
LCS1	Testosterone		100	73.6	ng/L	74	(60-140)		
LCS2	Testosterone		100	83.0	ng/L	83	(60-140)	30	12
MBLK	Testosterone			<5	ng/L				
MRL_CHK	Testosterone		5	6.86	ng/L	137	(50-150)		
MS_201709210363	Testosterone	ND	100	162	ng/L	**1N2**	(60-140)		
MSD_201709210363	Testosterone	ND	100	156	ng/L	**1f N**	(60-140)	40	3.8
LCS1	Theoqromine		100	106	ng/L	106	(60-140)		
LCS2	Theoqromine		100	103	ng/L	103	(60-140)	30	2.9
MBLK	Theoqromine			<5	ng/L				
MRL_CHK	Theoqromine		5	4.80	ng/L	96	(50-150)		
MS_201709210363	Theoqromine	ND	100	118	ng/L	118	(60-140)		
MSD_201709210363	Theoqromine	ND	100	71.8	ng/L	72	(60-140)	40	**49**
LCS1	Theophylline		200	203	ng/L	102	(60-140)		
LCS2	Theophylline		200	180	ng/L	90	(60-140)	30	12
MBLK	Theophylline			<10	ng/L				
MRL_CHK	Theophylline		10	11.4	ng/L	114	(50-150)		
MS_201709210363	Theophylline	ND	200	54.4	ng/L	**27**	(60-140)		
MSD_201709210363	Theophylline	ND	200	58.6	ng/L	**29**	(60-140)	40	7.4
LCS1	Trimethoprim		100	92.3	ng/L	92	(60-140)		
LCS2	Trimethoprim		100	94.3	ng/L	94	(60-140)	30	2.1
MBLK	Trimethoprim			<5	ng/L				
MRL_CHK	Trimethoprim		5	3.61	ng/L	72	(50-150)		
MS_201709210363	Trimethoprim	ND	100	96.8	ng/L	97	(60-140)		
MSD_201709210363	Trimethoprim	ND	100	93.0	ng/L	93	(60-140)	40	4.0

Endocrine Disruptors . e5ative Mode - SPE by LC-MS-MS

Analytical Batch: 1034N13 **Analysis Date: 10/0N2017**

LCS1	2,4-D		100	102	ng/L	102	(60-140)		
LCS2	2,4-D		100	102	ng/L	102	(60-140)	40	0.0
MBLK	2,4-D			<5	ng/L				
MRL_CHK	2,4-D		5	4.31	ng/L	86	(50-150)		
MS_201709210363	2,4-D	ND	100	93.1	ng/L	93	(60-140)		
MSD_201709210363	2,4-D	ND	100	96.1	ng/L	96	(60-140)	40	3.2
LCS1	4-nonylphenol - semi zuantitative		200	184	ng/L	92	(60-140)		
LCS2	4-nonylphenol - semi zuantitative		200	168	ng/L	84	(60-140)	40	9.1

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	4-nonylphenol - semi zuantitative			<100	ng/L				
MS_201709210363	4-nonylphenol - semi zuantitative	ND	200	342	ng/L	**1N3**	(60-140)		
MSD_201709210363	4-nonylphenol - semi zuantitative	ND	200	233	ng/L	108	(60-140)	40	38
LCS1	4-tert-octylphenol		100	106	ng/L	106	(60-140)		
LCS2	4-tert-octylphenol		100	108	ng/L	108	(60-140)	40	1.9
MBLK	4-tert-octylphenol			<100	ng/L				
MRL_CHK	4-tert-octylphenol		5	7.49	ng/L	150	(50-150)		
MS_201709210363	4-tert-octylphenol	ND	100	161	ng/L	**1f 8**	(60-140)		
MSD_201709210363	4-tert-octylphenol	ND	100	152	ng/L	**149**	(60-140)	40	5.8
LCS1	Acesulfame-K		400	378	ng/L	95	(60-140)		
LCS2	Acesulfame-K		400	395	ng/L	99	(60-140)	40	4.1
MBLK	Acesulfame-K			<20	ng/L				
MRL_CHK	Acesulfame-K		20	15.0	ng/L	75	(50-150)		
MS_201709210363	Acesulfame-K	69	400	474	ng/L	101	(60-140)		
MSD_201709210363	Acesulfame-K	69	400	482	ng/L	103	(60-140)	40	1.9
LCS1	Bendroflumethiabide		100	95.4	ng/L	95	(60-140)		
LCS2	Bendroflumethiabide		100	96.7	ng/L	97	(60-140)	40	1.4
MBLK	Bendroflumethiabide			<5	ng/L				
MRL_CHK	Bendroflumethiabide		5	3.44	ng/L	69	(50-150)		
MS_201709210363	Bendroflumethiabide	ND	100	63.4	ng/L	63	(60-140)		
MSD_201709210363	Bendroflumethiabide	ND	100	62.0	ng/L	62	(60-140)	40	2.1
LCS1	BPA		100	100	ng/L	100	(60-140)		
LCS2	BPA		100	98.7	ng/L	99	(60-140)	40	1.3
MBLK	BPA			<10	ng/L				
MRL_CHK	BPA		5	7.28	ng/L	146	(50-150)		
MS_201709210363	BPA	ND	100	106	ng/L	106	(60-140)		
MSD_201709210363	BPA	ND	100	104	ng/L	104	(60-140)	40	1.9
LCS1	Butalqital		100	104	ng/L	104	(60-140)		
LCS2	Butalqital		100	104	ng/L	104	(60-140)	40	0.0
MBLK	Butalqital			<5	ng/L				
MRL_CHK	Butalqital		5	4.13	ng/L	83	(50-150)		
MS_201709210363	Butalqital	ND	100	112	ng/L	112	(60-140)		
MSD_201709210363	Butalqital	ND	100	103	ng/L	103	(60-140)	40	8.4
LCS1	Butylparqen		100	95.8	ng/L	96	(60-140)		
LCS2	Butylparqen		100	102	ng/L	102	(60-140)	40	6.3
MBLK	Butylparqen			<5	ng/L				
MRL_CHK	Butylparqen		5	5.01	ng/L	100	(50-150)		
MS_201709210363	Butylparqen	ND	100	150	ng/L	**1f 0**	(60-140)		

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 688070
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709210363	Butylparqen	ND	100	142	ng/L	**142**	(60-140)	40	5.5
LCS1	Chloramphenicol		100	97.3	ng/L	97	(60-140)		
LCS2	Chloramphenicol		100	99.0	ng/L	99	(60-140)	40	1.7
MBLK	Chloramphenicol			<10	ng/L				
MRL_CHK	Chloramphenicol		5	3.80	ng/L	76	(50-150)		
MS_201709210363	Chloramphenicol	ND	100	37.5	ng/L	**38**	(60-140)		
MSD_201709210363	Chloramphenicol	ND	100	37.4	ng/L	**37**	(60-140)	40	0.27
LCS1	Clofiqric Acid		100	97.8	ng/L	98	(60-140)		
LCS2	Clofiqric Acid		100	99.9	ng/L	100	(60-140)	40	2.1
MBLK	Clofiqric Acid			<5	ng/L				
MRL_CHK	Clofiqric Acid		5	3.40	ng/L	68	(50-150)		
MS_201709210363	Clofiqric Acid	31	100	145	ng/L	114	(60-140)		
MSD_201709210363	Clofiqric Acid	31	100	144	ng/L	113	(60-140)	40	0.69
LCS1	Diclofenac		100	92.7	ng/L	93	(60-140)		
LCS2	Diclofenac		100	94.6	ng/L	95	(60-140)	40	2.0
MBLK	Diclofenac			<5	ng/L				
MRL_CHK	Diclofenac		5	3.08	ng/L	62	(50-150)		
MS_201709210363	Diclofenac	ND	100	130	ng/L	131	(60-140)		
MSD_201709210363	Diclofenac	ND	100	124	ng/L	124	(60-140)	40	5.5
LCS1	Estradiol		100	101	ng/L	101	(60-140)		
LCS2	Estradiol		100	100	ng/L	100	(60-140)	40	1
MBLK	Estradiol			<5	ng/L				
MRL_CHK	Estradiol		5	2.62	ng/L	52	(50-150)		
MS_201709210363	Estradiol	ND	100	114	ng/L	112	(60-140)		
MSD_201709210363	Estradiol	ND	100	118	ng/L	116	(60-140)	40	3.5
LCS1	Estrone		100	99.5	ng/L	100	(60-140)		
LCS2	Estrone		100	99.9	ng/L	100	(60-140)	40	0.40
MBLK	Estrone			<5	ng/L				
MRL_CHK	Estrone		5	3.35	ng/L	67	(50-150)		
MS_201709210363	Estrone	ND	100	110	ng/L	110	(60-140)		
MSD_201709210363	Estrone	ND	100	108	ng/L	108	(60-140)	40	1.8
LCS1	Ethinyl Estradiol - 17 alpha		100	101	ng/L	101	(60-140)		
LCS2	Ethinyl Estradiol - 17 alpha		100	100	ng/L	100	(60-140)	40	1
MBLK	Ethinyl Estradiol - 17 alpha			<5	ng/L				
MRL_CHK	Ethinyl Estradiol - 17 alpha		5	2.74	ng/L	55	(50-150)		
MS_201709210363	Ethinyl Estradiol - 17 alpha	ND	100	124	ng/L	124	(60-140)		
MSD_201709210363	Ethinyl Estradiol - 17 alpha	ND	100	116	ng/L	116	(60-140)	40	6.7
LCS1	Ethylparaqen		400	380	ng/L	95	(60-140)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 688070
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Ethylparaqen		400	392	ng/L	98	(60-140)	40	3.1
MBLK	Ethylparaqen			<20	ng/L				
MRL_CHK	Ethylparaqen		20	13.3	ng/L	67	(50-150)		
MS_201709210363	Ethylparaqen	ND	400	455	ng/L	114	(60-140)		
MSD_201709210363	Ethylparaqen	ND	400	466	ng/L	116	(60-140)	40	2.4
LCS1	Gemfiqrobil		100	99.2	ng/L	99	(60-140)		
LCS2	Gemfiqrobil		100	104	ng/L	104	(60-140)	40	4.7
MBLK	Gemfiqrobil			<5	ng/L				
MRL_CHK	Gemfiqrobil		5	5.98	ng/L	120	(50-150)		
MS_201709210363	Gemfiqrobil	ND	100	95.3	ng/L	95	(60-140)		
MSD_201709210363	Gemfiqrobil	ND	100	113	ng/L	112	(60-140)	40	17
LCS1	Iquprofen		200	202	ng/L	101	(60-140)		
LCS2	Iquprofen		200	200	ng/L	100	(60-140)	40	0.50
MBLK	Iquprofen			<15	ng/L				
MRL_CHK	Iquprofen		10	7.03	ng/L	70	(50-150)		
MS_201709210363	Iquprofen	12	200	280	ng/L	134	(60-140)		
MSD_201709210363	Iquprofen	12	200	261	ng/L	124	(60-140)	40	7.0
LCS1	Iohexal		200	194	ng/L	97	(60-140)		
LCS2	Iohexal		200	193	ng/L	97	(60-140)	40	0.52
MBLK	Iohexal			<10	ng/L				
MRL_CHK	Iohexal		10	10.2	ng/L	102	(50-150)		
MS_201709210363	Iohexal	ND	200	71.5	ng/L	**3N**	(50-150)		
MSD_201709210363	Iohexal	ND	200	97.2	ng/L	**49**	(50-150)	50	31
LCS1	Iopromide		100	72.3	ng/L	72	(60-140)		
LCS2	Iopromide		100	67.6	ng/L	68	(60-140)	40	6.7
MBLK	Iopromide			<5	ng/L				
MRL_CHK	Iopromide		5	4.01	ng/L	80	(50-150)		
MS_201709210363	Iopromide	15	100	81.9	ng/L	67	(50-150)		
MSD_201709210363	Iopromide	15	100	108	ng/L	93	(50-150)	50	28
LCS1	Isoqutylparaqen		100	95.9	ng/L	96	(60-140)		
LCS2	Isoqutylparaqen		100	102	ng/L	102	(60-140)	40	6.2
MBLK	Isoqutylparaqen			<5	ng/L				
MRL_CHK	Isoqutylparaqen		5	5.00	ng/L	100	(50-150)		
MS_201709210363	Isoqutylparaqen	ND	100	150	ng/L	**1f 0**	(60-140)		
MSD_201709210363	Isoqutylparaqen	ND	100	142	ng/L	**142**	(60-140)	40	5.5
LCS1	Lipitor (Atorvastain)		100	134	ng/L	134	(60-140)		
LCS2	Lipitor (Atorvastain)		100	129	ng/L	129	(60-140)	40	3.8
MBLK	Lipitor (Atorvastain)			<5	ng/L				

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Lipitor (Atorvastain)		5	6.20	ng/L	124	(50-150)		
MS_201709210363	Lipitor (Atorvastain)	ND	100	111	ng/L	111	(60-140)		
MSD_201709210363	Lipitor (Atorvastain)	ND	100	109	ng/L	109	(60-140)	40	1.8
LCS1	Methylparaqen		400	381	ng/L	95	(60-140)		
LCS2	Methylparaqen		400	384	ng/L	96	(60-140)	40	0.78
MBLK	Methylparaqen			<20	ng/L				
MRL_CHK	Methylparaqen		20	12.6	ng/L	63	(50-150)		
MS_201709210363	Methylparaqen	ND	400	340	ng/L	85	(60-140)		
MSD_201709210363	Methylparaqen	ND	400	370	ng/L	93	(60-140)	40	8.4
LCS1	Naproxen		200	193	ng/L	97	(60-140)		
LCS2	Naproxen		200	191	ng/L	96	(60-140)	40	1.0
MBLK	Naproxen			<10	ng/L				
MRL_CHK	Naproxen		10	6.76	ng/L	68	(50-150)		
MS_201709210363	Naproxen	ND	200	199	ng/L	99	(60-140)		
MSD_201709210363	Naproxen	ND	200	208	ng/L	103	(60-140)	40	4.4
LCS1	Propylparaqen		100	98.5	ng/L	99	(60-140)		
LCS2	Propylparaqen		100	97.0	ng/L	97	(60-140)	40	1.5
MBLK	Propylparaqen			<5	ng/L				
MRL_CHK	Propylparaqen		5	4.92	ng/L	99	(50-150)		
MS_201709210363	Propylparaqen	ND	100	134	ng/L	134	(60-140)		
MSD_201709210363	Propylparaqen	ND	100	138	ng/L	138	(60-140)	40	2.9
LCS1	Salicylic Acid		2000	1920	ng/L	96	(60-140)		
LCS2	Salicylic Acid		2000	1950	ng/L	98	(60-140)	40	1.6
MBLK	Salicylic Acid			<100	ng/L				
MRL_CHK	Salicylic Acid		100	98.3	ng/L	98	(50-150)		
MS_201709210363	Salicylic Acid	ND	2000	1600	ng/L	77	(60-140)		
MSD_201709210363	Salicylic Acid	ND	2000	1660	ng/L	80	(60-140)	40	3.7
LCS1	Sucralose		2000	1860	ng/L	93	(60-140)		
LCS2	Sucralose		2000	1660	ng/L	83	(60-140)	40	11
MBLK	Sucralose			<100	ng/L				
MRL_CHK	Sucralose		100	82.2	ng/L	82	(50-150)		
MS_201709210363	Sucralose	34000	2000	47300	ng/L	**N7N**	(60-140)		
MSD_201709210363	Sucralose	34000	2000	49900	ng/L	**807**	(60-140)	40	5.3
LCS1	Triclocarqan		100	122	ng/L	122	(60-140)		
LCS2	Triclocarqan		100	136	ng/L	136	(60-140)	40	11
MBLK	Triclocarqan			<5	ng/L				
MRL_CHK	Triclocarqan		5	5.01	ng/L	100	(50-150)		
MS_201709210363	Triclocarqan	ND	100	223	ng/L	**223**	(60-140)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709210363	Triclocarqan	ND	100	155	ng/L	**1f f**	(60-140)	40	36
LCS1	Triclosan		200	197	ng/L	98	(60-140)		
LCS2	Triclosan		200	213	ng/L	107	(60-140)	40	7.8
MBLK	Triclosan			<10	ng/L				
MRL_CHK	Triclosan		10	13.2	ng/L	132	(50-150)		
MS_201709210363	Triclosan	ND	200	220	ng/L	110	(60-140)		
MSD_201709210363	Triclosan	ND	200	219	ng/L	109	(60-140)	40	0.46
LCS1	Warfarin		100	82.9	ng/L	83	(60-140)		
LCS2	Warfarin		100	96.5	ng/L	97	(60-140)	40	15
MBLK	Warfarin			<5	ng/L				
MRL_CHK	Warfarin		5	4.46	ng/L	89	(50-150)		
MS_201709210363	Warfarin	ND	100	157	ng/L	**1f 7**	(60-140)		
MSD_201709210363	Warfarin	ND	100	154	ng/L	**1f 3**	(60-140)	40	1.9

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY AT-1807

Laboratory Report

for

State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attention: Joanna Seto

Date of Issue
10/11/2017

EUROFINS EATON ANALYTICAL, INC.

NELAP ACCREDITED TNI LABORATORY
ORELAP 4034

Report: 686572
Project: PPCP-HAWAII
Group: Maui

RCZ: Rick Zimmer

Project Manager

* Accredited in accordance with TNI 2009 and ISO/IEC 17025:2005.
* Laboratory certifies that the test results meet all **TNI 2009 and ISO/IEC 17025:2005** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.

STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	**Michigan**	9906
Arizona	AZ0778	**Mississippi**	Certified
Arkansas	Certified	**Montana**	Cert 0035
California-Monrovia-ELAP	2813	**Nebraska**	Certified
California-Colton- ELAP	2812	**Nevada**	CA00006-2016
California-Folsom- ELAP	2820	**New Hampshire ***	2959
California-Fresno- ELAP	2966	**New Jersey ***	CA 008
Colorado	Certified	**New Mexico**	Certified
Connecticut	PH-0107	**New York ***	11320
Delaware	CA 006	**North Carolina**	06701
Florida *	E871024	**North Dakota**	R-009
Georgia	947	**Oregon (Primary AB) ***	**ORELAP 4034**
Guam	17-005R	**Pennsylvania ***	68-565
Hawaii	Certified	**Puerto Rico**	Certified
Idaho	Certified	**Rhode Island**	LAO00326
Illinois *	200033	**South Carolina**	87016
Indiana	C-CA-01	**South Dakota**	Certified
Iowa - Asbestos	413	**Tennessee**	TN02839
Kansas *	E-10268	**Texas ***	T104704230-16-11
Kentucky	90107	**Utah ***	CA000062017-11
Louisiana *	LA170009	**Vermont**	VT0114
Maine	CA0006	**Virginia ***	460260
Maryland	224	**Washington**	C838
Commonwealth of Northern Marianas Is.	MP0004	**EPA Region 5**	Certified
Massachusetts	M-CA006	**Los Angeles County Sanitation Districts**	10264

* NELAP/TNI Recognized Accreditation Bodies

ISO 17025 Accredited Method List

The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB.

Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environ-mental (Drinking Water)	Environ-mental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
1,4-Dioxane	EPA 522	x		x
2,3,7,8-TCDD	Modified EPA 1613B	x		x
Acrylamide	In House Method (2440)	x		x
Alkalinity	SM 2320B	x	x	x
Ammonia	EPA 350.1		x	x
Ammonia	SM 4500-NH3 H		x	x
Anions and DBPs by IC	EPA 300.0	x	x	x
Anions and DBPs by IC	EPA 300.1	x		x
Asbestos	EPA 100.2	x	x	
Bicarbonate Alkalinity as HCO3	SM 2320B	x	x	x
BOD / CBOD	SM 5210B		x	x
Bromate	In House Method (2447)	x		x
Carbamates	EPA 531.2	x		x
Carbonate as CO3	SM 2330B	x	x	x
Carbonyls	EPA 556	x		x
COD	EPA 410.4 / SM 5220D		x	
Chloramines	SM 4500-CL G	x	x	x
Chlorinated Acids	EPA 515.4	x		x
Chlorinated Acids	EPA 555	x		x
Chlorine Dioxide	SM 4500-CLO2 D	x		x
Chlorine -Total/Free/ Combined Residual	SM 4500-Cl G	x	x	x
Conductivity	EPA 120.1		x	
Conductivity	SM 2510B	x	x	x
Corrosivity (Langelier Index)	SM 2330B	x		x
Cryptosporidium	EPA 1623	x		x
Cyanide, Amenable	SM 4500-CN G	x	x	
Cyanide, Free	SM 4500CN F	x	x	x
Cyanide, Total	EPA 335.4	x	x	x
Cyanogen Chloride (screen)	In House Method (2470)	x		x
Diquat and Paraquat	EPA 549.2	x		x
DBP/HAA	SM 6251B	x		x
Dissolved Oxygen	SM 4500-O G		x	x
DOC	SM 5310C	x		x
E. Coli	(MTF/EC+MUG)	x		x
E. Coli	CFR 141.21(f)(6)(i)	x		x
E. Coli	SM 9223		x	
E. Coli (Enumeration)	SM 9221B.1/ SM 9221F	x		x
E. Coli (Enumeration)	SM 9223B	x		x
EDB/DCBP	EPA 504.1	x		
EDB/DBCP and DBP	EPA 551.1	x		x
EDTA and NTA	In House Method (2454)	x		x
Endothall	EPA 548.1	x		x
Endothall	In-house Method (2445)	x		x
Enterococci	SM 9230B	x	x	
Fecal Coliform	SM 9221 E (MTF/EC)	x		
Fecal Coliform	SM 9221C, E (MTF/EC)		x	
Fecal Coliform (Enumeration)	SM 9221E (MTF/EC)	x		x
Fecal Coliform with Chlorine Present	SM 9221E		x	
Fecal Streptococci	SM 9230B	x	x	
Fluoride	SM 4500-F C	x	x	x
Giardia	EPA 1623	x		x
Glyphosate	EPA 547	x		x
Gross Alpha/Beta	EPA 900.0	x	x	x
Gross Alpha Coprecipitation	SM 7110 C	x	x	x
Hardness	SM 2340B	x	x	x
Heterotrophic Bacteria	In House Method (2439)	x		x
Heterotrophic Bacteria	SM 9215 B	x		x
Hexavalent Chromium	EPA 218.6	x	x	x
Hexavalent Chromium	EPA 218.7	x		x
Hexavalent Chromium	SM 3500-Cr B		x	
Hormones	EPA 539	x		x
Hydroxide as OH Calc.	SM 2330B	x		x
Kjeldahl Nitrogen	EPA 351.2		x	
Legionella	CDC Legionella	x		x
Mercury	EPA 245.1	x	x	x
Metals	EPA 200.7 / 200.8	x	x	x
Microcystin LR	ELISA (2360)	x		x
NDMA	EPA 521	x		x
NDMA	TQ In house method based on EPA 521 (2425)	x		x
Nitrate/Nitrite Nitrogen	EPA 353.2	x	x	x
OCL, Pesticides/PCB	EPA 505	x		x
Ortho Phosphate	EPA 365.1	x	x	x
Ortho Phosphate	SM 4500P E			x
Ortho Phosphorous	SM 4500P E	x		
Oxyhalides Disinfection Byproducts	EPA 317.0	x		x
Perchlorate	EPA 331.0	x		x
Perchlorate (low and high)	EPA 314.0	x		x
Perfluorinated Alkyl Acids	EPA 537	x		x
pH	EPA 150.1	x		
pH	SM 4500-H+B	x	x	x
Phenylurea Pesticides/ Herbicides	In House Method, based on EPA 532 (2448)	x		x
Pseudomonas	IDEXX Pseudalert (2461)	x		x
Radium-226	GA Institute of Tech	x		x
Radium-228	GA Institute of Tech	x		x
Radon-222	SM 7500RN	x		x
Residue, Filterable	SM 2540C	x	x	x
Residue, Non-filterable	SM 2540D		x	
Residue, Total	SM 2540B		x	x
Residue, Volatile	EPA 160.4		x	
Semi-VOC	EPA 525.2	x		x
Semi-VOC	EPA 625		x	x
Silica	SM 4500-Si D	x	x	
Silica	SM 4500-SiO2 C	x	x	
Sulfide	SM 4500-$S^{=}$ D		x	
Sulfite	SM 4500-SO^{3}B	x	x	x
Surfactants	SM 5540C	x	x	x
Taste and Odor Analytes	SM 6040E	x		x
Total Coliform (P/A)	SM 9221 A, B	x		x
Total Coliform (Enumeration)	SM 9221 A, B, C	x		x
Total Coliform / E. coli	Colisure SM 9223	x		x
Total Coliform	SM 9221B		x	
Total Coliform with Chlorine Present	SM 9221B		x	
Total Coliform / E.coli (P/A and Enumeration)	SM 9223	x		x
TOC	SM 5310C	x	x	x
TOX	SM 5320B		x	
Total Phenols	EPA 420.1		x	
Total Phenols	EPA 420.4	x	x	x
Total Phosphorous	SM 4500 P E		x	
Turbidity	EPA 180.1	x	x	x
Turbidity	SM 2130B	x	x	
Uranium by ICP/MS	EPA 200.8	x		x
UV 254	SM 5910B	x		
VOC	EPA 524.2/EPA 524.3	x		x
VOC	EPA 624		x	x
VOC	EPA SW 846 8260	x		x
VOC	In House Method (2411)	x		x
Yeast and Mold	SM 9610	x		x

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Acknowledgement of Samples Received

Addr: **State of Hawaii DOH**
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attn: Joanna Seto
Phone: 808-586-4258

Client ID: HAWAII-DOH
Folder #: 688072
Project: PPCP-HAWAII
Sample Group: Maui

Project Manager: Rick Zimmer
Phone: 626-386-1157

The following samples were received from you on **September 21, 2017** at **1250**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical, Inc..

Sample #	Sample ID	Sample Date
201709210393	Kihei WWRF R-1 Effluent	09/18/2017 1030
	Static ID: 091817-H025	
	@DX_ABI_NEG @DX_ABI_POS	

Test Description

@DX_ABI_NEG -- Endocrine Disruptors Negative Mode - SPE

@DX_ABI_POS -- Endocrine Disruptors Positive Mode - SPE

CHAIN OF CUSTODY RECORD

686572

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750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY:

LOGIN COMMENTS: _____ SAMPLES CHECKED AGAINST COC BY: _____

SAMPLES LOGGED IN BY: _____

SAMPLE TEMP RECEIVED AT: SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

☐ _____ (Other) IR Gun ID = _____ (Observation= _____ °C) (Corr.Factor _____ °C) (Final = _____ °C)

☑ Monrovia IR Gun ID = 570A (Observation= 4.8 °C) (Corr.Factor +.2 °C) (Final = 5.0 °C)

Compliance Acceptance Criteria: (Chemistry: 4 ± 2 °C) (Microbiology: < 10°C)

TYPE OF ICE: Real ____ Synthetic ✓ No Ice ____ **CONDITION OF ICE:** Frozen ✓ Partially Frozen ____ Thawed ____ N/A ____

METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: _____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME:	PROJECT CODE:	COMPLIANCE SAMPLES (check for yes)	NON-COMPLIANCE SAMPLES (check for yes)
HI DEPT OF HEALTH - SAFE DRINKING WATER BRANCH	PPCP-HAWAII	- Requires state forms ☐	REGULATION INVOLVED: ☒
		Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION	(eg. SDWA, NPDES, etc.)

EEA CLIENT CODE:	COC ID:	SAMPLE GROUP:	SEE ATTACHED KIT ORDER FOR ANALYSES ☒ (check for yes), OR
HAWAII-DOH		BASELINE	List ALL ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

TAT requested: rush by adv notice only STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA	PPCP	SAMPLER COMMENTS
9/12/17	9:20	PUKALANI WWRF		WW			2	SAMPLE STORED IN SDWB MONITORING SECTION REFRIDG/ LOCKED STORAGE ROOM UNTIL PACKED FOR FEDEX SHIPMENT ON 9/13/17.
		R-1 EFFLUENT WATER						
		091217-H018						
		pH - 7.53						
		Temp. - 28.6						
		Cond. - 680 µS						
		TDS - 481 ppt						
		Salinity - 0.34 ppt						
		Turbidity - 1.71 NTU						

* **MATRIX TYPES:** **RSW** = Raw Surface Water, **RGW** = Raw Ground Water, **CFW** = Chlor(am)inated Finished Water, **FW** = Other Finished Water, **SEAW** = Sea Water, **WW** = Waste Water, **BW** = Bottled Water, **SW** = Storm Water, **SO** = Soil, **SL** = Sludge, **O** = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	Daniel Chang	DANIEL CHANG	HI DEPT OF HEALTH - SAFE DRINKNG WATER	9/12/17	9:20AM
RELINQUISHED BY:	Daniel Chang	DANIEL CHANG	HI DOH - SAFE DRINKING WATER	9/13/17	10:00AM
RECEIVED BY:		Chris Burk	EEA	9.14.17	1232
RELINQUISHED BY:					
RECEIVED BY:					

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1 800 566 LABS (1 800 566 5227)

Laboratory Hits

Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201709141160	**Pukalani WWRF R-1 Effluent**				
10/05/2017 06:09	1,7-Dimethylxanthine		26		ng/L	10
10/05/2017 6:09	4-nonylphenol - semi quantitative		1100		ng/L	100
10/05/2017 6:09	Acesulfame-K		83		ng/L	20
10/05/2017 06:09	Acetaminophen		16		ng/L	5
10/05/2017 06:09	Amoxicillin (semi-quantitative)		55		ng/L	20
10/05/2017 06:09	Caffeine		16		ng/L	5
10/05/2017 06:09	Carbamazepine		65		ng/L	5
10/05/2017 06:09	Carisoprodol		190		ng/L	5
10/05/2017 06:09	Cotinine		16		ng/L	10
10/05/2017 06:09	Dehydronifedipine		9.1		ng/L	5
10/05/2017 06:09	Dilantin		87		ng/L	20
10/05/2017 06:09	Diuron		29		ng/L	5
10/05/2017 6:09	Ethinyl Estradiol - 17 alpha		6.4		ng/L	5
10/05/2017 06:09	Lidocaine		330		ng/L	5
10/05/2017 06:09	Lopressor		100		ng/L	20
10/05/2017 06:09	Meprobamate		6.6		ng/L	5
10/05/2017 06:09	Primidone		160		ng/L	5
10/05/2017 06:09	TCEP		170		ng/L	10
10/05/2017 06:09	TCPP		240		ng/L	100
10/05/2017 06:09	Theobromine		25		ng/L	10
10/05/2017 6:09	Triclocarban		5.8		ng/L	5

SUMMARY OF POSITIVE DATA ONLY

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Laboratory Data

Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Pukalani WWRF R-1 Effluent (201709141160) — **Sampled on 09/12/2017 0920**

Static ID: 091817-H012

LC-MS-MS - Endocrine Disruptors Positive Mode - SPE

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/05/17 06:09		1031674	(LC-MS-MS)	1,7-Dimethylxanthine	26	ng/L	3.4	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Acetaminophen	16	ng/L	3.0	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Albuterol	q.D	ng/L	2.4	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Amoxicillin (semi-. uantitative)	55	ng/L	6.4	20	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Androstenedione	q.D	ng/L	1.7	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Atenolol	q.D	ng/L	3.9	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Atrazine	q.D	ng/L	2.3	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Bezafibrate	q.D	ng/L	3.5	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Bromacil	q.D	ng/L	3.2	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Caffeine	16	ng/L	4.3	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Carbadox	q.D	ng/L	4.2	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Carbamazepine	65	ng/L	1.2	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Carisoprodol	190	ng/L	1.2	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Chloridazon	2.0J	ng/L	1.6	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Chlorotoluron	q.D	ng/L	0.89	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Cimetidine (semi-. uantitative)	q.D	ng/L	2.7	5	1
	09/27/17 07:00		1030288	(LC-MS-MS)	Ciprofloxacin - Cipro	q.D	ng/L	20	100	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Cotinine	16	ng/L	4.3	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Cyanazine	q.D	ng/L	1.7	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	DACT	q.D	ng/L	3.9	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	DEA	q.D	ng/L	1.5	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	DEET	6.0J	ng/L	1.1	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Dehydronifedipine	9.1	ng/L	1.4	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	DIA	q.D	ng/L	2.4	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Diazepam	q.D	ng/L	2.1	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Dilantin	87	ng/L	13	20	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Diltiazem	3.8J	ng/L	3.0	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Diuron	29	ng/L	1.8	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Erythromycin	q.D	ng/L	4.0	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Flume. ine	q.D	ng/L	7.1	10	1

Rounding on totals after summationb
(c) - Indicates calculated resultsb
q.D - Analyte was not detected at the calculated MDLb
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the re. uired QC criteriab

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Laboratory Data

Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/05/17 06:09		1031674	(LC-MS-MS)	Fluoxetine	q D	ng/L	10	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Isoproturon	q D	ng/L	12	100	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Ketoprofen	q D	ng/L	2b6	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Ketorolac	q D	ng/L	2b1	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Lidocaine	330	ng/L	1b1	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Lincomycin	q D	ng/L	1b7	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Linuron	q D	ng/L	2b8	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Lopressor	100	ng/L	5b1	20	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Meclofenamic Acid	q D	ng/L	4b7	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	MeproNamate	6b6	ng/L	2b0	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Metazachlor	q D	ng/L	1b3	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Metolachlor	q D	ng/L	3b1	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	q ifedipine (semi . uantitative)	q D	ng/L	12	20	1
	10/05/17 06:09		1031674	(LC-MS-MS)	q orethisterone	q D	ng/L	2b3	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Oxolinic acid	q D	ng/L	2b5	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Pentoxifylline	q D (R7)	ng/L	1b5	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Phenazone	q D	ng/L	5b0	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Primidone	160	ng/L	4b8	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Progesterone	q D	ng/L	2b9	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Propazine	q D	ng/L	1b8	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Quinoline	q D	ng/L	2b5	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Simazine	q D	ng/L	1b2	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Sulfachloropyridazine	q D	ng/L	2b1	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Sulfadiazine	q D	ng/L	3b9	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Sulfadimethoxine	q D	ng/L	1b6	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Sulfamerazine	q D	ng/L	4b6	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Sulfamethazine	q D	ng/L	1b5	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Sulfamethizole	q D	ng/L	3b2	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Sulfamethoxazole	q D	ng/L	2b8	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Sulfathiazole	q D	ng/L	2b4	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	TCEP	170 (R7)	ng/L	3b2	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	TCPP	240	ng/L	20	100	1
	10/05/17 06:09		1031674	(LC-MS-MS)	TDCPP	84J (R7)	ng/L	20	100	1

Rounding on totals after summationb
(c) - Indicates calculated resultsb
q D - Analyte was not detected at the calculated MDLb
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the re. uired QC criteriab

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Laboratory Data

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Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/05/17 06:09		1031674	(LC-MS-MS)	Testosterone	q D (R7)	ng/L	2b5	5	1
	10/05/17 06:09		1031674	(LC-MS-MS)	TheoNromine	25	ng/L	3b2	10	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Theophylline (semi-. uantitative)	14J	ng/L	4b8	20	1
	10/05/17 06:09		1031674	(LC-MS-MS)	Trimethoprim	3b5J	ng/L	1b8	5	1
	LC-MS-MS - Endocrine Disruptors Negative Mode - SPE									
	10/05/17 6:09		1031671	(LC-MS-MS)	2,4-D	q D	ng/L	5b0	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	4-nonylphenol - semi . uantitative	1100	ng/L	50	100	1
	10/05/17 6:09		1031671	(LC-MS-MS)	4-tert-Octylphenol	q D	ng/L	6b9	50	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Acesulfame-K	83	ng/L	20	20	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Bendroflumethiazide	q D	ng/L	4b4	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	BPA	q D	ng/L	7b2	10	1
	10/05/17 6:09		1031671	(LC-MS-MS)	ButalNital	q D	ng/L	2b9	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	ButylparaNen	q D	ng/L	3b3	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Chloramphenicol	q D	ng/L	3b1	10	1
	10/05/17 6:09		1031671	(LC-MS-MS)	ClofiNric Acid	q D	ng/L	5b0	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Diclofenac	q D	ng/L	3b3	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Estradiol	q D	ng/L	4b4	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Estrone	q D	ng/L	3b9	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Ethinyl Estradiol - 17 alpha	6b4	ng/L	3b3	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	EthylparaNen	q D	ng/L	11	20	1
	10/05/17 6:09		1031671	(LC-MS-MS)	GemfiNrozil	q D	ng/L	2b5	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	INuprofen	q D	ng/L	8b6	10	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Iohexal	q D	ng/L	7b7	10	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Iopromide	q D	ng/L	1b6	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	IsoNutylparaNen	q D	ng/L	4b2	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Lipitor (Atorvastatin)	q D	ng/L	50	100	1
	10/05/17 6:09		1031671	(LC-MS-MS)	MethylparaNen	q D	ng/L	11	20	1
	10/05/17 6:09		1031671	(LC-MS-MS)	q aproxen	q D	ng/L	8b5	10	1
	10/05/17 6:09		1031671	(LC-MS-MS)	PropylparaNen	q D	ng/L	2b9	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Salicylic Acid	q D	ng/L	50	100	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Sucralose	q D	ng/L	42	100	1
	10/05/17 6:09		1031671	(LC-MS-MS)	TriclocarNan	5b8	ng/L	2b5	5	1
	10/05/17 6:09		1031671	(LC-MS-MS)	Triclosan	9b6J	ng/L	6b3	10	1

Rounding on totals after summationb
(c) - Indicates calculated resultsb
q D - Analyte was not detected at the calculated MDLb
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the re. uired QC criteriab

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Laboratory Data

Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/14/2017 1232

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/05/17 6:09		1031671	(LC-MS-MS)	Warfarin	q D	ng/L	4b1	5	1

Rounding on totals after summationb
(c) - Indicates calculated resultsb
q D - Analyte was not detected at the calculated MDLb
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the re. uired QC criteriab

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Laboratory Comments

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Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Folder Comments

Sample results at both the MDL and MRL are included in this report to indicate estimated concentrations for samples below the MRLv

RPD calculation for Pentoxifyline, TC. P, TDCPP and Testosterone were highv HoweEer, data is acceptable based on passing LCS and other QCv

Flags Legend:

R7 - LFB/LFBD RPD exceeded the laboratory acceptance limitv RecoEery met acceptance criteriav

The Comments Report may be blank if there are no comments for this report.

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Laboratory QC Summary

Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 1030288 **Analysis Date: 09/27/2017**

201709141160 Pukalani WWRF R-1 Effluent Analyzed by: ALI

Endocrine Disruptors Negative Mode - SPE

Analytical Batch: 1031671 **Analysis Date: 10/05/2017**

201709141160 Pukalani WWRF R-1 Effluent Analyzed by: ARH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 1031674 **Analysis Date: 10/05/2017**

201709141160 Pukalani WWRF R-1 Effluent Analyzed by: ARH

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Laboratory QC

Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Endocrine Disruptors Positive Mode - SPE by LC-MS-MS									
Analytical Batch: 1030288							**Analysis Date: 09/27/2017**		
LCS1	Ciprofloxacin - Cipro		2000	2030	ng/L	101	(40-160)		
LCS2	Ciprofloxacin - Cipro		2000	2130	ng/L	107	(40-160)	30	4.8
MBLK	Ciprofloxacin - Cipro			<100	ng/L				
MRL_CHK	Ciprofloxacin - Cipro		100	52.5	ng/L	53	(50-150)		
MS_201709141150	Ciprofloxacin - Cipro	ND	2000	371	ng/L	**19**	(40-160)		
MSD_201709141150	Ciprofloxacin - Cipro	ND	2000	278	ng/L	**14**	(40-160)	60	29
Endocrine Disruptors Negative Mode - SPE by LC-MS-MS									
Analytical Batch: 1031671							**Analysis Date: 10/05/2017**		
LCS1	2,4-D		100	98.2	ng/L	98	(60-140)		
LCS2	2,4-D		100	101	ng/L	101	(60-140)	40	2.8
MBLK	2,4-D			<5	ng/L				
MRL_CHK	2,4-D		5	4.83	ng/L	97	(50-150)		
MS_201709141145	2,4-D	150	100	253	ng/L	106	(60-140)		
MSD_201709141145	2,4-D	150	100	242	ng/L	96	(60-140)	40	4.0
LCS1	4-nonylphenol - semi quantitative		200	219	ng/L	109	(60-140)		
LCS2	4-nonylphenol - semi quantitative		200	197	ng/L	98	(60-140)	40	11
MBLK	4-nonylphenol - semi quantitative			<100	ng/L				
MRL_CHK	4-nonylphenol - semi quantitative		10	8.31	ng/L	83	(50-150)		
MS_201709141145	4-nonylphenol - semi quantitative	1200	200	1340	ng/L	78	(60-140)		
MSD_201709141145	4-nonylphenol - semi quantitative	1200	200	1430	ng/L	123	(60-140)	40	6.5
LCS1	4-tert-octylphenol		100	117	ng/L	117	(60-140)		
LCS2	4-tert-octylphenol		100	98.8	ng/L	99	(60-140)	40	17
MBLK	4-tert-octylphenol			<100	ng/L				
MRL_CHK	4-tert-octylphenol		5	4.36	ng/L	87	(50-150)		
MS_201709141145	4-tert-octylphenol	120	100	294	ng/L	**169**	(60-140)		
MSD_201709141145	4-tert-octylphenol	120	100	286	ng/L	**160**	(60-140)	40	2.8
LCS1	Acesulfame-K		400	384	ng/L	96	(60-140)		
LCS2	Acesulfame-K		400	370	ng/L	92	(60-140)	40	3.7
MBLK	Acesulfame-K			<20	ng/L				
MRL_CHK	Acesulfame-K		20	20.4	ng/L	102	(50-150)		
MS_201709141145	Acesulfame-K	70	400	549	ng/L	120	(60-140)		
MSD_201709141145	Acesulfame-K	70	400	529	ng/L	115	(60-140)	40	3.7
LCS1	Bendroflumethiazide		100	102	ng/L	102	(60-140)		
LCS2	Bendroflumethiazide		100	97.6	ng/L	98	(60-140)	40	4.4

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Bendroflumethiazide			<5	ng/L				
MRL_CHK	Bendroflumethiazide		5	6.08	ng/L	122	(50-150)		
MS_201709141145	Bendroflumethiazide	ND	100	57.9	ng/L	**58**	(60-140)		
MSD_201709141145	Bendroflumethiazide	ND	100	52.9	ng/L	**53**	(60-140)	40	9.0
LCS1	BPA		100	98.1	ng/L	98	(60-140)		
LCS2	BPA		100	94.1	ng/L	94	(60-140)	40	4.2
MBLK	BPA			<10	ng/L				
MRL_CHK	BPA		5	4.22	ng/L	85	(50-150)		
MS_201709141145	BPA	ND	100	113	ng/L	104	(60-140)		
MSD_201709141145	BPA	ND	100	115	ng/L	106	(60-140)	40	1.8
LCS1	Butalbital		100	98.1	ng/L	98	(60-140)		
LCS2	Butalbital		100	106	ng/L	106	(60-140)	40	7.7
MBLK	Butalbital			<5	ng/L				
MRL_CHK	Butalbital		5	5.24	ng/L	105	(50-150)		
MS_201709141145	Butalbital	ND	100	134	ng/L	134	(60-140)		
MSD_201709141145	Butalbital	ND	100	128	ng/L	128	(60-140)	40	4.6
LCS1	Butylparben		100	104	ng/L	104	(60-140)		
LCS2	Butylparben		100	85.8	ng/L	86	(60-140)	40	19
MBLK	Butylparben			<5	ng/L				
MRL_CHK	Butylparben		5	3.85	ng/L	77	(50-150)		
MS_201709141145	Butylparben	ND	100	158	ng/L	**158**	(60-140)		
MSD_201709141145	Butylparben	ND	100	165	ng/L	**165**	(60-140)	40	4.3
LCS1	Chloramphenicol		100	99.1	ng/L	99	(60-140)		
LCS2	Chloramphenicol		100	103	ng/L	103	(60-140)	40	3.9
MBLK	Chloramphenicol			<10	ng/L				
MRL_CHK	Chloramphenicol		5	5.93	ng/L	119	(50-150)		
MS_201709141145	Chloramphenicol	ND	100	53.3	ng/L	**53**	(60-140)		
MSD_201709141145	Chloramphenicol	ND	100	47.1	ng/L	**47**	(60-140)	40	12
LCS1	Clofibric Acid		100	100	ng/L	100	(60-140)		
LCS2	Clofibric Acid		100	98.3	ng/L	98	(60-140)	40	1.7
MBLK	Clofibric Acid			<5	ng/L				
MRL_CHK	Clofibric Acid		5	4.94	ng/L	99	(50-150)		
MS_201709141145	Clofibric Acid	ND	100	220	ng/L	**220**	(60-140)		
MSD_201709141145	Clofibric Acid	ND	100	225	ng/L	**225**	(60-140)	40	2.3
LCS1	Diclofenac		100	101	ng/L	101	(60-140)		
LCS2	Diclofenac		100	98.3	ng/L	98	(60-140)	40	2.7
MBLK	Diclofenac			<5	ng/L				
MRL_CHK	Diclofenac		5	4.65	ng/L	93	(50-150)		

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709141145	Diclofenac	16	100	160	ng/L	**144**	(60-140)		
MSD_201709141145	Diclofenac	16	100	161	ng/L	**144**	(60-140)	40	0.62
LCS1	Estradiol		100	107	ng/L	107	(60-140)		
LCS2	Estradiol		100	94.6	ng/L	95	(60-140)	40	12
MBLK	Estradiol			<5	ng/L				
MRL_CHK	Estradiol		5	4.21	ng/L	84	(50-150)		
MS_201709141145	Estradiol	ND	100	119	ng/L	119	(60-140)		
MSD_201709141145	Estradiol	ND	100	113	ng/L	113	(60-140)	40	5.2
LCS1	Estrone		100	106	ng/L	106	(60-140)		
LCS2	Estrone		100	102	ng/L	102	(60-140)	40	3.9
MBLK	Estrone			<5	ng/L				
MRL_CHK	Estrone		5	3.91	ng/L	78	(50-150)		
MS_201709141145	Estrone	ND	100	137	ng/L	133	(60-140)		
MSD_201709141145	Estrone	ND	100	134	ng/L	130	(60-140)	40	2.2
LCS1	Ethinyl Estradiol - 17 alpha		100	96.7	ng/L	97	(60-140)		
LCS2	Ethinyl Estradiol - 17 alpha		100	87.9	ng/L	88	(60-140)	40	9.5
MBLK	Ethinyl Estradiol - 17 alpha			<5	ng/L				
MRL_CHK	Ethinyl Estradiol - 17 alpha		5	7.40	ng/L	148	(50-150)		
MS_201709141145	Ethinyl Estradiol - 17 alpha	ND	100	122	ng/L	123	(60-140)		
MSD_201709141145	Ethinyl Estradiol - 17 alpha	ND	100	118	ng/L	118	(60-140)	40	4.2
LCS1	Ethylparaben		400	393	ng/L	98	(60-140)		
LCS2	Ethylparaben		400	383	ng/L	96	(60-140)	40	2.6
MBLK	Ethylparaben			<20	ng/L				
MRL_CHK	Ethylparaben		20	19.0	ng/L	95	(50-150)		
MS_201709141145	Ethylparaben	ND	400	449	ng/L	110	(60-140)		
MSD_201709141145	Ethylparaben	ND	400	409	ng/L	100	(60-140)	40	9.3
LCS1	Gemfibrozil		100	101	ng/L	101	(60-140)		
LCS2	Gemfibrozil		100	96.0	ng/L	96	(60-140)	40	5.1
MBLK	Gemfibrozil			<5	ng/L				
MRL_CHK	Gemfibrozil		5	3.07	ng/L	61	(50-150)		
MS_201709141145	Gemfibrozil	270	100	359	ng/L	88	(60-140)		
MSD_201709141145	Gemfibrozil	270	100	346	ng/L	76	(60-140)	40	3.7
LCS1	Ibuprofen		200	213	ng/L	106	(60-140)		
LCS2	Ibuprofen		200	187	ng/L	93	(60-140)	40	13
MBLK	Ibuprofen			<15	ng/L				
MRL_CHK	Ibuprofen		10	11.0	ng/L	110	(50-150)		
MS_201709141145	Ibuprofen	ND	200	249	ng/L	125	(60-140)		
MSD_201709141145	Ibuprofen	ND	200	269	ng/L	135	(60-140)	40	7.7

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Iohexal		200	189	ng/L	95	(60-140)		
LCS2	Iohexal		200	185	ng/L	93	(60-140)	40	2.1
MBLK	Iohexal			<10	ng/L				
MRL_CHK	Iohexal		10	12.0	ng/L	120	(50-150)		
MS_201709141145	Iohexal	ND	200	65.5	ng/L	**33**	(50-150)		
MSD_201709141145	Iohexal	ND	200	96.6	ng/L	**48**	(50-150)	50	38
LCS1	Iopromide		100	113	ng/L	113	(60-140)		
LCS2	Iopromide		100	86.3	ng/L	86	(60-140)	40	27
MBLK	Iopromide			<5	ng/L				
MRL_CHK	Iopromide		5	6.82	ng/L	136	(50-150)		
MS_201709141145	Iopromide	2000	100	2020	ng/L	**16**	(50-150)		
MSD_201709141145	Iopromide	2000	100	1970	ng/L	**-32.8**	(50-150)	50	2.5
LCS1	Isobutylparaben		100	104	ng/L	105	(60-140)		
LCS2	Isobutylparaben		100	85.8	ng/L	86	(60-140)	40	20
MBLK	Isobutylparaben			<5	ng/L				
MRL_CHK	Isobutylparaben		5	3.74	ng/L	75	(50-150)		
MS_201709141145	Isobutylparaben	ND	100	158	ng/L	**158**	(60-140)		
MSD_201709141145	Isobutylparaben	ND	100	165	ng/L	**165**	(60-140)	40	4.3
LCS1	Lipitor (Atorvastain)		100	128	ng/L	128	(60-140)		
LCS2	Lipitor (Atorvastain)		100	105	ng/L	105	(60-140)	40	20
MBLK	Lipitor (Atorvastain)			<5	ng/L				
MRL_CHK	Lipitor (Atorvastain)		5	6.35	ng/L	127	(50-150)		
MS_201709141145	Lipitor (Atorvastain)	ND	100	125	ng/L	125	(60-140)		
MSD_201709141145	Lipitor (Atorvastain)	ND	100	134	ng/L	134	(60-140)	40	7.0
LCS1	Methylparaben		400	400	ng/L	100	(60-140)		
LCS2	Methylparaben		400	385	ng/L	96	(60-140)	40	3.8
MBLK	Methylparaben			<20	ng/L				
MRL_CHK	Methylparaben		20	19.9	ng/L	99	(50-150)		
MS_201709141145	Methylparaben	ND	400	359	ng/L	86	(60-140)		
MSD_201709141145	Methylparaben	ND	400	334	ng/L	80	(60-140)	40	6.9
LCS1	Naproxen		200	182	ng/L	91	(60-140)		
LCS2	Naproxen		200	185	ng/L	92	(60-140)	40	1.6
MBLK	Naproxen			<10	ng/L				
MRL_CHK	Naproxen		10	6.92	ng/L	69	(50-150)		
MS_201709141145	Naproxen	ND	200	52.6	ng/L	**26**	(60-140)		
MSD_201709141145	Naproxen	ND	200	45.2	ng/L	**23**	(60-140)	40	15
LCS1	Propylparaben		100	101	ng/L	101	(60-140)		
LCS2	Propylparaben		100	86.4	ng/L	86	(60-140)	40	16

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Propylparaben			<5	ng/L				
MRL_CHK	Propylparaben		5	2.63	ng/L	53	(50-150)		
MS_201709141145	Propylparaben	ND	100	133	ng/L	133	(60-140)		
MSD_201709141145	Propylparaben	ND	100	128	ng/L	128	(60-140)	40	3.8
LCS1	Salicylic Acid		2000	1980	ng/L	99	(60-140)		
LCS2	Salicylic Acid		2000	2080	ng/L	104	(60-140)	40	4.9
MBLK	Salicylic Acid			<100	ng/L				
MRL_CHK	Salicylic Acid		100	136	ng/L	137	(50-150)		
MS_201709141145	Salicylic Acid	ND	2000	2380	ng/L	119	(60-140)		
MSD_201709141145	Salicylic Acid	ND	2000	1700	ng/L	85	(60-140)	40	33
LCS1	Sucralose		2000	1900	ng/L	95	(60-140)		
LCS2	Sucralose		2000	1780	ng/L	89	(60-140)	40	7.0
MBLK	Sucralose			<100	ng/L				
MRL_CHK	Sucralose		100	124	ng/L	124	(50-150)		
MS_201709141145	Sucralose	52000	2000	70500	ng/L	**943**	(60-140)		
MSD_201709141145	Sucralose	52000	2000	52200	ng/L	**28**	(60-140)	40	30
LCS1	Triclocarban		100	122	ng/L	122	(60-140)		
LCS2	Triclocarban		100	128	ng/L	129	(60-140)	40	5.6
MBLK	Triclocarban			<5	ng/L				
MRL_CHK	Triclocarban		5	6.10	ng/L	122	(50-150)		
MS_201709141145	Triclocarban	7.9	100	92.8	ng/L	85	(60-140)		
MSD_201709141145	Triclocarban	7.9	100	102	ng/L	94	(60-140)	40	9.4
LCS1	Triclosan		200	199	ng/L	100	(60-140)		
LCS2	Triclosan		200	201	ng/L	100	(60-140)	40	1.0
MBLK	Triclosan			<10	ng/L				
MRL_CHK	Triclosan		10	8.08	ng/L	81	(50-150)		
MS_201709141145	Triclosan	22	200	256	ng/L	117	(60-140)		
MSD_201709141145	Triclosan	22	200	244	ng/L	111	(60-140)	40	4.8
LCS1	Warfarin		100	91.5	ng/L	92	(60-140)		
LCS2	Warfarin		100	114	ng/L	114	(60-140)	40	22
MBLK	Warfarin			<5	ng/L				
MRL_CHK	Warfarin		5	6.16	ng/L	123	(50-150)		
MS_201709141145	Warfarin	ND	100	109	ng/L	107	(60-140)		
MSD_201709141145	Warfarin	ND	100	81.2	ng/L	79	(60-140)	40	29

Endocrine Disruptors Positive Mode - SPE by LC-MS-MS

Analytical Batch: 1031674 **Analysis Date: 10/05/2017**

LCS1	1,7-Dimethylxanthine		100	103	ng/L	103	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	1,7-Dimethylxanthine		100	98.5	ng/L	99	(60-140)	30	4.5
MBLK	1,7-Dimethylxanthine			<5	ng/L				
MRL_CHK	1,7-Dimethylxanthine		5	4.85	ng/L	97	(50-150)		
MS_201709141145	1,7-Dimethylxanthine	39	100	103	ng/L	64	(60-140)		
MSD_201709141145	1,7-Dimethylxanthine	39	100	116	ng/L	77	(60-140)	40	12
LCS1	Acetaminophen		100	97.4	ng/L	97	(60-140)		
LCS2	Acetaminophen		100	93.5	ng/L	94	(60-140)	30	4.1
MBLK	Acetaminophen			<5	ng/L				
MRL_CHK	Acetaminophen		5	4.96	ng/L	99	(50-150)		
MS_201709141145	Acetaminophen	32	100	146	ng/L	113	(60-140)		
MSD_201709141145	Acetaminophen	32	100	120	ng/L	88	(60-140)	40	20
LCS1	Albuterol		100	93.6	ng/L	94	(60-140)		
LCS2	Albuterol		100	84.7	ng/L	85	(60-140)	30	10
MBLK	Albuterol			<5	ng/L				
MRL_CHK	Albuterol		5	2.70	ng/L	54	(50-150)		
MS_201709141145	Albuterol	ND	100	110	ng/L	110	(60-140)		
MSD_201709141145	Albuterol	ND	100	110	ng/L	111	(60-140)	40	0.91
LCS1	Amoxicillin (semi-quantitative)		400	363	ng/L	91	(60-140)		
LCS2	Amoxicillin (semi-quantitative)		400	377	ng/L	94	(60-140)	30	3.8
MBLK	Amoxicillin (semi-quantitative)			<20	ng/L				
MRL_CHK	Amoxicillin (semi-quantitative)		20	20.8	ng/L	104	(50-150)		
MS_201709141145	Amoxicillin (semi-quantitative)	1100	400	1450	ng/L	93	(60-140)		
MSD_201709141145	Amoxicillin (semi-quantitative)	1100	400	1240	ng/L	**40**	(60-140)	40	16
LCS1	Andorostenedione		100	77.7	ng/L	78	(60-140)		
LCS2	Andorostenedione		100	85.7	ng/L	86	(60-140)	30	9.8
MBLK	Andorostenedione			<5	ng/L				
MRL_CHK	Andorostenedione		5	5.55	ng/L	111	(50-150)		
MS_201709141145	Andorostenedione	ND	100	115	ng/L	115	(60-140)		
MSD_201709141145	Andorostenedione	ND	100	158	ng/L	**158**	(60-140)	40	32
LCS1	Atenolol		100	93.8	ng/L	94	(60-140)		
LCS2	Atenolol		100	76.7	ng/L	77	(60-140)	30	20
MBLK	Atenolol			<5	ng/L				
MRL_CHK	Atenolol		5	4.55	ng/L	91	(50-150)		
MS_201709141145	Atenolol	17	100	152	ng/L	135	(60-140)		
MSD_201709141145	Atenolol	17	100	178	ng/L	**161**	(60-140)	40	16
LCS1	Atrazine		100	101	ng/L	101	(60-140)		
LCS2	Atrazine		100	122	ng/L	122	(60-140)	30	19
MBLK	Atrazine			<5	ng/L				

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Atrazine		5	3.89	ng/L	78	(50-150)		
MS_201709141145	Atrazine	ND	100	113	ng/L	113	(60-140)		
MSD_201709141145	Atrazine	ND	100	125	ng/L	125	(60-140)	40	10
LCS1	Bezafibrate		100	98.3	ng/L	98	(60-140)		
LCS2	Bezafibrate		100	97.6	ng/L	98	(60-140)	30	0.72
MBLK	Bezafibrate			<5	ng/L				
MRL_CHK	Bezafibrate		5	4.32	ng/L	87	(50-150)		
MS_201709141145	Bezafibrate	ND	100	130	ng/L	130	(60-140)		
MSD_201709141145	Bezafibrate	ND	100	131	ng/L	131	(60-140)	40	0.77
LCS1	Bromacil		100	98.7	ng/L	99	(60-140)		
LCS2	Bromacil		100	95.1	ng/L	95	(60-140)	30	3.7
MBLK	Bromacil			<5	ng/L				
MRL_CHK	Bromacil		5	5.56	ng/L	111	(50-150)		
MS_201709141145	Bromacil	ND	100	91.9	ng/L	92	(60-140)		
MSD_201709141145	Bromacil	ND	100	86.1	ng/L	86	(60-140)	40	6.5
LCS1	Caffeine		100	85.2	ng/L	85	(60-140)		
LCS2	Caffeine		100	94.7	ng/L	95	(60-140)	30	11
MBLK	Caffeine			<5	ng/L				
MRL_CHK	Caffeine		5	5.44	ng/L	109	(50-150)		
MS_201709141145	Caffeine	37	100	126	ng/L	89	(60-140)		
MSD_201709141145	Caffeine	37	100	127	ng/L	90	(60-140)	40	0.79
LCS1	Carbadox		100	92.6	ng/L	93	(60-140)		
LCS2	Carbadox		100	93.4	ng/L	93	(60-140)	30	0.86
MBLK	Carbadox			<5	ng/L				
MRL_CHK	Carbadox		5	4.46	ng/L	89	(50-150)		
MS_201709141145	Carbadox	ND	100	65.0	ng/L	65	(60-140)		
MSD_201709141145	Carbadox	ND	100	69.0	ng/L	69	(60-140)	40	6.1
LCS1	Carbamazepine		100	101	ng/L	101	(60-140)		
LCS2	Carbamazepine		100	134	ng/L	134	(60-140)	30	28
MBLK	Carbamazepine			<5	ng/L				
MRL_CHK	Carbamazepine		5	7.41	ng/L	148	(50-150)		
MS_201709141145	Carbamazepine	110	100	249	ng/L	138	(60-140)		
MSD_201709141145	Carbamazepine	110	100	188	ng/L	77	(60-140)	40	27
LCS1	Carisoprodol		100	94.9	ng/L	95	(60-140)		
LCS2	Carisoprodol		100	98.9	ng/L	99	(60-140)	30	4.1
MBLK	Carisoprodol			<5	ng/L				
MRL_CHK	Carisoprodol		5	6.30	ng/L	126	(50-150)		
MS_201709141145	Carisoprodol	ND	100	0	ng/L	**0**	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709141145	Carisoprodol	ND	100	0	ng/L	**0**	(60-140)	40	**1000**
LCS1	Chloridazon		100	102	ng/L	102	(60-140)		
LCS2	Chloridazon		100	104	ng/L	104	(60-140)	30	1.9
MBLK	Chloridazon			<5	ng/L				
MRL_CHK	Chloridazon		5	5.39	ng/L	108	(50-150)		
MS_201709141145	Chloridazon	ND	100	18.5	ng/L	**19**	(60-140)		
MSD_201709141145	Chloridazon	ND	100	17.4	ng/L	**18**	(60-140)	40	5.6
LCS1	Chlorotoluron		100	101	ng/L	101	(60-140)		
LCS2	Chlorotoluron		100	98.6	ng/L	99	(60-140)	30	2.4
MBLK	Chlorotoluron			<5	ng/L				
MRL_CHK	Chlorotoluron		5	5.56	ng/L	111	(50-150)		
MS_201709141145	Chlorotoluron	ND	100	112	ng/L	112	(60-140)		
MSD_201709141145	Chlorotoluron	ND	100	97.9	ng/L	98	(60-140)	40	13
LCS1	Cimetidine		100	99.6	ng/L	100	(60-140)		
LCS2	Cimetidine		100	88.0	ng/L	88	(60-140)	30	12
MBLK	Cimetidine			<5	ng/L				
MRL_CHK	Cimetidine		5	3.86	ng/L	77	(50-150)		
MS_201709141145	Cimetidine	ND	100	130	ng/L	130	(60-140)		
MSD_201709141145	Cimetidine	ND	100	87.9	ng/L	88	(60-140)	40	39
LCS1	Cotinine		200	201	ng/L	100	(60-140)		
LCS2	Cotinine		200	195	ng/L	98	(60-140)	30	3.0
MBLK	Cotinine			<10	ng/L				
MRL_CHK	Cotinine		10	9.69	ng/L	97	(50-150)		
MS_201709141145	Cotinine	25	200	219	ng/L	97	(60-140)		
MSD_201709141145	Cotinine	25	200	198	ng/L	87	(60-140)	40	10
LCS1	Cyanazine		100	88.2	ng/L	88	(60-140)		
LCS2	Cyanazine		100	118	ng/L	118	(60-140)	30	29
MBLK	Cyanazine			<5	ng/L				
MRL_CHK	Cyanazine		5	5.79	ng/L	116	(50-150)		
MS_201709141145	Cyanazine	ND	100	63.6	ng/L	64	(60-140)		
MSD_201709141145	Cyanazine	ND	100	63.8	ng/L	64	(60-140)	40	0.31
LCS1	DACT		100	95.8	ng/L	96	(60-140)		
LCS2	DACT		100	93.0	ng/L	93	(60-140)	30	3.1
MBLK	DACT			<5	ng/L				
MRL_CHK	DACT		5	5.80	ng/L	116	(50-150)		
MS_201709141145	DACT	ND	100	121	ng/L	121	(60-140)		
MSD_201709141145	DACT	ND	100	70.7	ng/L	71	(60-140)	40	**53**
LCS1	DEA		100	104	ng/L	104	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	DEA		100	99.0	ng/L	99	(60-140)	30	4.9
MBLK	DEA			<5	ng/L				
MRL_CHK	DEA		5	5.91	ng/L	118	(50-150)		
MS_201709141145	DEA	8.4	100	17.1	ng/L	**8.7**	(60-140)		
MSD_201709141145	DEA	8.4	100	10.4	ng/L	**2**	(60-140)	40	**48**
LCS1	DEET		40	38.4	ng/L	96	(60-140)		
LCS2	DEET		40	31.1	ng/L	78	(60-140)	30	21
MBLK	DEET			<10	ng/L				
MRL_CHK	DEET		2	1.93	ng/L	97	(50-150)		
MS_201709141145	DEET	150	40	234	ng/L	**199**	(60-140)		
MSD_201709141145	DEET	150	40	161	ng/L	**18**	(60-140)	40	37
LCS1	Dehydronifedipine		100	96.8	ng/L	97	(60-140)		
LCS2	Dehydronifedipine		100	96.3	ng/L	96	(60-140)	30	0.52
MBLK	Dehydronifedipine			<5	ng/L				
MRL_CHK	Dehydronifedipine		5	5.80	ng/L	116	(50-150)		
MS_201709141145	Dehydronifedipine	ND	100	55.8	ng/L	**52**	(60-140)		
MSD_201709141145	Dehydronifedipine	ND	100	57.1	ng/L	**54**	(60-140)	40	2.3
LCS1	DIA		100	102	ng/L	102	(60-140)		
LCS2	DIA		100	97.8	ng/L	98	(60-140)	30	4.1
MBLK	DIA			<5	ng/L				
MRL_CHK	DIA		5	4.34	ng/L	87	(50-150)		
MS_201709141145	DIA	ND	100	96.0	ng/L	96	(60-140)		
MSD_201709141145	DIA	ND	100	86.0	ng/L	86	(60-140)	40	11
LCS1	Diazepam		100	110	ng/L	110	(60-140)		
LCS2	Diazepam		100	106	ng/L	106	(60-140)	30	3.7
MBLK	Diazepam			<5	ng/L				
MRL_CHK	Diazepam		5	4.83	ng/L	97	(50-150)		
MS_201709141145	Diazepam	ND	100	136	ng/L	136	(60-140)		
MSD_201709141145	Diazepam	ND	100	107	ng/L	107	(60-140)	40	24
LCS1	Dilantin		400	385	ng/L	96	(60-140)		
LCS2	Dilantin		400	340	ng/L	85	(60-140)	30	12
MBLK	Dilantin			<20	ng/L				
MRL_CHK	Dilantin		20	19.8	ng/L	99	(50-150)		
MS_201709141145	Dilantin	ND	400	394	ng/L	99	(60-140)		
MSD_201709141145	Dilantin	ND	400	430	ng/L	108	(60-140)	40	8.7
LCS1	Diltiazem		100	102	ng/L	102	(60-140)		
LCS2	Diltiazem		100	96.0	ng/L	96	(60-140)	30	6.1
MBLK	Diltiazem			<5	ng/L				

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Diltiazem		5	5.14	ng/L	103	(50-150)		
MS_201709141145	Diltiazem	120	100	248	ng/L	131	(60-140)		
MSD_201709141145	Diltiazem	120	100	282	ng/L	**166**	(60-140)	40	13
LCS1	Diuron		100	99.1	ng/L	99	(60-140)		
LCS2	Diuron		100	96.8	ng/L	97	(60-140)	30	2.2
MBLK	Diuron			<5	ng/L				
MRL_CHK	Diuron		5	5.24	ng/L	105	(50-150)		
MS_201709141145	Diuron	90	100	194	ng/L	103	(60-140)		
MSD_201709141145	Diuron	90	100	181	ng/L	91	(60-140)	40	6.9
LCS1	Erythromycin		200	204	ng/L	102	(60-140)		
LCS2	Erythromycin		200	192	ng/L	96	(60-140)	30	6.1
MBLK	Erythromycin			<10	ng/L				
MRL_CHK	Erythromycin		10	11.1	ng/L	111	(50-150)		
MS_201709141145	Erythromycin	12	200	251	ng/L	120	(60-140)		
MSD_201709141145	Erythromycin	12	200	285	ng/L	137	(60-140)	40	13
LCS1	Flumeqine		200	206	ng/L	103	(60-140)		
LCS2	Flumeqine		200	197	ng/L	99	(60-140)	30	5.0
MBLK	Flumeqine			<10	ng/L				
MRL_CHK	Flumeqine		10	12.3	ng/L	123	(50-150)		
MS_201709141145	Flumeqine	ND	200	96.5	ng/L	**48**	(60-140)		
MSD_201709141145	Flumeqine	ND	200	91.9	ng/L	**46**	(60-140)	40	4.9
LCS1	Fluoxetine		100	80.7	ng/L	81	(60-140)		
LCS2	Fluoxetine		100	102	ng/L	102	(60-140)	30	23
MBLK	Fluoxetine			<10	ng/L				
MRL_CHK	Fluoxetine		5	3.61	ng/L	72	(50-150)		
MS_201709141145	Fluoxetine	ND	100	84.5	ng/L	85	(60-140)		
MSD_201709141145	Fluoxetine	ND	100	69.2	ng/L	69	(60-140)	40	20
LCS1	Isoproturon		400	417	ng/L	104	(60-140)		
LCS2	Isoproturon		400	410	ng/L	102	(60-140)	30	1.7
MBLK	Isoproturon			<20	ng/L				
MRL_CHK	Isoproturon		20	19.0	ng/L	95	(50-150)		
MS_201709141145	Isoproturon	ND	400	265	ng/L	66	(60-140)		
MSD_201709141145	Isoproturon	ND	400	284	ng/L	71	(60-140)	40	6.9
LCS1	Ketoprofen		100	119	ng/L	119	(60-140)		
LCS2	Ketoprofen		100	108	ng/L	108	(60-140)	30	9.7
MBLK	Ketoprofen			<5	ng/L				
MRL_CHK	Ketoprofen		5	5.38	ng/L	108	(50-150)		
MS_201709141145	Ketoprofen	ND	100	89.2	ng/L	89	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 686572
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709141145	Ketoprofen	ND	100	67.5	ng/L	68	(60-140)	40	28
LCS1	Ketorolac		100	107	ng/L	107	(60-140)		
LCS2	Ketorolac		100	104	ng/L	104	(60-140)	30	2.8
MBLK	Ketorolac			<5	ng/L				
MRL_CHK	Ketorolac		5	5.83	ng/L	117	(50-150)		
MS_201709141145	Ketorolac	ND	100	69.9	ng/L	70	(60-140)		
MSD_201709141145	Ketorolac	ND	100	54.3	ng/L	**54**	(60-140)	40	25
LCS1	Lidocaine		100	103	ng/L	103	(60-140)		
LCS2	Lidocaine		100	93.1	ng/L	93	(60-140)	30	10
MBLK	Lidocaine			<5	ng/L				
MRL_CHK	Lidocaine		5	4.70	ng/L	94	(50-150)		
MS_201709141145	Lidocaine	390	100	454	ng/L	64	(60-140)		
MSD_201709141145	Lidocaine	390	100	460	ng/L	70	(60-140)	40	1.3
LCS1	Lincomycin		200	205	ng/L	103	(60-140)		
LCS2	Lincomycin		200	199	ng/L	99	(60-140)	30	3.0
MBLK	Lincomycin			<10	ng/L				
MRL_CHK	Lincomycin		10	12.1	ng/L	121	(50-150)		
MS_201709141145	Lincomycin	ND	200	0	ng/L	**0**	(60-140)		
MSD_201709141145	Lincomycin	ND	200	0	ng/L	**0**	(60-140)	40	**1000**
LCS1	Linuron		100	104	ng/L	104	(60-140)		
LCS2	Linuron		100	92.6	ng/L	93	(60-140)	30	12
MBLK	Linuron			<5	ng/L				
MRL_CHK	Linuron		5	4.65	ng/L	93	(50-150)		
MS_201709141145	Linuron	ND	100	142	ng/L	**142**	(60-140)		
MSD_201709141145	Linuron	ND	100	136	ng/L	136	(60-140)	40	4.3
LCS1	Lopressor		400	390	ng/L	98	(60-140)		
LCS2	Lopressor		400	333	ng/L	83	(60-140)	30	16
MBLK	Lopressor			<20	ng/L				
MRL_CHK	Lopressor		20	19.0	ng/L	95	(50-150)		
MS_201709141145	Lopressor	370	400	691	ng/L	79	(60-140)		
MSD_201709141145	Lopressor	370	400	651	ng/L	69	(60-140)	40	6.0
LCS1	Meclofenamic Acid		100	102	ng/L	102	(60-140)		
LCS2	Meclofenamic Acid		100	98.6	ng/L	99	(60-140)	30	3.4
MBLK	Meclofenamic Acid			<5	ng/L				
MRL_CHK	Meclofenamic Acid		5	4.77	ng/L	95	(50-150)		
MS_201709141145	Meclofenamic Acid	16	100	151	ng/L	135	(60-140)		
MSD_201709141145	Meclofenamic Acid	16	100	148	ng/L	131	(60-140)	40	2.0
LCS1	Meprobamate		100	111	ng/L	111	(60-140)		

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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Meprobamate		100	89.0	ng/L	89	(60-140)	30	22
MBLK	Meprobamate			<5	ng/L				
MRL_CHK	Meprobamate		5	4.91	ng/L	98	(50-150)		
MS_201709141145	Meprobamate	15	100	54.2	ng/L	**39**	(60-140)		
MSD_201709141145	Meprobamate	15	100	40.2	ng/L	**25**	(60-140)	40	30
LCS1	Metazachlor		100	94.8	ng/L	95	(60-140)		
LCS2	Metazachlor		100	127	ng/L	127	(60-140)	30	29
MBLK	Metazachlor			<5	ng/L				
MRL_CHK	Metazachlor		5	2.55	ng/L	51	(50-150)		
MS_201709141145	Metazachlor	ND	100	61.0	ng/L	61	(60-140)		
MSD_201709141145	Metazachlor	ND	100	75.0	ng/L	75	(60-140)	40	21
LCS1	Metolachlor		100	102	ng/L	102	(60-140)		
LCS2	Metolachlor		100	93.4	ng/L	93	(60-140)	30	8.8
MBLK	Metolachlor			<5	ng/L				
MRL_CHK	Metolachlor		5	5.62	ng/L	112	(50-150)		
MS_201709141145	Metolachlor	ND	100	106	ng/L	106	(60-140)		
MSD_201709141145	Metolachlor	ND	100	104	ng/L	104	(60-140)	40	1.9
LCS1	Nifedipine		400	261	ng/L	65	(60-140)		
LCS2	Nifedipine		400	278	ng/L	70	(60-140)	30	6.3
MBLK	Nifedipine			<20	ng/L				
MRL_CHK	Nifedipine		20	13.4	ng/L	67	(50-150)		
MS_201709141145	Nifedipine	ND	400	497	ng/L	124	(60-140)		
MSD_201709141145	Nifedipine	ND	400	546	ng/L	136	(60-140)	40	9.4
LCS1	Norethisterone		100	89.8	ng/L	90	(60-140)		
LCS2	Norethisterone		100	106	ng/L	107	(60-140)	30	18
MBLK	Norethisterone			<5	ng/L				
MRL_CHK	Norethisterone		5	4.31	ng/L	86	(50-150)		
MS_201709141145	Norethisterone	ND	100	107	ng/L	107	(60-140)		
MSD_201709141145	Norethisterone	ND	100	133	ng/L	133	(60-140)	40	22
LCS1	Oxolinic acid		100	103	ng/L	103	(60-140)		
LCS2	Oxolinic acid		100	118	ng/L	118	(60-140)	30	14
MBLK	Oxolinic acid			<5	ng/L				
MRL_CHK	Oxolinic acid		5	4.20	ng/L	84	(50-150)		
MS_201709141145	Oxolinic acid	ND	100	140	ng/L	140	(60-140)		
MSD_201709141145	Oxolinic acid	ND	100	152	ng/L	**152**	(60-140)	40	8.2
LCS1	Pentoxifylline		100	86.2	ng/L	86	(60-140)		
LCS2	Pentoxifylline		100	127	ng/L	127	(60-140)	30	**38**
MBLK	Pentoxifylline			<5	ng/L				

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Pentoxifylline		5	6.52	ng/L	130	(50-150)		
MS_201709141145	Pentoxifylline	6.8	100	156	ng/L	**150**	(60-140)		
MSD_201709141145	Pentoxifylline	6.8	100	118	ng/L	111	(60-140)	40	28
LCS1	Phenazone		100	101	ng/L	101	(60-140)		
LCS2	Phenazone		100	97.8	ng/L	98	(60-140)	30	3.2
MBLK	Phenazone			<5	ng/L				
MRL_CHK	Phenazone		5	5.99	ng/L	120	(50-150)		
MS_201709141145	Phenazone	ND	100	77.2	ng/L	77	(60-140)		
MSD_201709141145	Phenazone	ND	100	79.0	ng/L	79	(60-140)	40	2.3
LCS1	Primidone		100	109	ng/L	109	(60-140)		
LCS2	Primidone		100	82.8	ng/L	83	(60-140)	30	27
MBLK	Primidone			<5	ng/L				
MRL_CHK	Primidone		5	3.06	ng/L	61	(50-150)		
MS_201709141145	Primidone	93	100	163	ng/L	70	(60-140)		
MSD_201709141145	Primidone	93	100	179	ng/L	86	(60-140)	40	9.4
LCS1	Progesterone		100	108	ng/L	109	(60-140)		
LCS2	Progesterone		100	98.9	ng/L	99	(60-140)	30	9.7
MBLK	Progesterone			<5	ng/L				
MRL_CHK	Progesterone		5	4.68	ng/L	94	(50-150)		
MS_201709141145	Progesterone	ND	100	134	ng/L	134	(60-140)		
MSD_201709141145	Progesterone	ND	100	123	ng/L	123	(60-140)	40	8.6
LCS1	Propazine		100	94.8	ng/L	95	(60-140)		
LCS2	Propazine		100	83.1	ng/L	83	(60-140)	30	13
MBLK	Propazine			<5	ng/L				
MRL_CHK	Propazine		5	4.86	ng/L	97	(50-150)		
MS_201709141145	Propazine	ND	100	124	ng/L	124	(60-140)		
MSD_201709141145	Propazine	ND	100	113	ng/L	113	(60-140)	40	9.3
LCS1	Quinoline		100	104	ng/L	104	(60-140)		
LCS2	Quinoline		100	96.3	ng/L	96	(60-140)	30	7.7
MBLK	Quinoline			<5	ng/L				
MRL_CHK	Quinoline		5	6.64	ng/L	133	(50-150)		
MS_201709141145	Quinoline	36	100	169	ng/L	133	(60-140)		
MSD_201709141145	Quinoline	36	100	172	ng/L	136	(60-140)	40	1.8
LCS1	Simazine		100	100	ng/L	100	(60-140)		
LCS2	Simazine		100	96.2	ng/L	96	(60-140)	30	3.9
MBLK	Simazine			<5	ng/L				
MRL_CHK	Simazine		5	5.62	ng/L	112	(50-150)		
MS_201709141145	Simazine	ND	100	135	ng/L	135	(60-140)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709141145	Simazine	ND	100	140	ng/L	140	(60-140)	40	3.6
LCS1	Sulfachloropyridazine		100	94.5	ng/L	95	(60-140)		
LCS2	Sulfachloropyridazine		100	82.8	ng/L	83	(60-140)	30	13
MBLK	Sulfachloropyridazine			<5	ng/L				
MRL_CHK	Sulfachloropyridazine		5	3.93	ng/L	79	(50-150)		
MS_201709141145	Sulfachloropyridazine	ND	100	13.4	ng/L	**13**	(60-140)		
MSD_201709141145	Sulfachloropyridazine	ND	100	11.5	ng/L	**12**	(60-140)	40	15
LCS1	Sulfadiazine		100	97.2	ng/L	97	(60-140)		
LCS2	Sulfadiazine		100	96.7	ng/L	97	(60-140)	30	0.52
MBLK	Sulfadiazine			<5	ng/L				
MRL_CHK	Sulfadiazine		5	3.42	ng/L	68	(50-150)		
MS_201709141145	Sulfadiazine	ND	100	220	ng/L	**220**	(60-140)		
MSD_201709141145	Sulfadiazine	ND	100	227	ng/L	**227**	(60-140)	40	3.1
LCS1	Sulfadimethoxine		100	102	ng/L	102	(60-140)		
LCS2	Sulfadimethoxine		100	94.5	ng/L	95	(60-140)	30	7.6
MBLK	Sulfadimethoxine			<5	ng/L				
MRL_CHK	Sulfadimethoxine		5	3.36	ng/L	67	(50-150)		
MS_201709141145	Sulfadimethoxine	ND	100	109	ng/L	109	(60-140)		
MSD_201709141145	Sulfadimethoxine	ND	100	126	ng/L	127	(60-140)	40	15
LCS1	Sulfamerazine		100	106	ng/L	107	(60-140)		
LCS2	Sulfamerazine		100	140	ng/L	140	(60-140)	30	27
MBLK	Sulfamerazine			<5	ng/L				
MRL_CHK	Sulfamerazine		5	5.17	ng/L	103	(50-150)		
MS_201709141145	Sulfamerazine	ND	100	69.9	ng/L	70	(60-140)		
MSD_201709141145	Sulfamerazine	ND	100	65.1	ng/L	65	(60-140)	40	7.1
LCS1	Sulfamethazine		100	107	ng/L	107	(60-140)		
LCS2	Sulfamethazine		100	104	ng/L	104	(60-140)	30	2.8
MBLK	Sulfamethazine			<5	ng/L				
MRL_CHK	Sulfamethazine		5	5.73	ng/L	115	(50-150)		
MS_201709141145	Sulfamethazine	ND	100	20.9	ng/L	**21**	(60-140)		
MSD_201709141145	Sulfamethazine	ND	100	15.3	ng/L	**15**	(60-140)	40	31
LCS1	Sulfamethizole		100	94.8	ng/L	95	(60-140)		
LCS2	Sulfamethizole		100	95.8	ng/L	96	(60-140)	30	1.1
MBLK	Sulfamethizole			<5	ng/L				
MRL_CHK	Sulfamethizole		5	5.34	ng/L	107	(50-150)		
MS_201709141145	Sulfamethizole	ND	100	8.64	ng/L	**8.6**	(60-140)		
MSD_201709141145	Sulfamethizole	ND	100	20.4	ng/L	**20**	(60-140)	40	**81**
LCS1	Sulfamethoxazole		100	95.6	ng/L	96	(60-140)		

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Sulfamethoxazole		100	94.5	ng/L	95	(60-140)	30	1.2
MBLK	Sulfamethoxazole			<5	ng/L				
MRL_CHK	Sulfamethoxazole		5	5.37	ng/L	107	(50-150)		
MS_201709141145	Sulfamethoxazole	460	100	377	ng/L	**-86.2**	(60-140)		
MSD_201709141145	Sulfamethoxazole	460	100	352	ng/L	**-110**	(60-140)	40	6.9
LCS1	Sulfathiazole		100	96.7	ng/L	97	(60-140)		
LCS2	Sulfathiazole		100	95.3	ng/L	95	(60-140)	30	1.5
MBLK	Sulfathiazole			<5	ng/L				
MRL_CHK	Sulfathiazole		5	5.90	ng/L	118	(50-150)		
MS_201709141145	Sulfathiazole	ND	100	134	ng/L	134	(60-140)		
MSD_201709141145	Sulfathiazole	ND	100	104	ng/L	104	(60-140)	40	25
LCS1	TCEP		100	92.4	ng/L	92	(60-140)		
LCS2	TCEP		100	138	ng/L	138	(60-140)	30	**40**
MBLK	TCEP			<10	ng/L				
MRL_CHK	TCEP		5	4.59	ng/L	92	(50-150)		
MS_201709141145	TCEP	330	100	412	ng/L	84	(60-140)		
MSD_201709141145	TCEP	330	100	374	ng/L	**47**	(60-140)	40	9.7
LCS1	TCPP		100	102	ng/L	102	(40-160)		
LCS2	TCPP		100	113	ng/L	113	(40-160)	30	10
MBLK	TCPP			<100	ng/L				
MRL_CHK	TCPP		5	3.19	ng/L	64	(40-160)		
MS_201709141145	TCPP	620	100	719	ng/L	93	(40-160)		
MSD_201709141145	TCPP	620	100	753	ng/L	128	(40-160)	60	4.6
LCS1	TDCPP		400	484	ng/L	121	(40-160)		
LCS2	TDCPP		400	292	ng/L	73	(40-160)	30	**50**
MBLK	TDCPP			<100	ng/L				
MRL_CHK	TDCPP		20	30.6	ng/L	153	(40-160)		
MS_201709141145	TDCPP	500	400	905	ng/L	102	(40-160)		
MSD_201709141145	TDCPP	500	400	1110	ng/L	154	(40-160)	60	20
LCS1	Testosterone		100	110	ng/L	111	(60-140)		
LCS2	Testosterone		100	70.1	ng/L	70	(60-140)	30	**45**
MBLK	Testosterone			<5	ng/L				
MRL_CHK	Testosterone		5	5.05	ng/L	101	(50-150)		
MS_201709141145	Testosterone	ND	100	132	ng/L	131	(60-140)		
MSD_201709141145	Testosterone	ND	100	139	ng/L	138	(60-140)	40	5.2
LCS1	Theobromine		100	83.0	ng/L	83	(60-140)		
LCS2	Theobromine		100	78.1	ng/L	78	(60-140)	30	6.1
MBLK	Theobromine			<5	ng/L				

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Theobromine		5	3.90	ng/L	78	(50-150)		
MS_201709141145	Theobromine	140	100	263	ng/L	128	(60-140)		
MSD_201709141145	Theobromine	140	100	243	ng/L	108	(60-140)	40	7.9
LCS1	Theophylline		200	200	ng/L	100	(60-140)		
LCS2	Theophylline		200	185	ng/L	93	(60-140)	30	7.8
MBLK	Theophylline			<10	ng/L				
MRL_CHK	Theophylline		10	13.3	ng/L	133	(50-150)		
MS_201709141145	Theophylline	32	200	24.8	ng/L	**-3.48**	(60-140)		
MSD_201709141145	Theophylline	32	200	67.5	ng/L	**18**	(60-140)	40	**93**
LCS1	Trimethoprim		100	103	ng/L	103	(60-140)		
LCS2	Trimethoprim		100	99.1	ng/L	99	(60-140)	30	3.9
MBLK	Trimethoprim			<5	ng/L				
MRL_CHK	Trimethoprim		5	4.84	ng/L	97	(50-150)		
MS_201709141145	Trimethoprim	110	100	254	ng/L	**142**	(60-140)		
MSD_201709141145	Trimethoprim	110	100	222	ng/L	110	(60-140)	40	13

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Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
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ilac-MRA

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY
AT-1807

Laboratory Report

for

State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attention: Joanna Seto

Date of Issue
10/21/2017

EUROFINS EATON ANALYTICAL, INC.

NELAP ACCREDITED TNI LABORATORY
ORELAP 4034

Report: 688051
Project: PPCP-HAWAII
Group: Maui

RCZ: Rick Zimmer

Project Manager

* Accredited in accordance with TNI 2009 and ISO/IEC 17025:2005.
* Laboratory certifies that the test results meet all **TNI 2009 and ISO/IEC 17025:2005** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.

STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	**Michigan**	9906
Arizona	AZ0778	**Mississippi**	Certified
Arkansas	Certified	**Montana**	Cert 0035
California-Monrovia-ELAP	2813	**Nebraska**	Certified
California-Colton- ELAP	2812	**Nevada**	CA00006-2016
California-Folsom- ELAP	2820	**New Hampshire ***	2959
California-Fresno- ELAP	2966	**New Jersey ***	CA 008
Colorado	Certified	**New Mexico**	Certified
Connecticut	PH-0107	**New York ***	11320
Delaware	CA 006	**North Carolina**	06701
Florida *	E871024	**North Dakota**	R-009
Georgia	947	**Oregon (Primary AB) ***	**ORELAP 4034**
Guam	17-005R	**Pennsylvania ***	68-565
Hawaii	Certified	**Puerto Rico**	Certified
Idaho	Certified	**Rhode Island**	LAO00326
Illinois *	200033	**South Carolina**	87016
Indiana	C-CA-01	**South Dakota**	Certified
Iowa - Asbestos	413	**Tennessee**	TN02839
Kansas *	E-10268	**Texas ***	T104704230-16-11
Kentucky	90107	**Utah ***	CA000062017-11
Louisiana *	LA170009	**Vermont**	VT0114
Maine	CA0006	**Virginia ***	460260
Maryland	224	**Washington**	C838
Commonwealth of Northern Marianas Is.	MP0004	**EPA Region 5**	Certified
Massachusetts	M-CA006	**Los Angeles County Sanitation Districts**	10264

* NELAP/TNI Recognized Accreditation Bodies

ISO 17025 Accredited Method List

The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB.

Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environ-mental (Drinking Water)	Environ-mental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
1,4-Dioxane	EPA 522	x		x
2,3,7,8-TCDD	Modified EPA 1613B	x		x
Acrylamide	In House Method (2440)	x		x
Alkalinity	SM 2320B	x	x	x
Ammonia	EPA 350.1		x	x
Ammonia	SM 4500-NH3 H		x	x
Anions and DBPs by IC	EPA 300.0	x	x	x
Anions and DBPs by IC	EPA 300.1	x		x
Asbestos	EPA 100.2	x	x	
Bicarbonate Alkalinity as HCO3	SM 2320B	x	x	x
BOD / CBOD	SM 5210B		x	x
Bromate	In House Method (2447)	x		x
Carbamates	EPA 531.2	x		x
Carbonate as CO3	SM 2330B	x	x	x
Carbonyls	EPA 556	x		x
COD	EPA 410.4 / SM 5220D		x	
Chloramines	SM 4500-CL G	x	x	x
Chlorinated Acids	EPA 515.4	x		x
Chlorinated Acids	EPA 555	x		x
Chlorine Dioxide	SM 4500-CLO2 D	x		x
Chlorine -Total/Free/ Combined Residual	SM 4500-Cl G	x	x	x
Conductivity	EPA 120.1		x	
Conductivity	SM 2510B	x	x	x
Corrosivity (Langelier Index)	SM 2330B	x		x
Cryptosporidium	EPA 1623	x		x
Cyanide, Amenable	SM 4500-CN G	x	x	
Cyanide, Free	SM 4500CN F	x	x	x
Cyanide, Total	EPA 335.4	x	x	x
Cyanogen Chloride (screen)	In House Method (2470)	x		x
Diquat and Paraquat	EPA 549.2	x		x
DBP/HAA	SM 6251B	x		x
Dissolved Oxygen	SM 4500-O G		x	x
DOC	SM 5310C	x		x
E. Coli	(MTF/EC+MUG)	x		x
E. Coli	CFR 141.21(f)(6)(i)	x		x
E. Coli	SM 9223		x	
E. Coli (Enumeration)	SM 9221B.1/ SM 9221F	x		x
E. Coli (Enumeration)	SM 9223B	x		x
EDB/DCBP	EPA 504.1	x		
EDB/DBCP and DBP	EPA 551.1	x		x
EDTA and NTA	In House Method (2454)	x		x
Endothall	EPA 548.1	x		x
Endothall	In-house Method (2445)	x		x
Enterococci	SM 9230B	x	x	
Fecal Coliform	SM 9221 E (MTF/EC)	x		
Fecal Coliform	SM 9221C, E (MTF/EC)		x	
Fecal Coliform (Enumeration)	SM 9221E (MTF/EC)	x		x
Fecal Coliform with Chlorine Present	SM 9221E		x	
Fecal Streptococci	SM 9230B	x	x	
Fluoride	SM 4500-F C	x	x	x
Giardia	EPA 1623	x		x
Glyphosate	EPA 547	x		x
Gross Alpha/Beta	EPA 900.0	x	x	x
Gross Alpha Coprecipitation	SM 7110 C	x	x	x
Hardness	SM 2340B	x	x	x
Heterotrophic Bacteria	In House Method (2439)	x		x
Heterotrophic Bacteria	SM 9215 B	x		x
Hexavalent Chromium	EPA 218.6	x	x	x
Hexavalent Chromium	EPA 218.7	x		x
Hexavalent Chromium	SM 3500-Cr B		x	
Hormones	EPA 539	x		x
Hydroxide as OH Calc.	SM 2330B	x		x
Kjeldahl Nitrogen	EPA 351.2		x	
Legionella	CDC Legionella	x		x
Mercury	EPA 245.1	x	x	x
Metals	EPA 200.7 / 200.8	x	x	x
Microcystin LR	ELISA (2360)	x		x
NDMA	EPA 521	x		x
NDMA	TQ In house method based on EPA 521 (2425)	x		x
Nitrate/Nitrite Nitrogen	EPA 353.2	x	x	x
OCL, Pesticides/PCB	EPA 505	x		x
Ortho Phosphate	EPA 365.1	x	x	x
Ortho Phosphate	SM 4500P E			x
Ortho Phosphorous	SM 4500P E	x		
Oxyhalides Disinfection Byproducts	EPA 317.0	x		x
Perchlorate	EPA 331.0	x		x
Perchlorate (low and high)	EPA 314.0	x		x
Perfluorinated Alkyl Acids	EPA 537	x		x
pH	EPA 150.1	x		
pH	SM 4500-H+B	x	x	x
Phenylurea Pesticides/ Herbicides	In House Method, based on EPA 532 (2448)	x		x
Pseudomonas	IDEXX Pseudalert (2461)	x		x
Radium-226	GA Institute of Tech	x		x
Radium-228	GA Institute of Tech	x		x
Radon-222	SM 7500RN	x		x
Residue, Filterable	SM 2540C	x	x	x
Residue, Non-filterable	SM 2540D		x	
Residue, Total	SM 2540B		x	x
Residue, Volatile	EPA 160.4		x	
Semi-VOC	EPA 525.2	x		x
Semi-VOC	EPA 625		x	x
Silica	SM 4500-Si D	x	x	
Silica	SM 4500-SiO2 C	x	x	
Sulfide	SM 4500-$S^{=}$ D		x	
Sulfite	SM 4500-SO^{3}B	x	x	x
Surfactants	SM 5540C	x	x	x
Taste and Odor Analytes	SM 6040E	x		x
Total Coliform (P/A)	SM 9221 A, B	x		x
Total Coliform (Enumeration)	SM 9221 A, B, C	x		x
Total Coliform / E. coli	Colisure SM 9223	x		x
Total Coliform	SM 9221B		x	
Total Coliform with Chlorine Present	SM 9221B		x	
Total Coliform / E.coli (P/A and Enumeration)	SM 9223	x		x
TOC	SM 5310C	x	x	x
TOX	SM 5320B		x	
Total Phenols	EPA 420.1		x	
Total Phenols	EPA 420.4	x	x	x
Total Phosphorous	SM 4500 P E		x	
Turbidity	EPA 180.1	x	x	x
Turbidity	SM 2130B	x	x	
Uranium by ICP/MS	EPA 200.8	x		x
UV 254	SM 5910B	x		
VOC	EPA 524.2/EPA 524.3	x		x
VOC	EPA 624		x	x
VOC	EPA SW 846 8260	x		x
VOC	In House Method (2411)	x		x
Yeast and Mold	SM 9610	x		x

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Acknowledgement of Samples Received

Addr: **State of Hawaii DOH**
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attn: Joanna Seto
Phone: 808-586-4258

Client ID: HAWAII-DOH
Folder #: 688051
Project: PPCP-HAWAII
Sample Group: Maui

Project Manager: Rick Zimmer
Phone: 626-386-1157

The following samples were received from you on **September 21, 2017** at **1250**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical, Inc..

Sample #	Sample ID	Sample Date
201709210343	Pukalani WWRF R-1 Effluent	09/18/2017 0910
	Static ID: 091817-H023	
	@DX_ABI_NEG @DX_ABI_POS	

Test Description

@DX_ABI_NEG -- Endocrine Disruptors Negative Mode - SPE

@DX_ABI_POS -- Endocrine Disruptors Positive Mode - SPE

CHAIN OF CUSTODY RECORD

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Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY: 688057

LOGIN COMMENTS: _____ SAMPLES CHECKED AGAINST COC BY: _____

_____ SAMPLES LOGGED IN BY: (W)

SAMPLE TEMP RECEIVED AT: SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

☐ _____ (Other) IR Gun ID = _____ (Observation= _____ °C) (Corr.Factor _____ °C) (Final = _____ °C)

☒ Monrovia IR Gun ID = 570A (Observation= 4.2 °C) (Corr.Factor +.2 °C) (Final = 4.4 °C)

Compliance Acceptance Criteria: (Chemistry: 4 ± 2 °C) (Microbiology: < 10°C)

TYPE OF ICE: Real ____ Synthetic X No Ice ____ **CONDITION OF ICE:** Frozen X Partially Frozen ____ Thawed ____ N/A ____

METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: _____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME:	PROJECT CODE:
HI DEPT OF HEALTH - SAFE DRINKING WATER BRANCH	PPCP-HAWAII

EEA CLIENT CODE:	COC ID:	SAMPLE GROUP:
HAWAII-DOH		Baseline

TAT requested: rush by adv notice only STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___

(check for yes) (check for yes)

COMPLIANCE SAMPLES ☐ **NON-COMPLIANCE SAMPLES** X

- Requires state forms ☐ REGULATION INVOLVED: _____

Type of samples (circle one): **ROUTINE SPECIAL CONFIRMATION** (eg. SDWA, NPDES, etc.)

SEE ATTACHED KIT ORDER FOR ANALYSES X (check for yes), ***OR***

List ALL ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA	PPCP													SAMPLER COMMENTS
9/18/17	9:10	PUKALANI		WW			2													SAMPLE STORED IN
		R-1 EFFLUENT WATER																		SDWB MONITORING
		091817-1023																		SECTION REFRIG'D
																				LOCK STORAGE
		pH - 7.57																		ROOM UNTIL
		Temp. - 29.7																		PACKED FOR FEDEX
		Cond. - 993 µS																		SHIPMENT ON 9/20/17
		TDS - 680 ppm																		
		SALINITY - 0.48 ppt																		
		TURBIDITY - 2.24 NTU																		

* **MATRIX TYPES:** **RSW** = Raw Surface Water **RGW** = Raw Ground Water **CFW** = Chlor(am)inated Finished Water **FW** = Other Finished Water **SEAW** = Sea Water **WW** = Waste Water **BW** = Bottled Water **SW** = Storm Water **SO** = Soil **SL** = Sludge **O** = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	Daniel Chang	DANIEL CHANG	HI DEPT OF HEALTH - SAFE DRINKNG WATER	9/18/17	9:10 AM
RELINQUISHED BY:	Daniel Chang	DANIEL CHANG	HI DOH - SAFE DRINKING WATER	9/18/17	5:30 PM
RECEIVED BY:	[signature]	DAVID KAWAHARA	"	9/18/17	5:30 PM
RELINQUISHED BY:	[signature]	DAVID KAWAHARA	"	9/20/17	10 AM
RECEIVED BY:	[signature]	CHRIS AU/G	EEA	9/21/17	1250

QA FO 0029.2 (Version 2) (08/28/2014)

PAGE 5 OF 5

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Laboratory Hits

Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201709210343	**Pukalani WWRF R-1 Effluent**				
10/06/2017 11:23	1,7-Dimethylxanthine		27		ng/L	10
10/06/2017 11:23	4-nonylphenol - semi quantitative		1000		ng/L	100
10/06/2017 11:23	Acesulfame-K		42		ng/L	20
10/06/2017 11:23	Acetaminophen		12		ng/L	5
10/06/2017 11:23	Caffeine		32		ng/L	5
10/06/2017 11:23	Carbadox		110		ng/L	5
10/06/2017 11:23	Carbamazepine		96		ng/L	5
10/06/2017 11:23	Carisoprodol		150		ng/L	5
10/06/2017 11:23	Cimetidine (semi quantitative)		58		ng/L	5
10/06/2017 11:23	Cotinine		20		ng/L	10
10/06/2017 11:23	DACT		77		ng/L	5
10/06/2017 11:23	Dilantin		37		ng/L	20
10/06/2017 11:23	Diuron		37		ng/L	5
10/06/2017 11:23	Estrone		7.3		ng/L	5
10/06/2017 11:23	Gemfibrozil		13		ng/L	5
10/06/2017 11:23	Ibuprofen		72		ng/L	10
10/06/2017 11:23	Iopromide		6.6		ng/L	5
10/06/2017 11:23	Lidocaine		330		ng/L	5
10/06/2017 11:23	Lopressor		66		ng/L	20
10/06/2017 11:23	Meprobamate		48		ng/L	5
10/06/2017 11:23	Norethisterone		200		ng/L	5
10/06/2017 11:23	Primidone		180		ng/L	5
10/06/2017 11:23	Propylparaben		5.8		ng/L	5
10/06/2017 11:23	Sucralose		100000		ng/L	100
10/06/2017 11:23	Sulfamethoxazole		49		ng/L	5
10/06/2017 11:23	Sulfathiazole		160		ng/L	5
10/06/2017 11:23	TCEP		2600		ng/L	10
10/06/2017 11:23	TCPP		260		ng/L	100
10/06/2017 11:23	TDCPP		520		ng/L	100
10/06/2017 11:23	Theobromine		31		ng/L	10
10/06/2017 11:23	Theophylline (semi-quantitative)		21		ng/L	20

SUMMARY OF POSITIVE DATA ONLY

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Laboratory Data

Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
Pukalani WWRF R-1 Effluent (201709210343)							**Sampled on 09/18/2017 0910**			
Static ID: 091817-H023										
LC-MS-MS - Endocrine Disruptors Positive Mode - SPE										
	10/06/17 11:23		1034287	(LC-MS-MS)	1,7-Dimethylxanthine	27	ng/L	3.4	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Acetaminophen	12	ng/L	3.0	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Albuterol	q D	ng/L	2.4	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Amoxicillin (semi-. uantitative)	14J (R7)	ng/L	6.4	20	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Androstenedione	q D	ng/L	1.7	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Atenolol	q D	ng/L	3.9	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Atrazine	q D	ng/L	2.3	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Bezafibrate	q D	ng/L	3.5	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Bromacil	q D	ng/L	3.2	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Caffeine	32 (R7)	ng/L	4.3	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Carbadox	110	ng/L	4.2	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Carbamazepine	96	ng/L	1.2	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Carisoprodol	150	ng/L	1.2	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Chloridazon	q D	ng/L	1.6	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Chlorotoluron	q D	ng/L	0.89	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Cimetidine (semi . uantitative)	58	ng/L	2.7	5	1
	09/27/17 09:21		1030288	(LC-MS-MS)	Ciprofloxacin - Cipro	q D	ng/L	20	100	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Cotinine	20	ng/L	4.3	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Cyanazine	q D	ng/L	1.7	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	DACT	77	ng/L	3.9	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	DEA	q D	ng/L	1.5	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	DEET	7.8J	ng/L	1.1	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Dehydronifedipine	4.8J	ng/L	1.4	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	DIA	q D	ng/L	2.4	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Diazepam	q D	ng/L	2.1	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Dilantin	37	ng/L	13	20	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Diltiazem	3.4J	ng/L	3.0	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Diuron	37	ng/L	1.8	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Erythromycin	q D	ng/L	4.0	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Flume. ine	q D	ng/L	7.1	10	1

Rounding on totals after summationb
(c) - Indicates calculated resultsb
q D - Analyte was not detected at the calculated MDLb
J - The analyte was either detected at or greater than the MDL and less than the MRL, or did not meet any one of the re. uired QC criteriab

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Laboratory Data

Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/06/17 11:23		1034287	(LC-MS-MS)	Fluoxetine	q D	ng/L	10	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Isoproturon	q D	ng/L	12	100	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Ketoprofen	q D	ng/L	2b6	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Ketorolac	q D	ng/L	2b1	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Lidocaine	330	ng/L	1b1	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Lincomycin	q D	ng/L	1b7	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Linuron	q D	ng/L	2b8	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Lopressor	66	ng/L	5b1	20	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Meclofenamic Acid	q D	ng/L	4b7	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	MeproNamate	48	ng/L	2b0	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Metazachlor	q D	ng/L	1b3	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Metolachlor	q D	ng/L	3b1	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	q ifedipine (semi . uantitative)	q D	ng/L	12	20	1
	10/06/17 11:23		1034287	(LC-MS-MS)	q orethisterone	200	ng/L	2b3	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Oxolinic acid	q D	ng/L	2b5	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Pentoxifylline	q D	ng/L	1b5	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Phenazone	q D	ng/L	5b0	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Primidone	180	ng/L	4b8	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Progesterone	q D	ng/L	2b9	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Propazine	q D	ng/L	1b8	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Quinoline	q D	ng/L	2b5	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Simazine	3b1 J	ng/L	1b2	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Sulfachloropyridazine	q D	ng/L	2b1	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Sulfadiazine	q D	ng/L	3b9	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Sulfadimethoxine	q D	ng/L	1b6	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Sulfamerazine	q D	ng/L	4b6	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Sulfamethazine	q D	ng/L	1b5	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Sulfamethizole	q D	ng/L	3b2	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Sulfamethoxazole	49	ng/L	2b8	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Sulfathiazole	160	ng/L	2b4	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	TCEP	2600	ng/L	3b2	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	TCPP	260	ng/L	20	100	1
	10/06/17 11:23		1034287	(LC-MS-MS)	TDCPP	520	ng/L	20	100	1

Rounding on totals after summationb
(c) - Indicates calculated resultsb
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Laboratory Data

Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/06/17 11:23		1034287	(LC-MS-MS)	Testosterone	q D	ng/L	2b5	5	1
	10/06/17 11:23		1034287	(LC-MS-MS)	TheoNromine	31	ng/L	3b2	10	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Theophylline (semi-. uantitative)	21	ng/L	4b8	20	1
	10/06/17 11:23		1034287	(LC-MS-MS)	Trimethoprim	q D	ng/L	1b8	5	1
	LC-MS-MS - Endocrine Disruptors Negative Mode - SPE									
	10/06/17 11:23		1034613	(LC-MS-MS)	2,4-D	q D	ng/L	5b0	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	4-nonylphenol - semi . uantitative	1000	ng/L	50	100	1
	10/06/17 11:23		1034613	(LC-MS-MS)	4-tert-Octylphenol	q D	ng/L	6b9	50	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Acesulfame-K	42	ng/L	20	20	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Bendroflumethiazide	q D	ng/L	4b4	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	BPA	q D	ng/L	7b2	10	1
	10/06/17 11:23		1034613	(LC-MS-MS)	ButalNital	q D	ng/L	2b9	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	ButylparaNen	q D	ng/L	3b3	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Chloramphenicol	q D	ng/L	3b1	10	1
	10/06/17 11:23		1034613	(LC-MS-MS)	ClofiNric Acid	q D	ng/L	5b0	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Diclofenac	q D	ng/L	3b3	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Estradiol	q D	ng/L	4b4	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Estrone	7b8	ng/L	3b9	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Ethinyl Estradiol - 17 alpha	q D	ng/L	3b3	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	EthylparaNen	q D	ng/L	11	20	1
	10/06/17 11:23		1034613	(LC-MS-MS)	GemfiNrozil	13	ng/L	2b5	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	INuprofen	72	ng/L	8b6	10	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Iohexal	q D	ng/L	7b7	10	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Iopromide	6b6	ng/L	1b6	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	IsoNutylparaNen	q D	ng/L	4b2	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Lipitor (Atorvastatin)	q D	ng/L	50	100	1
	10/06/17 11:23		1034613	(LC-MS-MS)	MethylparaNen	q D	ng/L	11	20	1
	10/06/17 11:23		1034613	(LC-MS-MS)	q aproxen	q D	ng/L	8b5	10	1
	10/06/17 11:23		1034613	(LC-MS-MS)	PropylparaNen	5b8	ng/L	2b9	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Salicylic Acid	q D	ng/L	50	100	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Sucralose	100000	ng/L	42	100	1
	10/06/17 11:23		1034613	(LC-MS-MS)	TriclocarNan	4b9J	ng/L	2b5	5	1
	10/06/17 11:23		1034613	(LC-MS-MS)	Triclosan	q D	ng/L	6b3	10	1

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Laboratory Data

Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/21/2017 1250

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/06/17 11:23		1034613	(LC-MS-MS)	Warfarin	q D	ng/L	4b1	5	1

Rounding on totals after summationb
(c) - Indicates calculated resultsb
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Laboratory Comments

Report: 688051
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Pearl City, HI 96782

Folder Comments

Amoxicillin and Caffeine RPD calculations were high. However, data is acceptable based on passing LCS and other QC.

Flags Legend:

R7 - LFB/LFBD RPD exceeded the laboratory acceptance limit. Recovery met acceptance criteria.

The Comments Report may be blank if there are no comments for this report.

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Laboratory QC Summary

Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 1030288 **Analysis Date: 09/27/2017**

201709210343 Pukalani WWRF R-1 Effluent Analyzed by: ALI

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 1034287 **Analysis Date: 10/06/2017**

201709210343 Pukalani WWRF R-1 Effluent Analyzed by: ARH

Endocrine Disruptors Negative Mode - SPE

Analytical Batch: 1034613 **Analysis Date: 10/06/2017**

201709210343 Pukalani WWRF R-1 Effluent Analyzed by: ARH

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Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Endocrine Disruptors Positive Mode - SPE by LC-MS-MS									
Analytical Batch: 1030288							**Analysis Date: 09/27/2017**		
LCS1	Ciprofloxacin - Cipro		2000	2030	ng/L	101	(40-160)		
LCS2	Ciprofloxacin - Cipro		2000	2130	ng/L	107	(40-160)	30	4.8
MBLK	Ciprofloxacin - Cipro			<100	ng/L				
MRL_CHK	Ciprofloxacin - Cipro		100	52.5	ng/L	53	(50-150)		
MS_201709141150	Ciprofloxacin - Cipro	ND	2000	371	ng/L	**19**	(40-160)		
MSD_201709141150	Ciprofloxacin - Cipro	ND	2000	278	ng/L	**14**	(40-160)	60	29
Endocrine Disruptors Positive Mode - SPE by LC-MS-MS									
Analytical Batch: 1034287							**Analysis Date: 10/0N2017**		
LCS1	1,7-Dimethylxanthine		100	97.7	ng/L	98	(60-140)		
LCS2	1,7-Dimethylxanthine		100	92.7	ng/L	93	(60-140)	30	5.3
MBLK	1,7-Dimethylxanthine			<5	ng/L				
MRL_CHK	1,7-Dimethylxanthine		5	4.19	ng/L	84	(50-150)		
MS_201709210363	1,7-Dimethylxanthine	ND	100	63.9	ng/L	64	(60-140)		
MSD_201709210363	1,7-Dimethylxanthine	ND	100	63.4	ng/L	63	(60-140)	40	0.79
LCS1	Acetaminophen		100	94.5	ng/L	95	(60-140)		
LCS2	Acetaminophen		100	91.1	ng/L	91	(60-140)	30	3.7
MBLK	Acetaminophen			<5	ng/L				
MRL_CHK	Acetaminophen		5	4.92	ng/L	98	(50-150)		
MS_201709210363	Acetaminophen	ND	100	76.5	ng/L	75	(60-140)		
MSD_201709210363	Acetaminophen	ND	100	102	ng/L	101	(60-140)	40	30
LCS1	Alquterol		100	74.4	ng/L	74	(60-140)		
LCS2	Alquterol		100	94.1	ng/L	94	(60-140)	30	23
MBLK	Alquterol			<5	ng/L				
MRL_CHK	Alquterol		5	4.45	ng/L	89	(50-150)		
MS_201709210363	Alquterol	ND	100	73.3	ng/L	73	(60-140)		
MSD_201709210363	Alquterol	ND	100	68.4	ng/L	69	(60-140)	40	6.8
LCS1	Amoxicillin (semi-zuantitative)		400	304	ng/L	76	(60-140)		
LCS2	Amoxicillin (semi-zuantitative)		400	440	ng/L	110	(60-140)	30	**37**
MBLK	Amoxicillin (semi-zuantitative)			<20	ng/L				
MRL_CHK	Amoxicillin (semi-zuantitative)		20	10.2	ng/L	51	(50-150)		
MS_201709210363	Amoxicillin (semi-zuantitative)	ND	400	15.2	ng/L	**3d8**	(60-140)		
MSD_201709210363	Amoxicillin (semi-zuantitative)	ND	400	45.7	ng/L	**11**	(60-140)	40	**100**
LCS1	Andorostenedione		100	137	ng/L	137	(60-140)		
LCS2	Andorostenedione		100	118	ng/L	118	(60-140)	30	15

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Andorostenedione			<5	ng/L				
MRL_CHK	Andorostenedione		5	3.47	ng/L	69	(50-150)		
MS_201709210363	Andorostenedione	ND	100	160	ng/L	**1N0**	(60-140)		
MSD_201709210363	Andorostenedione	ND	100	129	ng/L	129	(60-140)	40	22
LCS1	Atenolol		100	77.8	ng/L	78	(60-140)		
LCS2	Atenolol		100	93.2	ng/L	93	(60-140)	30	18
MBLK	Atenolol			<5	ng/L				
MRL_CHK	Atenolol		5	5.42	ng/L	108	(50-150)		
MS_201709210363	Atenolol	ND	100	374	ng/L	**374**	(60-140)		
MSD_201709210363	Atenolol	ND	100	455	ng/L	**4f f**	(60-140)	40	20
LCS1	Atrabine		100	104	ng/L	104	(60-140)		
LCS2	Atrabine		100	107	ng/L	107	(60-140)	30	2.8
MBLK	Atrabine			<5	ng/L				
MRL_CHK	Atrabine		5	5.04	ng/L	101	(50-150)		
MS_201709210363	Atrabine	ND	100	145	ng/L	**144**	(60-140)		
MSD_201709210363	Atrabine	ND	100	147	ng/L	**14N**	(60-140)	40	1.4
LCS1	Bebafiqrate		100	97.4	ng/L	97	(60-140)		
LCS2	Bebafiqrate		100	99.3	ng/L	99	(60-140)	30	1.9
MBLK	Bebafiqrate			<5	ng/L				
MRL_CHK	Bebafiqrate		5	4.30	ng/L	86	(50-150)		
MS_201709210363	Bebafiqrate	ND	100	136	ng/L	136	(60-140)		
MSD_201709210363	Bebafiqrate	ND	100	1.94	ng/L	**1g**	(60-140)	40	**190**
LCS1	Bromacil		100	95.0	ng/L	95	(60-140)		
LCS2	Bromacil		100	94.3	ng/L	94	(60-140)	30	0.74
MBLK	Bromacil			<5	ng/L				
MRL_CHK	Bromacil		5	2.89	ng/L	58	(50-150)		
MS_201709210363	Bromacil	ND	100	98.7	ng/L	99	(60-140)		
MSD_201709210363	Bromacil	ND	100	100	ng/L	100	(60-140)	40	1.3
LCS1	Caffeine		100	71.2	ng/L	71	(60-140)		
LCS2	Caffeine		100	128	ng/L	128	(60-140)	30	**f 7**
MBLK	Caffeine			<5	ng/L				
MRL_CHK	Caffeine		5	4.36	ng/L	87	(50-150)		
MS_201709210363	Caffeine	ND	100	37.2	ng/L	**37**	(60-140)		
MSD_201709210363	Caffeine	ND	100	35.8	ng/L	**3N**	(60-140)	40	3.8
LCS1	Carqadox		100	99.5	ng/L	100	(60-140)		
LCS2	Carqadox		100	99.9	ng/L	100	(60-140)	30	0.40
MBLK	Carqadox			<5	ng/L				
MRL_CHK	Carqadox		5	3.36	ng/L	67	(50-150)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 688051
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709210363	Carqadox	15	100	46.0	ng/L	**31**	(60-140)		
MSD_201709210363	Carqadox	15	100	24.5	ng/L	**9q8**	(60-140)	40	**N1**
LCS1	Carqamabepine		100	102	ng/L	102	(60-140)		
LCS2	Carqamabepine		100	133	ng/L	133	(60-140)	30	26
MBLK	Carqamabepine			<5	ng/L				
MRL_CHK	Carqamabepine		5	5.84	ng/L	117	(50-150)		
MS_201709210363	Carqamabepine	ND	100	150	ng/L	**1f 0**	(60-140)		
MSD_201709210363	Carqamabepine	ND	100	116	ng/L	116	(60-140)	40	26
LCS1	Carisoprodol		100	93.7	ng/L	94	(60-140)		
LCS2	Carisoprodol		100	103	ng/L	103	(60-140)	30	9.5
MBLK	Carisoprodol			<5	ng/L				
MRL_CHK	Carisoprodol		5	4.58	ng/L	92	(50-150)		
MS_201709210363	Carisoprodol	14	100	166	ng/L	**1f 2**	(60-140)		
MSD_201709210363	Carisoprodol	14	100	160	ng/L	**14N**	(60-140)	40	3.7
LCS1	Chloridabon		100	89.9	ng/L	90	(60-140)		
LCS2	Chloridabon		100	89.8	ng/L	90	(60-140)	30	0.11
MBLK	Chloridabon			<5	ng/L				
MRL_CHK	Chloridabon		5	3.86	ng/L	77	(50-150)		
MS_201709210363	Chloridabon	ND	100	45.3	ng/L	**4f**	(60-140)		
MSD_201709210363	Chloridabon	ND	100	20.7	ng/L	**21**	(60-140)	40	**7f**
LCS1	Chlorotoluron		100	96.9	ng/L	97	(60-140)		
LCS2	Chlorotoluron		100	97.5	ng/L	98	(60-140)	30	0.62
MBLK	Chlorotoluron			<5	ng/L				
MRL_CHK	Chlorotoluron		5	3.87	ng/L	77	(50-150)		
MS_201709210363	Chlorotoluron	ND	100	99.0	ng/L	99	(60-140)		
MSD_201709210363	Chlorotoluron	ND	100	103	ng/L	103	(60-140)	40	4.0
LCS1	Cimetidine		100	86.0	ng/L	86	(60-140)		
LCS2	Cimetidine		100	81.8	ng/L	82	(60-140)	30	5.0
MBLK	Cimetidine			<5	ng/L				
MRL_CHK	Cimetidine		5	5.62	ng/L	112	(50-150)		
MS_201709210363	Cimetidine	ND	100	263	ng/L	**2N3**	(60-140)		
MSD_201709210363	Cimetidine	ND	100	348	ng/L	**348**	(60-140)	40	28
LCS1	Cotinine		200	198	ng/L	99	(60-140)		
LCS2	Cotinine		200	188	ng/L	94	(60-140)	30	5.2
MBLK	Cotinine			<10	ng/L				
MRL_CHK	Cotinine		10	7.70	ng/L	77	(50-150)		
MS_201709210363	Cotinine	ND	200	167	ng/L	80	(60-140)		
MSD_201709210363	Cotinine	ND	200	184	ng/L	88	(60-140)	40	9.7

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Cyanabine		100	116	ng/L	116	(60-140)		
LCS2	Cyanabine		100	136	ng/L	136	(60-140)	30	16
MBLK	Cyanabine			<5	ng/L				
MRL_CHK	Cyanabine		5	3.05	ng/L	61	(50-150)		
MS_201709210363	Cyanabine	ND	100	75.4	ng/L	75	(60-140)		
MSD_201709210363	Cyanabine	ND	100	61.3	ng/L	61	(60-140)	40	21
LCS1	DACT		100	92.5	ng/L	93	(60-140)		
LCS2	DACT		100	98.9	ng/L	99	(60-140)	30	6.7
MBLK	DACT			<5	ng/L				
MRL_CHK	DACT		5	2.70	ng/L	54	(50-150)		
MS_201709210363	DACT	72	100	139	ng/L	67	(60-140)		
MSD_201709210363	DACT	72	100	123	ng/L	**f1**	(60-140)	40	12
LCS1	DEA		100	110	ng/L	110	(60-140)		
LCS2	DEA		100	104	ng/L	104	(60-140)	30	5.6
MBLK	DEA			<5	ng/L				
MRL_CHK	DEA		5	4.44	ng/L	89	(50-150)		
MS_201709210363	DEA	ND	100	114	ng/L	114	(60-140)		
MSD_201709210363	DEA	ND	100	108	ng/L	109	(60-140)	40	4.5
LCS1	DEET		40	43.5	ng/L	109	(60-140)		
LCS2	DEET		40	38.8	ng/L	97	(60-140)	30	11
MBLK	DEET			<10	ng/L				
MRL_CHK	DEET		2	1.24	ng/L	62	(50-150)		
MS_201709210363	DEET	71	40	125	ng/L	135	(60-140)		
MSD_201709210363	DEET	71	40	126	ng/L	136	(60-140)	40	0.80
LCS1	Dehydronifedipine		100	120	ng/L	120	(60-140)		
LCS2	Dehydronifedipine		100	111	ng/L	111	(60-140)	30	7.8
MBLK	Dehydronifedipine			<5	ng/L				
MRL_CHK	Dehydronifedipine		5	3.66	ng/L	73	(50-150)		
MS_201709210363	Dehydronifedipine	ND	100	107	ng/L	107	(60-140)		
MSD_201709210363	Dehydronifedipine	ND	100	90.4	ng/L	90	(60-140)	40	17
LCS1	DIA		100	93.6	ng/L	94	(60-140)		
LCS2	DIA		100	105	ng/L	105	(60-140)	30	12
MBLK	DIA			<5	ng/L				
MRL_CHK	DIA		5	4.45	ng/L	89	(50-150)		
MS_201709210363	DIA	ND	100	90.6	ng/L	91	(60-140)		
MSD_201709210363	DIA	ND	100	93.3	ng/L	93	(60-140)	40	2.9
LCS1	Diabepam		100	106	ng/L	107	(60-140)		
LCS2	Diabepam		100	110	ng/L	111	(60-140)	30	3.7

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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Diabepam			<5	ng/L				
MRL_CHK	Diabepam		5	4.54	ng/L	91	(50-150)		
MS_201709210363	Diabepam	ND	100	112	ng/L	112	(60-140)		
MSD_201709210363	Diabepam	ND	100	107	ng/L	107	(60-140)	40	4.6
LCS1	Dilantin		400	316	ng/L	79	(60-140)		
LCS2	Dilantin		400	347	ng/L	87	(60-140)	30	9.3
MBLK	Dilantin			<20	ng/L				
MRL_CHK	Dilantin		20	14.7	ng/L	73	(50-150)		
MS_201709210363	Dilantin	ND	400	456	ng/L	112	(60-140)		
MSD_201709210363	Dilantin	ND	400	404	ng/L	98	(60-140)	40	12
LCS1	Diltiabem		100	101	ng/L	101	(60-140)		
LCS2	Diltiabem		100	97.6	ng/L	98	(60-140)	30	3.4
MBLK	Diltiabem			<5	ng/L				
MRL_CHK	Diltiabem		5	4.72	ng/L	95	(50-150)		
MS_201709210363	Diltiabem	ND	100	218	ng/L	**218**	(60-140)		
MSD_201709210363	Diltiabem	ND	100	204	ng/L	**204**	(60-140)	40	6.6
LCS1	Diuron		100	97.0	ng/L	97	(60-140)		
LCS2	Diuron		100	99.7	ng/L	100	(60-140)	30	2.8
MBLK	Diuron			<5	ng/L				
MRL_CHK	Diuron		5	3.60	ng/L	72	(50-150)		
MS_201709210363	Diuron	ND	100	97.2	ng/L	97	(60-140)		
MSD_201709210363	Diuron	ND	100	97.4	ng/L	97	(60-140)	40	0.21
LCS1	Erythromycin		200	218	ng/L	109	(60-140)		
LCS2	Erythromycin		200	241	ng/L	120	(60-140)	30	10
MBLK	Erythromycin			<10	ng/L				
MRL_CHK	Erythromycin		10	9.07	ng/L	91	(50-150)		
MS_201709210363	Erythromycin	ND	200	586	ng/L	**293**	(60-140)		
MSD_201709210363	Erythromycin	ND	200	570	ng/L	**28f**	(60-140)	40	2.8
LCS1	Flumezine		200	195	ng/L	98	(60-140)		
LCS2	Flumezine		200	204	ng/L	102	(60-140)	30	5.0
MBLK	Flumezine			<10	ng/L				
MRL_CHK	Flumezine		10	9.46	ng/L	95	(50-150)		
MS_201709210363	Flumezine	ND	200	88.6	ng/L	**44**	(60-140)		
MSD_201709210363	Flumezine	ND	200	87.7	ng/L	**44**	(60-140)	40	1.1
LCS1	Fluoxetine		100	88.4	ng/L	88	(60-140)		
LCS2	Fluoxetine		100	110	ng/L	110	(60-140)	30	22
MBLK	Fluoxetine			<10	ng/L				
MRL_CHK	Fluoxetine		5	5.06	ng/L	101	(50-150)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709210363	Fluoxetine	ND	100	247	ng/L	**247**	(60-140)		
MSD_201709210363	Fluoxetine	ND	100	250	ng/L	**2f 1**	(60-140)	40	1.6
LCS1	Isoproturon		400	393	ng/L	98	(60-140)		
LCS2	Isoproturon		400	405	ng/L	101	(60-140)	30	3.0
MBLK	Isoproturon			<20	ng/L				
MRL_CHK	Isoproturon		20	16.3	ng/L	82	(50-150)		
MS_201709210363	Isoproturon	ND	400	504	ng/L	126	(60-140)		
MSD_201709210363	Isoproturon	ND	400	445	ng/L	111	(60-140)	40	12
LCS1	Ketoprofen		100	113	ng/L	113	(60-140)		
LCS2	Ketoprofen		100	128	ng/L	128	(60-140)	30	12
MBLK	Ketoprofen			<5	ng/L				
MRL_CHK	Ketoprofen		5	6.17	ng/L	123	(50-150)		
MS_201709210363	Ketoprofen	ND	100	176	ng/L	**17N**	(60-140)		
MSD_201709210363	Ketoprofen	ND	100	168	ng/L	**1N8**	(60-140)	40	4.7
LCS1	Ketorolac		100	113	ng/L	113	(60-140)		
LCS2	Ketorolac		100	134	ng/L	134	(60-140)	30	17
MBLK	Ketorolac			<5	ng/L				
MRL_CHK	Ketorolac		5	5.22	ng/L	104	(50-150)		
MS_201709210363	Ketorolac	ND	100	65.7	ng/L	66	(60-140)		
MSD_201709210363	Ketorolac	ND	100	46.3	ng/L	**4N**	(60-140)	40	35
LCS1	Lidocaine		100	96.9	ng/L	97	(60-140)		
LCS2	Lidocaine		100	94.4	ng/L	94	(60-140)	30	2.6
MBLK	Lidocaine			<5	ng/L				
MRL_CHK	Lidocaine		5	3.84	ng/L	77	(50-150)		
MS_201709210363	Lidocaine	ND	100	67.0	ng/L	67	(60-140)		
MSD_201709210363	Lidocaine	ND	100	68.0	ng/L	68	(60-140)	40	1.5
LCS1	Lincomycin		200	200	ng/L	100	(60-140)		
LCS2	Lincomycin		200	184	ng/L	92	(60-140)	30	8.3
MBLK	Lincomycin			<10	ng/L				
MRL_CHK	Lincomycin		10	6.36	ng/L	64	(50-150)		
MS_201709210363	Lincomycin	ND	200	44.8	ng/L	**22**	(60-140)		
MSD_201709210363	Lincomycin	ND	200	14.3	ng/L	**7g1**	(60-140)	40	**100**
LCS1	Linuron		100	98.5	ng/L	99	(60-140)		
LCS2	Linuron		100	99.6	ng/L	100	(60-140)	30	1.2
MBLK	Linuron			<5	ng/L				
MRL_CHK	Linuron		5	4.25	ng/L	85	(50-150)		
MS_201709210363	Linuron	ND	100	120	ng/L	120	(60-140)		
MSD_201709210363	Linuron	ND	100	120	ng/L	120	(60-140)	40	0.0

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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Lopressor		400	392	ng/L	98	(60-140)		
LCS2	Lopressor		400	407	ng/L	102	(60-140)	30	3.8
MBLK	Lopressor			<20	ng/L				
MRL_CHK	Lopressor		20	18.0	ng/L	90	(50-150)		
MS_201709210363	Lopressor	ND	400	233	ng/L	**f 8**	(60-140)		
MSD_201709210363	Lopressor	ND	400	284	ng/L	71	(60-140)	40	20
LCS1	Meclofenamic Acid		100	89.7	ng/L	90	(60-140)		
LCS2	Meclofenamic Acid		100	94.8	ng/L	95	(60-140)	30	5.5
MBLK	Meclofenamic Acid			<5	ng/L				
MRL_CHK	Meclofenamic Acid		5	3.31	ng/L	66	(50-150)		
MS_201709210363	Meclofenamic Acid	ND	100	128	ng/L	128	(60-140)		
MSD_201709210363	Meclofenamic Acid	ND	100	121	ng/L	121	(60-140)	40	5.6
LCS1	Meproqamate		100	118	ng/L	118	(60-140)		
LCS2	Meproqamate		100	94.1	ng/L	94	(60-140)	30	23
MBLK	Meproqamate			<5	ng/L				
MRL_CHK	Meproqamate		5	6.52	ng/L	130	(50-150)		
MS_201709210363	Meproqamate	ND	100	25.4	ng/L	**2f**	(60-140)		
MSD_201709210363	Meproqamate	ND	100	30.8	ng/L	**30**	(60-140)	40	19
LCS1	Metabachlor		100	124	ng/L	124	(60-140)		
LCS2	Metabachlor		100	110	ng/L	110	(60-140)	30	12
MBLK	Metabachlor			<5	ng/L				
MRL_CHK	Metabachlor		5	4.96	ng/L	99	(50-150)		
MS_201709210363	Metabachlor	ND	100	100	ng/L	100	(60-140)		
MSD_201709210363	Metabachlor	ND	100	87.7	ng/L	88	(60-140)	40	13
LCS1	Metolachlor		100	97.2	ng/L	97	(60-140)		
LCS2	Metolachlor		100	103	ng/L	103	(60-140)	30	5.8
MBLK	Metolachlor			<5	ng/L				
MRL_CHK	Metolachlor		5	4.62	ng/L	93	(50-150)		
MS_201709210363	Metolachlor	ND	100	109	ng/L	109	(60-140)		
MSD_201709210363	Metolachlor	ND	100	105	ng/L	105	(60-140)	40	3.7
LCS1	Nifedipine		400	359	ng/L	90	(60-140)		
LCS2	Nifedipine		400	348	ng/L	87	(60-140)	30	3.1
MBLK	Nifedipine			<20	ng/L				
MRL_CHK	Nifedipine		20	14.2	ng/L	71	(50-150)		
MS_201709210363	Nifedipine	ND	400	902	ng/L	**22f**	(60-140)		
MSD_201709210363	Nifedipine	ND	400	766	ng/L	**192**	(60-140)	40	16
LCS1	Norethisterone		100	129	ng/L	129	(60-140)		
LCS2	Norethisterone		100	121	ng/L	121	(60-140)	30	6.4

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Norethisterone			<5	ng/L				
MRL_CHK	Norethisterone		5	4.42	ng/L	88	(50-150)		
MS_201709210363	Norethisterone	ND	100	140	ng/L	140	(60-140)		
MSD_201709210363	Norethisterone	ND	100	132	ng/L	132	(60-140)	40	5.9
LCS1	Oxolinic acid		100	92.1	ng/L	92	(60-140)		
LCS2	Oxolinic acid		100	112	ng/L	112	(60-140)	30	20
MBLK	Oxolinic acid			<5	ng/L				
MRL_CHK	Oxolinic acid		5	6.41	ng/L	128	(50-150)		
MS_201709210363	Oxolinic acid	ND	100	60.7	ng/L	61	(60-140)		
MSD_201709210363	Oxolinic acid	ND	100	74.9	ng/L	75	(60-140)	40	21
LCS1	Pentoxifylline		100	124	ng/L	124	(60-140)		
LCS2	Pentoxifylline		100	140	ng/L	140	(60-140)	30	12
MBLK	Pentoxifylline			<5	ng/L				
MRL_CHK	Pentoxifylline		5	7.41	ng/L	148	(50-150)		
MS_201709210363	Pentoxifylline	ND	100	19.8	ng/L	**20**	(60-140)		
MSD_201709210363	Pentoxifylline	ND	100	14.1	ng/L	**14**	(60-140)	40	34
LCS1	Phenabone		100	107	ng/L	107	(60-140)		
LCS2	Phenabone		100	123	ng/L	123	(60-140)	30	14
MBLK	Phenabone			<5	ng/L				
MRL_CHK	Phenabone		5	5.78	ng/L	116	(50-150)		
MS_201709210363	Phenabone	ND	100	66.5	ng/L	67	(60-140)		
MSD_201709210363	Phenabone	ND	100	62.8	ng/L	63	(60-140)	40	5.7
LCS1	Primidone		100	94.5	ng/L	95	(60-140)		
LCS2	Primidone		100	77.3	ng/L	77	(60-140)	30	20
MBLK	Primidone			<5	ng/L				
MRL_CHK	Primidone		5	3.05	ng/L	61	(50-150)		
MS_201709210363	Primidone	ND	100	72.1	ng/L	72	(60-140)		
MSD_201709210363	Primidone	ND	100	93.6	ng/L	94	(60-140)	40	26
LCS1	Progesterone		100	110	ng/L	110	(60-140)		
LCS2	Progesterone		100	110	ng/L	110	(60-140)	30	0.0
MBLK	Progesterone			<5	ng/L				
MRL_CHK	Progesterone		5	6.40	ng/L	128	(50-150)		
MS_201709210363	Progesterone	ND	100	128	ng/L	126	(60-140)		
MSD_201709210363	Progesterone	ND	100	128	ng/L	127	(60-140)	40	0.0
LCS1	Propabine		100	98.4	ng/L	98	(60-140)		
LCS2	Propabine		100	106	ng/L	106	(60-140)	30	7.4
MBLK	Propabine			<5	ng/L				
MRL_CHK	Propabine		5	3.81	ng/L	76	(50-150)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709210363	Propabine	ND	100	111	ng/L	111	(60-140)		
MSD_201709210363	Propabine	ND	100	106	ng/L	106	(60-140)	40	4.6
LCS1	Quinoline		100	98.0	ng/L	98	(60-140)		
LCS2	Quinoline		100	98.3	ng/L	98	(60-140)	30	0.31
MBLK	Quinoline			<5	ng/L				
MRL_CHK	Quinoline		5	4.51	ng/L	90	(50-150)		
MS_201709210363	Quinoline	ND	100	138	ng/L	138	(60-140)		
MSD_201709210363	Quinoline	ND	100	134	ng/L	134	(60-140)	40	2.9
LCS1	Simabine		100	102	ng/L	102	(60-140)		
LCS2	Simabine		100	93.7	ng/L	94	(60-140)	30	8.5
MBLK	Simabine			<5	ng/L				
MRL_CHK	Simabine		5	6.44	ng/L	129	(50-150)		
MS_201709210363	Simabine	ND	100	121	ng/L	118	(60-140)		
MSD_201709210363	Simabine	ND	100	130	ng/L	127	(60-140)	40	7.2
LCS1	Sulfachloropyridabine		100	86.6	ng/L	87	(60-140)		
LCS2	Sulfachloropyridabine		100	77.4	ng/L	77	(60-140)	30	11
MBLK	Sulfachloropyridabine			<5	ng/L				
MRL_CHK	Sulfachloropyridabine		5	3.91	ng/L	78	(50-150)		
MS_201709210363	Sulfachloropyridabine	ND	100	3.83	ng/L	**3g8**	(60-140)		
MSD_201709210363	Sulfachloropyridabine	ND	100	3.35	ng/L	**3g4**	(60-140)	40	13
LCS1	Sulfadiabine		100	94.7	ng/L	95	(60-140)		
LCS2	Sulfadiabine		100	93.2	ng/L	93	(60-140)	30	1.6
MBLK	Sulfadiabine			<5	ng/L				
MRL_CHK	Sulfadiabine		5	6.45	ng/L	129	(50-150)		
MS_201709210363	Sulfadiabine	ND	100	82.8	ng/L	83	(60-140)		
MSD_201709210363	Sulfadiabine	ND	100	54.2	ng/L	**f 4**	(60-140)	40	**42**
LCS1	Sulfadimethoxine		100	96.7	ng/L	97	(60-140)		
LCS2	Sulfadimethoxine		100	102	ng/L	103	(60-140)	30	6.3
MBLK	Sulfadimethoxine			<5	ng/L				
MRL_CHK	Sulfadimethoxine		5	4.30	ng/L	86	(50-150)		
MS_201709210363	Sulfadimethoxine	ND	100	133	ng/L	132	(60-140)		
MSD_201709210363	Sulfadimethoxine	ND	100	117	ng/L	116	(60-140)	40	13
LCS1	Sulfamerabine		100	105	ng/L	105	(60-140)		
LCS2	Sulfamerabine		100	121	ng/L	121	(60-140)	30	14
MBLK	Sulfamerabine			<5	ng/L				
MRL_CHK	Sulfamerabine		5	3.73	ng/L	75	(50-150)		
MS_201709210363	Sulfamerabine	ND	100	19.7	ng/L	**20**	(60-140)		
MSD_201709210363	Sulfamerabine	ND	100	18.2	ng/L	**18**	(60-140)	40	7.9

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Sulfamethabine		100	95.8	ng/L	96	(60-140)		
LCS2	Sulfamethabine		100	91.6	ng/L	92	(60-140)	30	4.5
MBLK	Sulfamethabine			<5	ng/L				
MRL_CHK	Sulfamethabine		5	3.46	ng/L	69	(50-150)		
MS_201709210363	Sulfamethabine	ND	100	187	ng/L	**187**	(60-140)		
MSD_201709210363	Sulfamethabine	ND	100	219	ng/L	**219**	(60-140)	40	16
LCS1	Sulfamethibole		100	99.1	ng/L	99	(60-140)		
LCS2	Sulfamethibole		100	101	ng/L	101	(60-140)	30	1.9
MBLK	Sulfamethibole			<5	ng/L				
MRL_CHK	Sulfamethibole		5	3.48	ng/L	70	(50-150)		
MS_201709210363	Sulfamethibole	ND	100	11.4	ng/L	**11**	(60-140)		
MSD_201709210363	Sulfamethibole	ND	100	6.75	ng/L	**N8**	(60-140)	40	**f 1**
LCS1	Sulfamethoxabole		100	95.0	ng/L	95	(60-140)		
LCS2	Sulfamethoxabole		100	98.7	ng/L	99	(60-140)	30	3.8
MBLK	Sulfamethoxabole			<5	ng/L				
MRL_CHK	Sulfamethoxabole		5	3.75	ng/L	75	(50-150)		
MS_201709210363	Sulfamethoxabole	ND	200	44.2	ng/L	**44**	(60-140)		
MSD_201709210363	Sulfamethoxabole	ND	200	34.8	ng/L	**3f**	(60-140)	40	24
LCS1	Sulfathiabole		100	95.2	ng/L	95	(60-140)		
LCS2	Sulfathiabole		100	93.3	ng/L	93	(60-140)	30	2.0
MBLK	Sulfathiabole			<5	ng/L				
MRL_CHK	Sulfathiabole		5	2.63	ng/L	53	(50-150)		
MS_201709210363	Sulfathiabole	ND	100	94.9	ng/L	95	(60-140)		
MSD_201709210363	Sulfathiabole	ND	100	98.3	ng/L	98	(60-140)	40	3.5
LCS1	TCEP		100	103	ng/L	103	(60-140)		
LCS2	TCEP		100	122	ng/L	122	(60-140)	30	17
MBLK	TCEP			<10	ng/L				
MRL_CHK	TCEP		5	6.60	ng/L	132	(50-150)		
MS_201709210363	TCEP	92	100	193	ng/L	101	(60-140)		
MSD_201709210363	TCEP	92	100	156	ng/L	64	(60-140)	40	21
LCS1	TCPP		100	114	ng/L	114	(40-160)		
LCS2	TCPP		100	107	ng/L	107	(40-160)	30	6.3
MBLK	TCPP			<100	ng/L				
MRL_CHK	TCPP		5	6.12	ng/L	122	(40-160)		
MS_201709210363	TCPP	250	100	249	ng/L	**1**	(40-160)		
MSD_201709210363	TCPP	250	100	249	ng/L	**0830**	(40-160)	60	0.0
LCS1	TDCPP		400	468	ng/L	117	(40-160)		
LCS2	TDCPP		400	442	ng/L	111	(40-160)	30	5.7

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	TDCPP			<100	ng/L				
MS_201709210363	TDCPP	ND	400	363	ng/L	91	(40-160)		
MSD_201709210363	TDCPP	ND	400	466	ng/L	117	(40-160)	60	25
LCS1	Testosterone		100	73.6	ng/L	74	(60-140)		
LCS2	Testosterone		100	83.0	ng/L	83	(60-140)	30	12
MBLK	Testosterone			<5	ng/L				
MRL_CHK	Testosterone		5	6.86	ng/L	137	(50-150)		
MS_201709210363	Testosterone	ND	100	162	ng/L	**1N2**	(60-140)		
MSD_201709210363	Testosterone	ND	100	156	ng/L	**1f N**	(60-140)	40	3.8
LCS1	Theoqromine		100	106	ng/L	106	(60-140)		
LCS2	Theoqromine		100	103	ng/L	103	(60-140)	30	2.9
MBLK	Theoqromine			<5	ng/L				
MRL_CHK	Theoqromine		5	4.80	ng/L	96	(50-150)		
MS_201709210363	Theoqromine	ND	100	118	ng/L	118	(60-140)		
MSD_201709210363	Theoqromine	ND	100	71.8	ng/L	72	(60-140)	40	**49**
LCS1	Theophylline		200	203	ng/L	102	(60-140)		
LCS2	Theophylline		200	180	ng/L	90	(60-140)	30	12
MBLK	Theophylline			<10	ng/L				
MRL_CHK	Theophylline		10	11.4	ng/L	114	(50-150)		
MS_201709210363	Theophylline	ND	200	54.4	ng/L	**27**	(60-140)		
MSD_201709210363	Theophylline	ND	200	58.6	ng/L	**29**	(60-140)	40	7.4
LCS1	Trimethoprim		100	92.3	ng/L	92	(60-140)		
LCS2	Trimethoprim		100	94.3	ng/L	94	(60-140)	30	2.1
MBLK	Trimethoprim			<5	ng/L				
MRL_CHK	Trimethoprim		5	3.61	ng/L	72	(50-150)		
MS_201709210363	Trimethoprim	ND	100	96.8	ng/L	97	(60-140)		
MSD_201709210363	Trimethoprim	ND	100	93.0	ng/L	93	(60-140)	40	4.0
Endocrine Disruptors . e5ative Mode - SPE by LC-MS-MS									
Analytical Batch: 1034N13							**Analysis Date: 10/0N2017**		
LCS1	2,4-D		100	102	ng/L	102	(60-140)		
LCS2	2,4-D		100	102	ng/L	102	(60-140)	40	0.0
MBLK	2,4-D			<5	ng/L				
MRL_CHK	2,4-D		5	4.31	ng/L	86	(50-150)		
MS_201709210363	2,4-D	ND	100	93.1	ng/L	93	(60-140)		
MSD_201709210363	2,4-D	ND	100	96.1	ng/L	96	(60-140)	40	3.2
LCS1	4-nonylphenol - semi zuantitative		200	184	ng/L	92	(60-140)		
LCS2	4-nonylphenol - semi zuantitative		200	168	ng/L	84	(60-140)	40	9.1

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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	4-nonylphenol - semi zuantitative			<100	ng/L				
MS_201709210363	4-nonylphenol - semi zuantitative	ND	200	342	ng/L	**1N3**	(60-140)		
MSD_201709210363	4-nonylphenol - semi zuantitative	ND	200	233	ng/L	108	(60-140)	40	38
LCS1	4-tert-octylphenol		100	106	ng/L	106	(60-140)		
LCS2	4-tert-octylphenol		100	108	ng/L	108	(60-140)	40	1.9
MBLK	4-tert-octylphenol			<100	ng/L				
MRL_CHK	4-tert-octylphenol		5	7.49	ng/L	150	(50-150)		
MS_201709210363	4-tert-octylphenol	ND	100	161	ng/L	**1f 8**	(60-140)		
MSD_201709210363	4-tert-octylphenol	ND	100	152	ng/L	**149**	(60-140)	40	5.8
LCS1	Acesulfame-K		400	378	ng/L	95	(60-140)		
LCS2	Acesulfame-K		400	395	ng/L	99	(60-140)	40	4.1
MBLK	Acesulfame-K			<20	ng/L				
MRL_CHK	Acesulfame-K		20	15.0	ng/L	75	(50-150)		
MS_201709210363	Acesulfame-K	69	400	474	ng/L	101	(60-140)		
MSD_201709210363	Acesulfame-K	69	400	482	ng/L	103	(60-140)	40	1.9
LCS1	Bendroflumethiabide		100	95.4	ng/L	95	(60-140)		
LCS2	Bendroflumethiabide		100	96.7	ng/L	97	(60-140)	40	1.4
MBLK	Bendroflumethiabide			<5	ng/L				
MRL_CHK	Bendroflumethiabide		5	3.44	ng/L	69	(50-150)		
MS_201709210363	Bendroflumethiabide	ND	100	63.4	ng/L	63	(60-140)		
MSD_201709210363	Bendroflumethiabide	ND	100	62.0	ng/L	62	(60-140)	40	2.1
LCS1	BPA		100	100	ng/L	100	(60-140)		
LCS2	BPA		100	98.7	ng/L	99	(60-140)	40	1.3
MBLK	BPA			<10	ng/L				
MRL_CHK	BPA		5	7.28	ng/L	146	(50-150)		
MS_201709210363	BPA	ND	100	106	ng/L	106	(60-140)		
MSD_201709210363	BPA	ND	100	104	ng/L	104	(60-140)	40	1.9
LCS1	Butalqital		100	104	ng/L	104	(60-140)		
LCS2	Butalqital		100	104	ng/L	104	(60-140)	40	0.0
MBLK	Butalqital			<5	ng/L				
MRL_CHK	Butalqital		5	4.13	ng/L	83	(50-150)		
MS_201709210363	Butalqital	ND	100	112	ng/L	112	(60-140)		
MSD_201709210363	Butalqital	ND	100	103	ng/L	103	(60-140)	40	8.4
LCS1	Butylparqen		100	95.8	ng/L	96	(60-140)		
LCS2	Butylparqen		100	102	ng/L	102	(60-140)	40	6.3
MBLK	Butylparqen			<5	ng/L				
MRL_CHK	Butylparqen		5	5.01	ng/L	100	(50-150)		
MS_201709210363	Butylparqen	ND	100	150	ng/L	**1f 0**	(60-140)		

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Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709210363	Butylparqen	ND	100	142	ng/L	**142**	(60-140)	40	5.5
LCS1	Chloramphenicol		100	97.3	ng/L	97	(60-140)		
LCS2	Chloramphenicol		100	99.0	ng/L	99	(60-140)	40	1.7
MBLK	Chloramphenicol			<10	ng/L				
MRL_CHK	Chloramphenicol		5	3.80	ng/L	76	(50-150)		
MS_201709210363	Chloramphenicol	ND	100	37.5	ng/L	**38**	(60-140)		
MSD_201709210363	Chloramphenicol	ND	100	37.4	ng/L	**37**	(60-140)	40	0.27
LCS1	Clofiqric Acid		100	97.8	ng/L	98	(60-140)		
LCS2	Clofiqric Acid		100	99.9	ng/L	100	(60-140)	40	2.1
MBLK	Clofiqric Acid			<5	ng/L				
MRL_CHK	Clofiqric Acid		5	3.40	ng/L	68	(50-150)		
MS_201709210363	Clofiqric Acid	31	100	145	ng/L	114	(60-140)		
MSD_201709210363	Clofiqric Acid	31	100	144	ng/L	113	(60-140)	40	0.69
LCS1	Diclofenac		100	92.7	ng/L	93	(60-140)		
LCS2	Diclofenac		100	94.6	ng/L	95	(60-140)	40	2.0
MBLK	Diclofenac			<5	ng/L				
MRL_CHK	Diclofenac		5	3.08	ng/L	62	(50-150)		
MS_201709210363	Diclofenac	ND	100	130	ng/L	131	(60-140)		
MSD_201709210363	Diclofenac	ND	100	124	ng/L	124	(60-140)	40	5.5
LCS1	Estradiol		100	101	ng/L	101	(60-140)		
LCS2	Estradiol		100	100	ng/L	100	(60-140)	40	1
MBLK	Estradiol			<5	ng/L				
MRL_CHK	Estradiol		5	2.62	ng/L	52	(50-150)		
MS_201709210363	Estradiol	ND	100	114	ng/L	112	(60-140)		
MSD_201709210363	Estradiol	ND	100	118	ng/L	116	(60-140)	40	3.5
LCS1	Estrone		100	99.5	ng/L	100	(60-140)		
LCS2	Estrone		100	99.9	ng/L	100	(60-140)	40	0.40
MBLK	Estrone			<5	ng/L				
MRL_CHK	Estrone		5	3.35	ng/L	67	(50-150)		
MS_201709210363	Estrone	ND	100	110	ng/L	110	(60-140)		
MSD_201709210363	Estrone	ND	100	108	ng/L	108	(60-140)	40	1.8
LCS1	Ethinyl Estradiol - 17 alpha		100	101	ng/L	101	(60-140)		
LCS2	Ethinyl Estradiol - 17 alpha		100	100	ng/L	100	(60-140)	40	1
MBLK	Ethinyl Estradiol - 17 alpha			<5	ng/L				
MRL_CHK	Ethinyl Estradiol - 17 alpha		5	2.74	ng/L	55	(50-150)		
MS_201709210363	Ethinyl Estradiol - 17 alpha	ND	100	124	ng/L	124	(60-140)		
MSD_201709210363	Ethinyl Estradiol - 17 alpha	ND	100	116	ng/L	116	(60-140)	40	6.7
LCS1	Ethylparaqen		400	380	ng/L	95	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Ethylparaqen		400	392	ng/L	98	(60-140)	40	3.1
MBLK	Ethylparaqen			<20	ng/L				
MRL_CHK	Ethylparaqen		20	13.3	ng/L	67	(50-150)		
MS_201709210363	Ethylparaqen	ND	400	455	ng/L	114	(60-140)		
MSD_201709210363	Ethylparaqen	ND	400	466	ng/L	116	(60-140)	40	2.4
LCS1	Gemfiqrobil		100	99.2	ng/L	99	(60-140)		
LCS2	Gemfiqrobil		100	104	ng/L	104	(60-140)	40	4.7
MBLK	Gemfiqrobil			<5	ng/L				
MRL_CHK	Gemfiqrobil		5	5.98	ng/L	120	(50-150)		
MS_201709210363	Gemfiqrobil	ND	100	95.3	ng/L	95	(60-140)		
MSD_201709210363	Gemfiqrobil	ND	100	113	ng/L	112	(60-140)	40	17
LCS1	Iquprofen		200	202	ng/L	101	(60-140)		
LCS2	Iquprofen		200	200	ng/L	100	(60-140)	40	0.50
MBLK	Iquprofen			<15	ng/L				
MRL_CHK	Iquprofen		10	7.03	ng/L	70	(50-150)		
MS_201709210363	Iquprofen	12	200	280	ng/L	134	(60-140)		
MSD_201709210363	Iquprofen	12	200	261	ng/L	124	(60-140)	40	7.0
LCS1	Iohexal		200	194	ng/L	97	(60-140)		
LCS2	Iohexal		200	193	ng/L	97	(60-140)	40	0.52
MBLK	Iohexal			<10	ng/L				
MRL_CHK	Iohexal		10	10.2	ng/L	102	(50-150)		
MS_201709210363	Iohexal	ND	200	71.5	ng/L	**3N**	(50-150)		
MSD_201709210363	Iohexal	ND	200	97.2	ng/L	**49**	(50-150)	50	31
LCS1	Iopromide		100	72.3	ng/L	72	(60-140)		
LCS2	Iopromide		100	67.6	ng/L	68	(60-140)	40	6.7
MBLK	Iopromide			<5	ng/L				
MRL_CHK	Iopromide		5	4.01	ng/L	80	(50-150)		
MS_201709210363	Iopromide	15	100	81.9	ng/L	67	(50-150)		
MSD_201709210363	Iopromide	15	100	108	ng/L	93	(50-150)	50	28
LCS1	Isoqutylparaqen		100	95.9	ng/L	96	(60-140)		
LCS2	Isoqutylparaqen		100	102	ng/L	102	(60-140)	40	6.2
MBLK	Isoqutylparaqen			<5	ng/L				
MRL_CHK	Isoqutylparaqen		5	5.00	ng/L	100	(50-150)		
MS_201709210363	Isoqutylparaqen	ND	100	150	ng/L	**1f 0**	(60-140)		
MSD_201709210363	Isoqutylparaqen	ND	100	142	ng/L	**142**	(60-140)	40	5.5
LCS1	Lipitor (Atorvastain)		100	134	ng/L	134	(60-140)		
LCS2	Lipitor (Atorvastain)		100	129	ng/L	129	(60-140)	40	3.8
MBLK	Lipitor (Atorvastain)			<5	ng/L				

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Lipitor (Atorvastain)		5	6.20	ng/L	124	(50-150)		
MS_201709210363	Lipitor (Atorvastain)	ND	100	111	ng/L	111	(60-140)		
MSD_201709210363	Lipitor (Atorvastain)	ND	100	109	ng/L	109	(60-140)	40	1.8
LCS1	Methylparaqen		400	381	ng/L	95	(60-140)		
LCS2	Methylparaqen		400	384	ng/L	96	(60-140)	40	0.78
MBLK	Methylparaqen			<20	ng/L				
MRL_CHK	Methylparaqen		20	12.6	ng/L	63	(50-150)		
MS_201709210363	Methylparaqen	ND	400	340	ng/L	85	(60-140)		
MSD_201709210363	Methylparaqen	ND	400	370	ng/L	93	(60-140)	40	8.4
LCS1	Naproxen		200	193	ng/L	97	(60-140)		
LCS2	Naproxen		200	191	ng/L	96	(60-140)	40	1.0
MBLK	Naproxen			<10	ng/L				
MRL_CHK	Naproxen		10	6.76	ng/L	68	(50-150)		
MS_201709210363	Naproxen	ND	200	199	ng/L	99	(60-140)		
MSD_201709210363	Naproxen	ND	200	208	ng/L	103	(60-140)	40	4.4
LCS1	Propylparaqen		100	98.5	ng/L	99	(60-140)		
LCS2	Propylparaqen		100	97.0	ng/L	97	(60-140)	40	1.5
MBLK	Propylparaqen			<5	ng/L				
MRL_CHK	Propylparaqen		5	4.92	ng/L	99	(50-150)		
MS_201709210363	Propylparaqen	ND	100	134	ng/L	134	(60-140)		
MSD_201709210363	Propylparaqen	ND	100	138	ng/L	138	(60-140)	40	2.9
LCS1	Salicylic Acid		2000	1920	ng/L	96	(60-140)		
LCS2	Salicylic Acid		2000	1950	ng/L	98	(60-140)	40	1.6
MBLK	Salicylic Acid			<100	ng/L				
MRL_CHK	Salicylic Acid		100	98.3	ng/L	98	(50-150)		
MS_201709210363	Salicylic Acid	ND	2000	1600	ng/L	77	(60-140)		
MSD_201709210363	Salicylic Acid	ND	2000	1660	ng/L	80	(60-140)	40	3.7
LCS1	Sucralose		2000	1860	ng/L	93	(60-140)		
LCS2	Sucralose		2000	1660	ng/L	83	(60-140)	40	11
MBLK	Sucralose			<100	ng/L				
MRL_CHK	Sucralose		100	82.2	ng/L	82	(50-150)		
MS_201709210363	Sucralose	34000	2000	47300	ng/L	**N7N**	(60-140)		
MSD_201709210363	Sucralose	34000	2000	49900	ng/L	**807**	(60-140)	40	5.3
LCS1	Triclocarqan		100	122	ng/L	122	(60-140)		
LCS2	Triclocarqan		100	136	ng/L	136	(60-140)	40	11
MBLK	Triclocarqan			<5	ng/L				
MRL_CHK	Triclocarqan		5	5.01	ng/L	100	(50-150)		
MS_201709210363	Triclocarqan	ND	100	223	ng/L	**223**	(60-140)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Tel: (626) 386-1100
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Report: 688051
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709210363	Triclocarqan	ND	100	155	ng/L	**1f f**	(60-140)	40	36
LCS1	Triclosan		200	197	ng/L	98	(60-140)		
LCS2	Triclosan		200	213	ng/L	107	(60-140)	40	7.8
MBLK	Triclosan			<10	ng/L				
MRL_CHK	Triclosan		10	13.2	ng/L	132	(50-150)		
MS_201709210363	Triclosan	ND	200	220	ng/L	110	(60-140)		
MSD_201709210363	Triclosan	ND	200	219	ng/L	109	(60-140)	40	0.46
LCS1	Warfarin		100	82.9	ng/L	83	(60-140)		
LCS2	Warfarin		100	96.5	ng/L	97	(60-140)	40	15
MBLK	Warfarin			<5	ng/L				
MRL_CHK	Warfarin		5	4.46	ng/L	89	(50-150)		
MS_201709210363	Warfarin	ND	100	157	ng/L	**1f 7**	(60-140)		
MSD_201709210363	Warfarin	ND	100	154	ng/L	**1f 3**	(60-140)	40	1.9

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted qy Underlining.
Criteria for MS and Dup are advisory only, qatch control is qased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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ilac-MRA

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY
AT-1807

Laboratory Report

for

State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attention: Joanna Seto

Date of Issue
10/29/2017

EUROFINS EATON ANALYTICAL, INC.

NELAP ACCREDITED TNI LABORATORY
ORELAP 4034

Report: 689521
Project: PPCP-HAWAII
Group: Maui

RCZ: Rick Zimmer

Project Manager

* Accredited in accordance with TNI 2009 and ISO/IEC 17025:2005.
* Laboratory certifies that the test results meet all **TNI 2009 and ISO/IEC 17025:2005** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.

STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	**Michigan**	9906
Arizona	AZ0778	**Mississippi**	Certified
Arkansas	Certified	**Montana**	Cert 0035
California-Monrovia-ELAP	2813	**Nebraska**	Certified
California-Colton- ELAP	2812	**Nevada**	CA00006-2016
California-Folsom- ELAP	2820	**New Hampshire ***	2959
California-Fresno- ELAP	2966	**New Jersey ***	CA 008
Colorado	Certified	**New Mexico**	Certified
Connecticut	PH-0107	**New York ***	11320
Delaware	CA 006	**North Carolina**	06701
Florida *	E871024	**North Dakota**	R-009
Georgia	947	**Oregon (Primary AB) ***	**ORELAP 4034**
Guam	17-005R	**Pennsylvania ***	68-565
Hawaii	Certified	**Puerto Rico**	Certified
Idaho	Certified	**Rhode Island**	LAO00326
Illinois *	200033	**South Carolina**	87016
Indiana	C-CA-01	**South Dakota**	Certified
Iowa - Asbestos	413	**Tennessee**	TN02839
Kansas *	E-10268	**Texas ***	T104704230-16-11
Kentucky	90107	**Utah ***	CA000062017-11
Louisiana *	LA170009	**Vermont**	VT0114
Maine	CA0006	**Virginia ***	460260
Maryland	224	**Washington**	C838
Commonwealth of Northern Marianas Is.	MP0004	**EPA Region 5**	Certified
Massachusetts	M-CA006	**Los Angeles County Sanitation Districts**	10264

* NELAP/TNI Recognized Accreditation Bodies

Eurofins Eaton Analytical, Inc.
750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629
T | 626-386-1100
F | 626-386-1101
www.EatonAnalytical.com

ISO 17025 Accredited Method List

The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB.

Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environ-mental (Drinking Water)	Environ-mental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
1,4-Dioxane	EPA 522	x		x
2,3,7,8-TCDD	Modified EPA 1613B	x		x
Acrylamide	In House Method (2440)	x		x
Alkalinity	SM 2320B	x	x	x
Ammonia	EPA 350.1		x	x
Ammonia	SM 4500-NH3 H		x	x
Anions and DBPs by IC	EPA 300.0	x	x	x
Anions and DBPs by IC	EPA 300.1	x		x
Asbestos	EPA 100.2	x	x	
Bicarbonate Alkalinity as HCO3	SM 2320B	x	x	x
BOD / CBOD	SM 5210B		x	x
Bromate	In House Method (2447)	x		x
Carbamates	EPA 531.2	x		x
Carbonate as CO3	SM 2330B	x	x	x
Carbonyls	EPA 556	x		x
COD	EPA 410.4 / SM 5220D		x	
Chloramines	SM 4500-CL G	x	x	x
Chlorinated Acids	EPA 515.4	x		x
Chlorinated Acids	EPA 555	x		x
Chlorine Dioxide	SM 4500-CLO2 D	x		x
Chlorine -Total/Free/ Combined Residual	SM 4500-Cl G	x	x	x
Conductivity	EPA 120.1		x	
Conductivity	SM 2510B	x	x	x
Corrosivity (Langelier Index)	SM 2330B	x		x
Cryptosporidium	EPA 1623	x		x
Cyanide, Amenable	SM 4500-CN G	x	x	
Cyanide, Free	SM 4500CN F	x	x	x
Cyanide, Total	EPA 335.4	x	x	x
Cyanogen Chloride (screen)	In House Method (2470)	x		x
Diquat and Paraquat	EPA 549.2	x		x
DBP/HAA	SM 6251B	x		x
Dissolved Oxygen	SM 4500-O G		x	x
DOC	SM 5310C	x		x
E. Coli	(MTF/EC+MUG)	x		x
E. Coli	CFR 141.21(f)(6)(i)	x		x
E. Coli	SM 9223		x	
E. Coli (Enumeration)	SM 9221B.1/ SM 9221F	x		x
E. Coli (Enumeration)	SM 9223B	x		x
EDB/DCBP	EPA 504.1	x		
EDB/DBCP and DBP	EPA 551.1	x		x
EDTA and NTA	In House Method (2454)	x		x
Endothall	EPA 548.1	x		x
Endothall	In-house Method (2445)	x		x
Enterococci	SM 9230B	x	x	
Fecal Coliform	SM 9221 E (MTF/EC)	x		
Fecal Coliform	SM 9221C, E (MTF/EC)		x	
Fecal Coliform (Enumeration)	SM 9221E (MTF/EC)	x		x
Fecal Coliform with Chlorine Present	SM 9221E		x	
Fecal Streptococci	SM 9230B	x	x	
Fluoride	SM 4500-F C	x	x	x
Giardia	EPA 1623	x		x
Glyphosate	EPA 547	x		x
Gross Alpha/Beta	EPA 900.0	x	x	x
Gross Alpha Coprecipitation	SM 7110 C	x	x	x
Hardness	SM 2340B	x	x	x
Heterotrophic Bacteria	In House Method (2439)	x		x
Heterotrophic Bacteria	SM 9215 B	x		x
Hexavalent Chromium	EPA 218.6	x	x	x
Hexavalent Chromium	EPA 218.7	x		x
Hexavalent Chromium	SM 3500-Cr B		x	
Hormones	EPA 539	x		x
Hydroxide as OH Calc.	SM 2330B	x		x
Kjeldahl Nitrogen	EPA 351.2		x	
Legionella	CDC Legionella	x		x
Mercury	EPA 245.1	x	x	x
Metals	EPA 200.7 / 200.8	x	x	x
Microcystin LR	ELISA (2360)	x		x
NDMA	EPA 521	x		x
NDMA	TQ In house method based on EPA 521 (2425)	x		x
Nitrate/Nitrite Nitrogen	EPA 353.2	x	x	x
OCL, Pesticides/PCB	EPA 505	x		x
Ortho Phosphate	EPA 365.1	x	x	x
Ortho Phosphate	SM 4500P E			x
Ortho Phosphorous	SM 4500P E	x		
Oxyhalides Disinfection Byproducts	EPA 317.0	x		x
Perchlorate	EPA 331.0	x		x
Perchlorate (low and high)	EPA 314.0	x		x
Perfluorinated Alkyl Acids	EPA 537	x		x
pH	EPA 150.1	x		
pH	SM 4500-H+B	x	x	x
Phenylurea Pesticides/ Herbicides	In House Method, based on EPA 532 (2448)	x		x
Pseudomonas	IDEXX Pseudalert (2461)	x		x
Radium-226	GA Institute of Tech	x		x
Radium-228	GA Institute of Tech	x		x
Radon-222	SM 7500RN	x		x
Residue, Filterable	SM 2540C	x	x	x
Residue, Non-filterable	SM 2540D		x	
Residue, Total	SM 2540B		x	x
Residue, Volatile	EPA 160.4		x	
Semi-VOC	EPA 525.2	x		x
Semi-VOC	EPA 625		x	x
Silica	SM 4500-Si D	x	x	
Silica	SM 4500-SiO2 C	x	x	
Sulfide	SM 4500-$S^{=}$ D		x	
Sulfite	SM 4500-SO^{3}B	x	x	x
Surfactants	SM 5540C	x	x	x
Taste and Odor Analytes	SM 6040E	x		x
Total Coliform (P/A)	SM 9221 A, B	x		x
Total Coliform (Enumeration)	SM 9221 A, B, C	x		x
Total Coliform / E. coli	Colisure SM 9223	x		x
Total Coliform	SM 9221B		x	
Total Coliform with Chlorine Present	SM 9221B		x	
Total Coliform / E.coli (P/A and Enumeration)	SM 9223	x		x
TOC	SM 5310C	x	x	x
TOX	SM 5320B		x	
Total Phenols	EPA 420.1		x	
Total Phenols	EPA 420.4	x	x	x
Total Phosphorous	SM 4500 P E		x	
Turbidity	EPA 180.1	x	x	x
Turbidity	SM 2130B	x	x	
Uranium by ICP/MS	EPA 200.8	x		x
UV 254	SM 5910B	x		
VOC	EPA 524.2/EPA 524.3	x		x
VOC	EPA 624		x	x
VOC	EPA SW 846 8260	x		x
VOC	In House Method (2411)	x		x
Yeast and Mold	SM 9610	x		x

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Acknowledgement of Samples Received

Addr: **State of Hawaii DOH**
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attn: Joanna Seto
Phone: 808-586-4258

Client ID: HAWAII-DOH
Folder #: 689521
Project: PPCP-HAWAII
Sample Group: Maui

Project Manager: Rick Zimmer
Phone: 626-386-1157

The following samples were received from you on **September 28, 2017** at **1217**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical, Inc..

Sample #	Sample ID	Sample Date
201709280362	Pukalani Golf Course Well	09/20/2017 0830
	Static ID: 092017-H031	
	@DX_ABI_NEG @DX_ABI_POS	

Test Description

@DX_ABI_NEG -- Endocrine Disruptors Negative Mode - SPE

@DX_ABI_POS -- Endocrine Disruptors Positive Mode - SPE

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CHAIN OF CUSTODY RECORD

GG9521

750 Royal Oaks Drive, Suite 100
Monrovia, CA 91016-3629

Phone: 626 386 1100
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY:

LOGIN COMMENTS: _____ SAMPLES CHECKED AGAINST COC BY: _____

SAMPLES LOGGED IN BY: _____

SAMPLE TEMP RECEIVED AT: SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

☐ _____ (Other) IR Gun ID = _____ (Observation= _____ °C) (Corr.Factor _____ °C) (Final = _____ °C)

☑ Monrovia IR Gun ID = 510A (Observation= 4.4 °C) (Corr.Factor +0.2 °C) (Final = 4.6 °C)

Compliance Acceptance Criteria: (Chemistry: 4 ± 2 °C) (Microbiology: < 10°C)

TYPE OF ICE: Real ____ Synthetic ____ ✓ No Ice ____ CONDITION OF ICE: Frozen ✓ Partially Frozen ____ Thawed ____ N/A ____

METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: _____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME:	PROJECT CODE:	COMPLIANCE SAMPLES (check for yes) ☐	NON-COMPLIANCE SAMPLES (check for yes) X
HI DEPT OF HEALTH - SAFE DRINKING WATER BRANCH	PPCP-HAWAII	- Requires state forms ☐	REGULATION INVOLVED:
EEA CLIENT CODE: HAWAII-DOH / COC ID:	SAMPLE GROUP: Baseline	Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION	(eg. SDWA, NPDES, etc.)
TAT requested: rush by adv notice only STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___		SEE ATTACHED KIT ORDER FOR ANALYSES X (check for yes), OR	
		List ALL ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)	

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA	PPCP	SAMPLER COMMENTS
9/20/17	8:30	PUKALANI GC WELL GROUNDWATER 092017-H031		GW			2	SAMPLE STORED IN SDWB MONITORING SECTION REFRIGERATED LOCKED STORAGE ROOM UNTIL PACK FOR FEDEX SHIPMENT ON 9/27/17.
		pH- 7.73						
		TEMP- 24.2						
		COND- 2.09 mS						
		TDS - 1.48 ppt						
		SALINITY - 1.03 ppt						
		TURBIDITY - 0.20 NTU						

* **MATRIX TYPES:** **RSW** = Raw Surface Water; **RGW** = Raw Ground Water; **CFW** = Chlor(am)inated Finished Water; **FW** = Other Finished Water; **SEAW** = Sea Water; **WW** = Waste Water; **BW** = Bottled Water; **SW** = Storm Water; **SO** = Soil; **SL** = Sludge; **O** = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	Daniel Chang	DANIEL CHANG	HI DEPT OF HEALTH - SAFE DRINKNG WATER	9/20/17	8:30AM
RELINQUISHED BY:	Daniel Chang	DANIEL CHANG	HI DOH - SAFE DRINKING WATER	9/20/17	4:00PM
RECEIVED BY:		Vivint Plasencia	EEA	9/26/17	7:17
RELINQUISHED BY:					
RECEIVED BY:					

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Kit Order for State of Hawaii DOH

Rick Zimmer is your Eurofins Eaton Analytical, Inc. Service Manager

750 Royal Oaks Drive, Suite 100
Monrovia, California 91016-3629
(626) 386-1100 FAX (866) 988-3757

Note: Sampler Please return this paper with your samples

Kit #: 179322

Created By: Rick Zimmer - [RCZ]
Deliver By: 09/01/2017
STG: Bottle Orders
Ice Type: W

Client ID: HAWAII-DOH
Project Code: PPCP-HAWAII Bottle Orders
Group Name: Baseline
PO#/JOB#:

Ship Sample Kits to
State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Pearl City, HI 96782

Attn: Daniel Chang
Phone: 808-586-4258
Fax: 808-586-4351

Send Report to
State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Pearl City, HI 96782

Attn: Joanna Seto
Phone: 808-586-4258
Fax: 808-586-4351

Billing Address
State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Pearl City, HI 96782

Attn: Alan Dillon
Phone: 808-586-4258
Fax: 808-586-4351

# of Samples	Tests	Bottle Qty - Type [preservative information]	UN DOT #
40	@DX_ABI_NEG, @DX_ABI_POS	2 - 40ml amber glass vial [2.56 mg NaOmadine + 5 mg Ascorbic Acid]	

Comments

LABEL COOLERS "PPCP"
INCLUDE AT LEAST 9 ICE PACKS IN EACH 48 QT COOLER
10 SETS PER COOLER
4 COOLERS TOTAL

Code	Status	Date Shipped	Via	Tracking #	# of Coolers	Prepared By

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Laboratory Hits

Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/28/2017 1217

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201709280362	**Pukalani Golf Course Well**				
10/01/2017 12:59	4-nonylphenol - semi quantitative		460		ng/L	100
10/10/2017 2:29	Acesulfame-K		30		ng/L	20
10/10/2017 02:29	Amoxicillin (semi-quantitative)		300		ng/L	20
10/10/2017 2:29	Chloridazon		13		ng/L	5
10/10/2017 2:29	Sulfamethoxazole		11		ng/L	5
10/10/2017 2:29	Sulfathiazole		30		ng/L	5

SUMMARY OF POSITIVE DATA ONLY

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Laboratory Data

Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/28/2017 1217

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
Pukalani Golf Course Well (201709280362)							**Sampled on 09/20/2017 0830**			
	Static ID: 092017-H031									
	LC-MS-MS - Endocrine Disruptors Positive Mode - SPE									
	10/10/17 2:29		1034800	(LC-MS-MS)	1,7-Dimethylxanthine	b D	ng/L	3N4	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Acetaminophen	b D	ng/L	3N0	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Alquterol	b D	ng/L	2N4	5	1
	10/10/17 02:29		1034800	(LC-MS-MS)	Amoxicillin (semi-. uantitative)	300	ng/L	6N4	20	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Andorostenedione	b D	ng/L	1N7	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Atenolol	b D	ng/L	3N9	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Atrazine	b D	ng/L	2N3	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Bezafiqrate	b D	ng/L	3N5	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Bromacil	b D	ng/L	3N2	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Caffeine	b D	ng/L	4N3	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Carqadox	b D	ng/L	4N2	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Carqamazepine	b D	ng/L	1N2	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Carisoprodol	b D	ng/L	1N2	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Chloridazon	13	ng/L	1N6	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Chlorotoluron	b D	ng/L	0N89	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Cimetidine (semi . uantitative)	b D	ng/L	2N7	5	1
	09/29/17 23:41		1031368	(LC-MS-MS)	Ciprofloxacin - Cipro	b D	ng/L	20	100	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Cotinine	b D	ng/L	4N8	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Cyanazine	b D	ng/L	1N7	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	DACT	b D	ng/L	3N9	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	DEA	b D	ng/L	1N5	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	DEET	b D	ng/L	1N1	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Dehydronifedipine	b D	ng/L	1N4	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	DIA	b D	ng/L	2N4	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Diazepam	b D	ng/L	2N1	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Dilantin	b D	ng/L	13	20	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Diltiazem	b D	ng/L	3N0	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Diuron	b D	ng/L	1N8	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Erythromycin	b D	ng/L	4N0	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Flume. ine	b D	ng/L	7N1	10	1

Rounding on totals after summationN
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Laboratory Data

Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/28/2017 1217

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/10/17 2:29		1034800	(LC-MS-MS)	Fluoxetine	b D	ng/L	10	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Isoproturon	b D	ng/L	12	100	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Ketoprofen	b D	ng/L	2N6	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Ketorolac	b D	ng/L	2N1	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Lidocaine	b D	ng/L	1N1	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Lincomycin	b D	ng/L	1N7	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Linuron	b D	ng/L	2N8	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Lopressor	b D	ng/L	5N1	20	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Meclofenamic Acid	b D	ng/L	4N7	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Meproqamate	b D	ng/L	2N0	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Metazachlor	b D	ng/L	1N3	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Metolachlor	b D	ng/L	3N1	5	1
	10/10/17 02:29		1034800	(LC-MS-MS)	b ifedipine (semi . uantitative)	b D	ng/L	12	20	1
	10/10/17 2:29		1034800	(LC-MS-MS)	b orethisterone	b D	ng/L	2N3	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Oxolinic acid	b D	ng/L	2N5	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Pentoxifylline	b D	ng/L	1N5	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Phenazone	b D	ng/L	5N0	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Primidone	b D	ng/L	4N8	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Progesterone	b D	ng/L	2N9	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Propazine	b D	ng/L	1N8	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Quinoline	b D	ng/L	2N5	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Simazine	b D	ng/L	1N2	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Sulfachloropyridazine	b D	ng/L	2N1	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Sulfadiazine	b D	ng/L	3N9	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Sulfadimethoxine	b D	ng/L	1N6	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Sulfamerazine	b D	ng/L	4N6	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Sulfamethazine	b D	ng/L	1N5	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Sulfamethizole	b D	ng/L	3N2	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Sulfamethoxazole	11	ng/L	2N8	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Sulfathiazole	30	ng/L	2N4	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	TCEP	b D	ng/L	3N2	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	TCPP	b D	ng/L	20	100	1
	10/10/17 2:29		1034800	(LC-MS-MS)	TDCPP	b D	ng/L	20	100	1

Rounding on totals after summationN
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Samples Received on:
09/28/2017 1217

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/10/17 2:29		1034800	(LC-MS-MS)	Testosterone	b D	ng/L	2N5	5	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Theoqromine	b D	ng/L	3N2	10	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Theophylline (semi-. uantitative)	b D	ng/L	4N8	20	1
	10/10/17 2:29		1034800	(LC-MS-MS)	Trimethoprim	b D	ng/L	1N8	5	1
				LC-MS-MS - Endocrine Disruptors Negative Mode - SPE						
	10/10/17 2:29		1034755	(LC-MS-MS)	2,4-D	b D	ng/L	5N0	5	1
	10/01/17 12:59		1038517	(LC-MS-MS)	4-nonylphenol - semi . uantitative	460	ng/L	50	100	1
	10/10/17 2:29		1034755	(LC-MS-MS)	4-tert-Octylphenol	b D	ng/L	6N9	50	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Acesulfame-K	30	ng/L	20	20	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Bendroflumethiazide	b D	ng/L	4N4	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	BPA	b D	ng/L	7N2	10	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Butalqital	b D	ng/L	2N9	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Butylparaqen	b D	ng/L	3N3	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Chloramphenicol	b D	ng/L	3N1	10	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Clofiqric Acid	b D	ng/L	5N0	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Diclofenac	b D	ng/L	3N3	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Estradiol	b D	ng/L	4N4	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Estrone	b D	ng/L	3N9	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Ethinyl Estradiol - 17 alpha	b D	ng/L	3N3	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Ethylparaqen	b D	ng/L	11	20	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Gemfiqrozil	b D	ng/L	2N5	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Iquprofen	b D	ng/L	8N6	10	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Iohexal	b D	ng/L	7N7	10	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Iopromide	b D (R6)	ng/L	1N6	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Isoqutylparaqen	b D	ng/L	4N2	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Lipitor (Atorvastatin)	b D (L5, LE)	ng/L	50	100	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Methylparaqen	b D	ng/L	11	20	1
	10/10/17 2:29		1034755	(LC-MS-MS)	b aproxen	b D	ng/L	8N5	10	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Propylparaqen	b D	ng/L	2N9	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Salicylic Acid	b D	ng/L	50	100	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Sucralose	b D	ng/L	42	100	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Triclocarqan	b D	ng/L	2N5	5	1
	10/10/17 2:29		1034755	(LC-MS-MS)	Triclosan	b D	ng/L	6N3	10	1

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Group: Maui

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Samples Received on:
09/28/2017 1217

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/10/17 2:29		1034755	(LC-MS-MS)	Warfarin	b D	ng/L	4N	5	1

Rounding on totals after summationN
(c) - Indicates calculated resultsN
b D - Analyte was not detected at the calculated MDLN
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Laboratory Comments

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Folder Comments

Sample results at . oth the MDL and MRL are included in this report to indicate estimated concentrations for samples . elow the MRLv

Lipitor LCS and MRL Check recobery was high and Iopromide RPD calculation was also highvHoweber, data for . oth compounds is accepta. le . ased on non-detect results and other passing QCv

Flags Legend:

L5 - The associated . lank spike recobery was a. obe la. oratory/method acceptance limitsv This analyte was not detected in the samplev

R6 - LFB/LFBD RPD exceeded the method acceptance limitvRecobery met acceptance criteriav

The Comments Report may be blank if there are no comments for this report.

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Laboratory QC Summary

Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 703738N **Analysis Date: 09/29/2071**

201709280362 Pukalani Golf Course Well Analyzed by: ALI

Endocrine Disruptors ge5ative Mode - SPE

Analytical Batch: 7036144 **Analysis Date: 70/70/2071**

201709280362 Pukalani Golf Course Well Analyzed by: ARH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 7036N00 **Analysis Date: 70/70/2071**

201709280362 Pukalani Golf Course Well Analyzed by: ARH

Endocrine Disruptors ge5ative Mode - SPE

Analytical Batch: 703N471 **Analysis Date: 70/07/2071**

201709280362 Pukalani Golf Course Well Analyzed by: ARH

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Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Endocrine Disruptors Positive Mode - SPE by LC-MS-MS									
Analytical Batch: 7037384							**Analysis Date: 09/29/2071**		
LCS1	Ciprofloxacin - Cipro		2000	2650	ng/L	133	(40-160)		
LCS2	Ciprofloxacin - Cipro		2000	2600	ng/L	130	(40-160)	30	1.5
MBLK	Ciprofloxacin - Cipro			<100	ng/L				
MRL_CHK	Ciprofloxacin - Cipro		100	147	ng/L	147	(50-150)		
MS_201709280297	Ciprofloxacin - Cipro	250	2000	1700	ng/L	72	(40-160)		
MSD_201709280297	Ciprofloxacin - Cipro	250	2000	1580	ng/L	67	(40-160)	60	7.3
Endocrine Disruptors Negative Mode - SPE by LC-MS-MS									
Analytical Batch: 7035166							**Analysis Date: 70/09/2071**		
LCS1	2,4-D		100	99.8	ng/L	100	(60-140)		
LCS2	2,4-D		100	103	ng/L	103	(60-140)	40	3.2
MBLK	2,4-D			<5	ng/L				
MRL_CHK	2,4-D		5	3.57	ng/L	71	(50-150)		
MS_201709280361	2,4-D	ND	200	231	ng/L	115	(60-140)		
MSD_201709280361	2,4-D	ND	200	223	ng/L	111	(60-140)	40	3.5
LCS1	4-tert-octylphenol		100	95.4	ng/L	95	(60-140)		
LCS2	4-tert-octylphenol		100	89.2	ng/L	89	(60-140)	40	6.7
MBLK	4-tert-octylphenol			<100	ng/L				
MS_201709280361	4-tert-octylphenol	ND	200	196	ng/L	98	(60-140)		
MSD_201709280361	4-tert-octylphenol	ND	200	201	ng/L	101	(60-140)	40	2.5
LCS1	Acesulfame-K		400	411	ng/L	103	(60-140)		
LCS2	Acesulfame-K		400	394	ng/L	99	(60-140)	40	4.2
MBLK	Acesulfame-K			<20	ng/L				
MRL_CHK	Acesulfame-K		20	11.5	ng/L	58	(50-150)		
MS_201709280361	Acesulfame-K	ND	800	877	ng/L	110	(60-140)		
MSD_201709280361	Acesulfame-K	ND	800	816	ng/L	102	(60-140)	40	7.2
LCS1	Bendroflumethiaqide		100	96.8	ng/L	97	(60-140)		
LCS2	Bendroflumethiaqide		100	100	ng/L	101	(60-140)	40	4.1
MBLK	Bendroflumethiaqide			<5	ng/L				
MRL_CHK	Bendroflumethiaqide		5	3.08	ng/L	62	(50-150)		
MS_201709280361	Bendroflumethiaqide	ND	200	167	ng/L	83	(60-140)		
MSD_201709280361	Bendroflumethiaqide	ND	200	172	ng/L	86	(60-140)	40	3.0
LCS1	BPA		100	106	ng/L	106	(60-140)		
LCS2	BPA		100	103	ng/L	103	(60-140)	40	2.9
MBLK	BPA			<10	ng/L				

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted zy Underlining.
Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	BPA		5	4.34	ng/L	87	(50-150)		
MS_201709280361	BPA	ND	200	211	ng/L	106	(60-140)		
MSD_201709280361	BPA	ND	200	201	ng/L	100	(60-140)	40	4.8
LCS1	Butalzital		100	102	ng/L	102	(60-140)		
LCS2	Butalzital		100	90.3	ng/L	90	(60-140)	40	12
MBLK	Butalzital			<5	ng/L				
MRL_CHK	Butalzital		5	6.89	ng/L	138	(50-150)		
MS_201709280361	Butalzital	ND	200	172	ng/L	86	(60-140)		
MSD_201709280361	Butalzital	ND	200	166	ng/L	83	(60-140)	40	3.5
LCS1	Butylparzen		100	99.1	ng/L	99	(60-140)		
LCS2	Butylparzen		100	102	ng/L	102	(60-140)	40	2.9
MBLK	Butylparzen			<5	ng/L				
MRL_CHK	Butylparzen		5	2.99	ng/L	60	(50-150)		
MS_201709280361	Butylparzen	ND	200	230	ng/L	115	(60-140)		
MSD_201709280361	Butylparzen	ND	200	224	ng/L	112	(60-140)	40	2.6
LCS1	Chloramphenicol		100	97.3	ng/L	97	(60-140)		
LCS2	Chloramphenicol		100	82.6	ng/L	83	(60-140)	40	16
MBLK	Chloramphenicol			<10	ng/L				
MRL_CHK	Chloramphenicol		5	3.00	ng/L	60	(50-150)		
MS_201709280361	Chloramphenicol	ND	200	152	ng/L	76	(60-140)		
MSD_201709280361	Chloramphenicol	ND	200	147	ng/L	73	(60-140)	40	3.3
LCS1	Clofizric Acid		100	101	ng/L	101	(60-140)		
LCS2	Clofizric Acid		100	104	ng/L	104	(60-140)	40	2.9
MBLK	Clofizric Acid			<5	ng/L				
MRL_CHK	Clofizric Acid		5	2.72	ng/L	55	(50-150)		
MS_201709280361	Clofizric Acid	ND	200	247	ng/L	123	(60-140)		
MSD_201709280361	Clofizric Acid	ND	200	233	ng/L	117	(60-140)	40	5.8
LCS1	Diclofenac		100	103	ng/L	103	(60-140)		
LCS2	Diclofenac		100	113	ng/L	113	(60-140)	40	9.3
MBLK	Diclofenac			<5	ng/L				
MRL_CHK	Diclofenac		5	2.82	ng/L	56	(50-150)		
MS_201709280361	Diclofenac	ND	200	233	ng/L	116	(60-140)		
MSD_201709280361	Diclofenac	ND	200	233	ng/L	116	(60-140)	40	0.0
LCS1	bstradiol		100	101	ng/L	101	(60-140)		
LCS2	bstradiol		100	96.7	ng/L	97	(60-140)	40	4.3
MBLK	bstradiol			<5	ng/L				
MRL_CHK	bstradiol		5	6.83	ng/L	137	(50-150)		
MS_201709280361	bstradiol	ND	200	189	ng/L	93	(60-140)		

Spike recovery is already corrected for native results.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709280361	bstradiol	ND	200	194	ng/L	96	(60-140)	40	2.6
LCS1	bstrone		100	91.6	ng/L	92	(60-140)		
LCS2	bstrone		100	98.7	ng/L	99	(60-140)	40	7.3
MBLK	bstrone			<5	ng/L				
MRL_CHK	bstrone		5	4.34	ng/L	87	(50-150)		
MS_201709280361	bstrone	ND	200	187	ng/L	92	(60-140)		
MSD_201709280361	bstrone	ND	200	189	ng/L	93	(60-140)	40	1.1
LCS1	bthinyl bstradiol - 17 alpha		100	106	ng/L	107	(60-140)		
LCS2	bthinyl bstradiol - 17 alpha		100	100	ng/L	100	(60-140)	40	6.8
MBLK	bthinyl bstradiol - 17 alpha			<5	ng/L				
MRL_CHK	bthinyl bstradiol - 17 alpha		5	4.89	ng/L	98	(50-150)		
MS_201709280361	bthinyl bstradiol - 17 alpha	ND	200	252	ng/L	126	(60-140)		
MSD_201709280361	bthinyl bstradiol - 17 alpha	ND	200	165	ng/L	82	(60-140)	40	**52**
LCS1	bthylparazen		400	401	ng/L	100	(60-140)		
LCS2	bthylparazen		400	430	ng/L	108	(60-140)	40	7.0
MBLK	bthylparazen			<20	ng/L				
MRL_CHK	bthylparazen		20	12.6	ng/L	63	(50-150)		
MS_201709280361	bthylparazen	ND	800	1020	ng/L	128	(60-140)		
MSD_201709280361	bthylparazen	ND	800	1000	ng/L	125	(60-140)	40	2.0
LCS1	Eemfizroqil		100	115	ng/L	115	(60-140)		
LCS2	Eemfizroqil		100	123	ng/L	123	(60-140)	40	6.7
MBLK	Eemfizroqil			<5	ng/L				
MRL_CHK	Eemfizroqil		5	5.72	ng/L	114	(50-150)		
MS_201709280361	Eemfizroqil	ND	200	304	ng/L	**767**	(60-140)		
MSD_201709280361	Eemfizroqil	ND	200	312	ng/L	**766**	(60-140)	40	2.6
LCS1	Izuprofen		200	192	ng/L	96	(60-140)		
LCS2	Izuprofen		200	203	ng/L	102	(60-140)	40	5.6
MBLK	Izuprofen			<15	ng/L				
MRL_CHK	Izuprofen		10	7.89	ng/L	79	(50-150)		
MS_201709280361	Izuprofen	ND	400	427	ng/L	107	(60-140)		
MSD_201709280361	Izuprofen	ND	400	421	ng/L	105	(60-140)	40	1.4
LCS1	Iohexal		200	193	ng/L	97	(60-140)		
LCS2	Iohexal		200	192	ng/L	96	(60-140)	40	0.52
MBLK	Iohexal			<10	ng/L				
MRL_CHK	Iohexal		10	7.26	ng/L	73	(50-150)		
MS_201709280361	Iohexal	ND	400	60.1	ng/L	**76**	(50-150)		
MSD_201709280361	Iohexal	ND	400	240	ng/L	60	(50-150)	50	**720**
LCS1	Iopromide		100	90.3	ng/L	90	(60-140)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted zy Underlining.
Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Iopromide		100	138	ng/L	139	(60-140)	40	**53**
MBLK	Iopromide			<5	ng/L				
MRL_CHK	Iopromide		5	2.57	ng/L	51	(50-150)		
MS_201709280361	Iopromide	ND	200	257	ng/L	128	(50-150)		
MSD_201709280361	Iopromide	ND	200	222	ng/L	111	(50-150)	50	15
LCS1	Isozutylparazen		100	99.1	ng/L	99	(60-140)		
LCS2	Isozutylparazen		100	102	ng/L	102	(60-140)	40	2.9
MBLK	Isozutylparazen			<5	ng/L				
MRL_CHK	Isozutylparazen		5	2.99	ng/L	60	(50-150)		
MS_201709280361	Isozutylparazen	ND	200	230	ng/L	115	(60-140)		
MSD_201709280361	Isozutylparazen	ND	200	224	ng/L	112	(60-140)	40	2.6
LCS1	Lipitor (Atorvastain)		100	154	ng/L	**765**	(60-140)		
LCS2	Lipitor (Atorvastain)		100	160	ng/L	**780**	(60-140)	40	3.8
MBLK	Lipitor (Atorvastain)			<5	ng/L				
MRL_CHK	Lipitor (Atorvastain)		5	8.90	ng/L	**714**	(50-150)		
MS_201709280361	Lipitor (Atorvastain)	ND	200	82.4	ng/L	**57**	(60-140)		
MSD_201709280361	Lipitor (Atorvastain)	ND	200	115	ng/L	**64**	(60-140)	40	33
LCS1	Methylparazen		400	410	ng/L	103	(60-140)		
LCS2	Methylparazen		400	440	ng/L	110	(60-140)	40	7.1
MBLK	Methylparazen			<20	ng/L				
MRL_CHK	Methylparazen		20	13.2	ng/L	66	(50-150)		
MS_201709280361	Methylparazen	ND	800	916	ng/L	115	(60-140)		
MSD_201709280361	Methylparazen	ND	800	895	ng/L	112	(60-140)	40	2.3
LCS1	Naproxen		200	194	ng/L	97	(60-140)		
LCS2	Naproxen		200	205	ng/L	103	(60-140)	40	5.5
MBLK	Naproxen			<10	ng/L				
MRL_CHK	Naproxen		10	6.83	ng/L	68	(50-150)		
MS_201709280361	Naproxen	ND	400	392	ng/L	98	(60-140)		
MSD_201709280361	Naproxen	ND	400	402	ng/L	101	(60-140)	40	2.5
LCS1	Propylparazen		100	107	ng/L	107	(60-140)		
LCS2	Propylparazen		100	112	ng/L	112	(60-140)	40	4.6
MBLK	Propylparazen			<5	ng/L				
MRL_CHK	Propylparazen		5	2.66	ng/L	53	(50-150)		
MS_201709280361	Propylparazen	ND	200	252	ng/L	126	(60-140)		
MSD_201709280361	Propylparazen	ND	200	242	ng/L	121	(60-140)	40	4.0
LCS1	Salicylic Acid		2000	2030	ng/L	101	(60-140)		
LCS2	Salicylic Acid		2000	2130	ng/L	106	(60-140)	40	4.8
MBLK	Salicylic Acid			<100	ng/L				

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted zy Underlining.
Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Salicylic Acid		100	125	ng/L	125	(50-150)		
MS_201709280361	Salicylic Acid	ND	4000	3760	ng/L	94	(60-140)		
MSD_201709280361	Salicylic Acid	ND	4000	3470	ng/L	87	(60-140)	40	8.0
LCS1	Sucralose		2000	2730	ng/L	136	(60-140)		
LCS2	Sucralose		2000	2700	ng/L	135	(60-140)	40	1.1
MBLK	Sucralose			<100	ng/L				
MRL_CHK	Sucralose		100	135	ng/L	135	(50-150)		
MS_201709280361	Sucralose	ND	4000	9570	ng/L	**239**	(60-140)		
MSD_201709280361	Sucralose	ND	4000	8110	ng/L	**203**	(60-140)	40	17
LCS1	Triclocarzan		100	94.1	ng/L	94	(60-140)		
LCS2	Triclocarzan		100	120	ng/L	120	(60-140)	40	24
MBLK	Triclocarzan			<5	ng/L				
MRL_CHK	Triclocarzan		5	4.93	ng/L	99	(50-150)		
MS_201709280361	Triclocarzan	ND	200	276	ng/L	138	(60-140)		
MSD_201709280361	Triclocarzan	ND	200	342	ng/L	**717**	(60-140)	40	21
LCS1	Triclosan		200	216	ng/L	108	(60-140)		
LCS2	Triclosan		200	204	ng/L	102	(60-140)	40	5.7
MBLK	Triclosan			<10	ng/L				
MRL_CHK	Triclosan		10	7.07	ng/L	71	(50-150)		
MS_201709280361	Triclosan	ND	400	360	ng/L	90	(60-140)		
MSD_201709280361	Triclosan	ND	400	364	ng/L	91	(60-140)	40	1.1
LCS1	Warfarin		100	93.0	ng/L	93	(60-140)		
LCS2	Warfarin		100	101	ng/L	101	(60-140)	40	8.3
MBLK	Warfarin			<5	ng/L				
MRL_CHK	Warfarin		5	2.57	ng/L	51	(50-150)		
MS_201709280361	Warfarin	ND	200	325	ng/L	**782**	(60-140)		
MSD_201709280361	Warfarin	ND	200	286	ng/L	**753**	(60-140)	40	13

Endocrine Disruptors Positive Mode - SPE by LC-MS-MS

Analytical Batch: 7035400 **Analysis Date: 07/70/2071**

LCS1	1,7-Dimethylxanthine		100	86.1	ng/L	86	(60-140)		
LCS2	1,7-Dimethylxanthine		100	96.9	ng/L	97	(60-140)	30	12
MBLK	1,7-Dimethylxanthine			<5	ng/L				
MRL_CHK	1,7-Dimethylxanthine		5	4.44	ng/L	89	(50-150)		
MS_201709280361	1,7-Dimethylxanthine	ND	200	133	ng/L	67	(60-140)		
MSD_201709280361	1,7-Dimethylxanthine	ND	200	123	ng/L	61	(60-140)	40	7.8
LCS1	Acetaminophen		100	99.4	ng/L	99	(60-140)		
LCS2	Acetaminophen		100	96.3	ng/L	96	(60-140)	30	3.2

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Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Acetaminophen			<5	ng/L				
MRL_CHK	Acetaminophen		5	2.86	ng/L	57	(50-150)		
MS_201709280361	Acetaminophen	ND	200	174	ng/L	87	(60-140)		
MSD_201709280361	Acetaminophen	ND	200	180	ng/L	90	(60-140)	40	3.4
LCS1	Alzuterol		100	97.7	ng/L	98	(60-140)		
LCS2	Alzuterol		100	115	ng/L	115	(60-140)	30	16
MBLK	Alzuterol			<5	ng/L				
MRL_CHK	Alzuterol		5	2.50	ng/L	50	(50-150)		
MS_201709280361	Alzuterol	ND	200	181	ng/L	90	(60-140)		
MSD_201709280361	Alzuterol	ND	200	133	ng/L	67	(60-140)	40	31
LCS1	Amoxicillin (semi-Quantitative)		400	395	ng/L	99	(60-140)		
LCS2	Amoxicillin (semi-Quantitative)		400	362	ng/L	90	(60-140)	30	8.7
MBLK	Amoxicillin (semi-Quantitative)			<20	ng/L				
MRL_CHK	Amoxicillin (semi-Quantitative)		20	22.1	ng/L	111	(50-150)		
LCS1	Andorostenedione		100	91.5	ng/L	92	(60-140)		
LCS2	Andorostenedione		100	107	ng/L	107	(60-140)	30	16
MBLK	Andorostenedione			<5	ng/L				
MRL_CHK	Andorostenedione		5	2.60	ng/L	52	(50-150)		
MS_201709280361	Andorostenedione	ND	200	259	ng/L	130	(60-140)		
MSD_201709280361	Andorostenedione	ND	200	231	ng/L	115	(60-140)	40	11
LCS1	Atenolol		100	91.8	ng/L	92	(60-140)		
LCS2	Atenolol		100	94.6	ng/L	95	(60-140)	30	3.0
MBLK	Atenolol			<5	ng/L				
MRL_CHK	Atenolol		5	2.99	ng/L	60	(50-150)		
MS_201709280361	Atenolol	ND	200	237	ng/L	118	(60-140)		
MSD_201709280361	Atenolol	ND	200	233	ng/L	116	(60-140)	40	1.7
LCS1	Atraqine		100	98.0	ng/L	98	(60-140)		
LCS2	Atraqine		100	105	ng/L	105	(60-140)	30	6.9
MBLK	Atraqine			<5	ng/L				
MRL_CHK	Atraqine		5	3.25	ng/L	65	(50-150)		
MS_201709280361	Atraqine	ND	200	137	ng/L	69	(60-140)		
MSD_201709280361	Atraqine	ND	200	140	ng/L	70	(60-140)	40	2.2
LCS1	Beqafizrate		100	102	ng/L	102	(60-140)		
LCS2	Beqafizrate		100	116	ng/L	116	(60-140)	30	13
MBLK	Beqafizrate			<5	ng/L				
MRL_CHK	Beqafizrate		5	3.02	ng/L	60	(50-150)		
MS_201709280361	Beqafizrate	ND	200	289	ng/L	**755**	(60-140)		
MSD_201709280361	Beqafizrate	ND	200	285	ng/L	**753**	(60-140)	40	1.4

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Bromacil		100	104	ng/L	105	(60-140)		
LCS2	Bromacil		100	116	ng/L	116	(60-140)	30	9.9
MBLK	Bromacil			<5	ng/L				
MRL_CHK	Bromacil		5	3.01	ng/L	60	(50-150)		
MS_201709280361	Bromacil	ND	200	224	ng/L	112	(60-140)		
MSD_201709280361	Bromacil	ND	200	215	ng/L	107	(60-140)	40	4.1
LCS1	Caffeine		100	99.1	ng/L	99	(60-140)		
LCS2	Caffeine		100	68.5	ng/L	69	(60-140)	30	**31**
MBLK	Caffeine			<5	ng/L				
MRL_CHK	Caffeine		5	4.93	ng/L	99	(50-150)		
MS_201709280361	Caffeine	ND	200	27.3	ng/L	**75**	(60-140)		
MSD_201709280361	Caffeine	ND	200	27.3	ng/L	**75**	(60-140)	40	0.0
LCS1	Carzadox		100	97.3	ng/L	97	(60-140)		
LCS2	Carzadox		100	107	ng/L	107	(60-140)	30	9.5
MBLK	Carzadox			<5	ng/L				
MRL_CHK	Carzadox		5	3.18	ng/L	64	(50-150)		
MS_201709280361	Carzadox	ND	200	248	ng/L	123	(60-140)		
MSD_201709280361	Carzadox	ND	200	221	ng/L	109	(60-140)	40	12
LCS1	Carzamaqepine		100	113	ng/L	113	(60-140)		
LCS2	Carzamaqepine		100	101	ng/L	101	(60-140)	30	11
MBLK	Carzamaqepine			<5	ng/L				
MRL_CHK	Carzamaqepine		5	3.47	ng/L	69	(50-150)		
MS_201709280361	Carzamaqepine	ND	200	186	ng/L	93	(60-140)		
MSD_201709280361	Carzamaqepine	ND	200	199	ng/L	100	(60-140)	40	6.8
LCS1	Carisoprodol		100	102	ng/L	102	(60-140)		
LCS2	Carisoprodol		100	97.5	ng/L	98	(60-140)	30	4.5
MBLK	Carisoprodol			<5	ng/L				
MRL_CHK	Carisoprodol		5	4.10	ng/L	82	(50-150)		
MS_201709280361	Carisoprodol	ND	200	322	ng/L	**787**	(60-140)		
MSD_201709280361	Carisoprodol	ND	200	330	ng/L	**786**	(60-140)	40	2.5
LCS1	Chloridaqon		100	102	ng/L	102	(60-140)		
LCS2	Chloridaqon		100	98.6	ng/L	99	(60-140)	30	3.4
MBLK	Chloridaqon			<5	ng/L				
MRL_CHK	Chloridaqon		5	3.13	ng/L	63	(50-150)		
MS_201709280361	Chloridaqon	24	200	156	ng/L	66	(60-140)		
MSD_201709280361	Chloridaqon	24	200	164	ng/L	70	(60-140)	40	5.0
LCS1	Chlorotoluron		100	105	ng/L	105	(60-140)		
LCS2	Chlorotoluron		100	119	ng/L	119	(60-140)	30	13

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Chlorotoluron			<5	ng/L				
MRL_CHK	Chlorotoluron		5	3.21	ng/L	64	(50-150)		
MS_201709280361	Chlorotoluron	ND	200	231	ng/L	115	(60-140)		
MSD_201709280361	Chlorotoluron	ND	200	232	ng/L	116	(60-140)	40	0.43
LCS1	Cimetidine		100	94.2	ng/L	94	(60-140)		
LCS2	Cimetidine		100	97.4	ng/L	97	(60-140)	30	3.3
MBLK	Cimetidine			<5	ng/L				
MRL_CHK	Cimetidine		5	5.54	ng/L	111	(50-150)		
MS_201709280361	Cimetidine	ND	200	0	ng/L	**0**	(60-140)		
MSD_201709280361	Cimetidine	ND	200	0	ng/L	**0**	(60-140)	40	**7000**
LCS1	Cotinine		200	208	ng/L	104	(60-140)		
LCS2	Cotinine		200	205	ng/L	102	(60-140)	30	1.5
MBLK	Cotinine			<10	ng/L				
MRL_CHK	Cotinine		10	6.04	ng/L	61	(50-150)		
MS_201709280361	Cotinine	ND	400	390	ng/L	98	(60-140)		
MSD_201709280361	Cotinine	ND	400	345	ng/L	86	(60-140)	40	12
LCS1	Cyanaqine		100	108	ng/L	109	(60-140)		
LCS2	Cyanaqine		100	106	ng/L	106	(60-140)	30	2.8
MBLK	Cyanaqine			<5	ng/L				
MRL_CHK	Cyanaqine		5	3.76	ng/L	75	(50-150)		
MS_201709280361	Cyanaqine	ND	200	340	ng/L	**710**	(60-140)		
MSD_201709280361	Cyanaqine	ND	200	324	ng/L	**782**	(60-140)	40	4.8
LCS1	DACT		100	98.9	ng/L	99	(60-140)		
LCS2	DACT		100	89.4	ng/L	89	(60-140)	30	10
MBLK	DACT			<5	ng/L				
MRL_CHK	DACT		5	3.94	ng/L	79	(50-150)		
MS_201709280361	DACT	ND	200	132	ng/L	66	(60-140)		
MSD_201709280361	DACT	ND	200	126	ng/L	63	(60-140)	40	4.7
LCS1	DbA		100	106	ng/L	106	(60-140)		
LCS2	DbA		100	108	ng/L	108	(60-140)	30	1.9
MBLK	DbA			<5	ng/L				
MRL_CHK	DbA		5	2.82	ng/L	56	(50-150)		
MS_201709280361	DbA	ND	200	195	ng/L	98	(60-140)		
MSD_201709280361	DbA	ND	200	173	ng/L	87	(60-140)	40	12
LCS1	DbbT		40	38.5	ng/L	96	(60-140)		
LCS2	DbbT		40	36.0	ng/L	90	(60-140)	30	6.4
MBLK	DbbT			<10	ng/L				
MRL_CHK	DbbT		2	1.43	ng/L	71	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted zy Underlining.
Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709280361	DbbT	ND	80	79.8	ng/L	100	(60-140)		
MSD_201709280361	DbbT	ND	80	72.3	ng/L	90	(60-140)	40	9.9
LCS1	Dehydronifedipine		100	112	ng/L	113	(60-140)		
LCS2	Dehydronifedipine		100	109	ng/L	109	(60-140)	30	3.6
MBLK	Dehydronifedipine			<5	ng/L				
MRL_CHK	Dehydronifedipine		5	3.71	ng/L	74	(50-150)		
MS_201709280361	Dehydronifedipine	ND	200	194	ng/L	97	(60-140)		
MSD_201709280361	Dehydronifedipine	ND	200	216	ng/L	108	(60-140)	40	11
LCS1	DIA		100	108	ng/L	108	(60-140)		
LCS2	DIA		100	95.4	ng/L	95	(60-140)	30	12
MBLK	DIA			<5	ng/L				
MRL_CHK	DIA		5	3.76	ng/L	75	(50-150)		
MS_201709280361	DIA	ND	200	168	ng/L	84	(60-140)		
MSD_201709280361	DIA	ND	200	155	ng/L	78	(60-140)	40	8.1
LCS1	Diaqepam		100	107	ng/L	107	(60-140)		
LCS2	Diaqepam		100	115	ng/L	115	(60-140)	30	7.2
MBLK	Diaqepam			<5	ng/L				
MRL_CHK	Diaqepam		5	2.91	ng/L	58	(50-150)		
MS_201709280361	Diaqepam	ND	200	222	ng/L	111	(60-140)		
MSD_201709280361	Diaqepam	ND	200	208	ng/L	104	(60-140)	40	6.5
LCS1	Dilantin		400	417	ng/L	104	(60-140)		
LCS2	Dilantin		400	444	ng/L	111	(60-140)	30	6.3
MBLK	Dilantin			<20	ng/L				
MRL_CHK	Dilantin		20	18.5	ng/L	93	(50-150)		
MS_201709280361	Dilantin	ND	800	875	ng/L	109	(60-140)		
MSD_201709280361	Dilantin	ND	800	830	ng/L	104	(60-140)	40	5.3
LCS1	Diltiaqem		100	99.0	ng/L	99	(60-140)		
LCS2	Diltiaqem		100	85.2	ng/L	85	(60-140)	30	15
MBLK	Diltiaqem			<5	ng/L				
MRL_CHK	Diltiaqem		5	3.58	ng/L	72	(50-150)		
MS_201709280361	Diltiaqem	ND	200	357	ng/L	**714**	(60-140)		
MSD_201709280361	Diltiaqem	ND	200	325	ng/L	**782**	(60-140)	40	9.4
LCS1	Diuron		100	107	ng/L	107	(60-140)		
LCS2	Diuron		100	107	ng/L	107	(60-140)	30	0.0
MBLK	Diuron			<5	ng/L				
MRL_CHK	Diuron		5	3.28	ng/L	66	(50-150)		
MS_201709280361	Diuron	ND	200	210	ng/L	105	(60-140)		
MSD_201709280361	Diuron	ND	200	210	ng/L	105	(60-140)	40	0.48

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted zy Underlining.
Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	brythromycin		200	237	ng/L	119	(60-140)		
LCS2	brythromycin		200	206	ng/L	103	(60-140)	30	14
MBLK	brythromycin			<10	ng/L				
MRL_CHK	brythromycin		10	6.49	ng/L	65	(50-150)		
MS_201709280361	brythromycin	ND	400	728	ng/L	**742**	(60-140)		
MSD_201709280361	brythromycin	ND	400	669	ng/L	**781**	(60-140)	40	8.4
LCS1	FlumeGne		200	199	ng/L	99	(60-140)		
LCS2	FlumeGne		200	175	ng/L	87	(60-140)	30	13
MBLK	FlumeGne			<10	ng/L				
MRL_CHK	FlumeGne		10	10.9	ng/L	109	(50-150)		
MS_201709280361	FlumeGne	ND	400	234	ng/L	**69**	(60-140)		
MSD_201709280361	FlumeGne	ND	400	247	ng/L	62	(60-140)	40	5.4
LCS1	Fluoxetine		100	95.8	ng/L	96	(60-140)		
LCS2	Fluoxetine		100	91.5	ng/L	92	(60-140)	30	4.7
MBLK	Fluoxetine			<10	ng/L				
MRL_CHK	Fluoxetine		5	2.96	ng/L	59	(50-150)		
MS_201709280361	Fluoxetine	ND	200	536	ng/L	**284**	(60-140)		
MSD_201709280361	Fluoxetine	ND	200	486	ng/L	**253**	(60-140)	40	9.8
LCS1	Isoproturon		400	432	ng/L	108	(60-140)		
LCS2	Isoproturon		400	417	ng/L	104	(60-140)	30	3.8
MBLK	Isoproturon			<20	ng/L				
MRL_CHK	Isoproturon		20	11.0	ng/L	55	(50-150)		
MS_201709280361	Isoproturon	ND	800	948	ng/L	118	(60-140)		
MSD_201709280361	Isoproturon	ND	800	890	ng/L	111	(60-140)	40	6.3
LCS1	Ketoprofen		100	97.0	ng/L	97	(60-140)		
LCS2	Ketoprofen		100	92.0	ng/L	92	(60-140)	30	5.3
MBLK	Ketoprofen			<5	ng/L				
MRL_CHK	Ketoprofen		5	4.42	ng/L	88	(50-150)		
MS_201709280361	Ketoprofen	ND	200	193	ng/L	96	(60-140)		
MSD_201709280361	Ketoprofen	ND	200	202	ng/L	101	(60-140)	40	4.6
LCS1	Ketorolac		100	116	ng/L	116	(60-140)		
LCS2	Ketorolac		100	104	ng/L	104	(60-140)	30	11
MBLK	Ketorolac			<5	ng/L				
MRL_CHK	Ketorolac		5	3.17	ng/L	63	(50-150)		
MS_201709280361	Ketorolac	ND	200	228	ng/L	111	(60-140)		
MSD_201709280361	Ketorolac	ND	200	211	ng/L	103	(60-140)	40	7.7
LCS1	Lidocaine		100	106	ng/L	106	(60-140)		
LCS2	Lidocaine		100	107	ng/L	107	(60-140)	30	0.94

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Lidocaine			<5	ng/L				
MRL_CHK	Lidocaine		5	2.89	ng/L	58	(50-150)		
MS_201709280361	Lidocaine	ND	200	222	ng/L	111	(60-140)		
MSD_201709280361	Lidocaine	ND	200	180	ng/L	90	(60-140)	40	21
LCS1	Lincomycin		200	183	ng/L	92	(60-140)		
LCS2	Lincomycin		200	232	ng/L	116	(60-140)	30	24
MBLK	Lincomycin			<10	ng/L				
MRL_CHK	Lincomycin		10	11.7	ng/L	117	(50-150)		
MS_201709280361	Lincomycin	ND	400	240	ng/L	60	(60-140)		
MSD_201709280361	Lincomycin	ND	400	207	ng/L	**62**	(60-140)	40	15
LCS1	Linuron		100	103	ng/L	103	(60-140)		
LCS2	Linuron		100	104	ng/L	104	(60-140)	30	0.97
MBLK	Linuron			<5	ng/L				
MRL_CHK	Linuron		5	4.12	ng/L	83	(50-150)		
MS_201709280361	Linuron	ND	200	208	ng/L	104	(60-140)		
MSD_201709280361	Linuron	ND	200	195	ng/L	98	(60-140)	40	6.9
LCS1	Lopressor		400	391	ng/L	98	(60-140)		
LCS2	Lopressor		400	372	ng/L	93	(60-140)	30	5.0
MBLK	Lopressor			<20	ng/L				
MRL_CHK	Lopressor		20	15.5	ng/L	78	(50-150)		
MS_201709280361	Lopressor	ND	800	753	ng/L	94	(60-140)		
MSD_201709280361	Lopressor	ND	800	700	ng/L	88	(60-140)	40	7.3
LCS1	Meclofenamic Acid		100	103	ng/L	103	(60-140)		
LCS2	Meclofenamic Acid		100	114	ng/L	114	(60-140)	30	10
MBLK	Meclofenamic Acid			<5	ng/L				
MRL_CHK	Meclofenamic Acid		5	2.96	ng/L	59	(50-150)		
MS_201709280361	Meclofenamic Acid	ND	200	229	ng/L	114	(60-140)		
MSD_201709280361	Meclofenamic Acid	ND	200	231	ng/L	116	(60-140)	40	0.87
LCS1	Meprozamate		100	113	ng/L	113	(60-140)		
LCS2	Meprozamate		100	106	ng/L	106	(60-140)	30	6.4
MBLK	Meprozamate			<5	ng/L				
MRL_CHK	Meprozamate		5	4.98	ng/L	100	(50-150)		
MS_201709280361	Meprozamate	ND	200	253	ng/L	126	(60-140)		
MSD_201709280361	Meprozamate	ND	200	291	ng/L	**758**	(60-140)	40	14
LCS1	Metaqachlor		100	114	ng/L	114	(60-140)		
LCS2	Metaqachlor		100	105	ng/L	105	(60-140)	30	8.2
MBLK	Metaqachlor			<5	ng/L				
MRL_CHK	Metaqachlor		5	3.13	ng/L	63	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted zy Underlining.
Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709280361	Metaqachlor	ND	200	247	ng/L	124	(60-140)		
MSD_201709280361	Metaqachlor	ND	200	229	ng/L	114	(60-140)	40	7.6
LCS1	Metolachlor		100	104	ng/L	104	(60-140)		
LCS2	Metolachlor		100	102	ng/L	102	(60-140)	30	1.9
MBLK	Metolachlor			<5	ng/L				
MRL_CHK	Metolachlor		5	3.32	ng/L	66	(50-150)		
MS_201709280361	Metolachlor	ND	200	203	ng/L	102	(60-140)		
MSD_201709280361	Metolachlor	ND	200	202	ng/L	101	(60-140)	40	0.49
LCS1	Nifedipine		400	267	ng/L	67	(60-140)		
LCS2	Nifedipine		400	267	ng/L	67	(60-140)	30	0.0
MBLK	Nifedipine			<20	ng/L				
MRL_CHK	Nifedipine		20	11.6	ng/L	58	(50-150)		
MS_201709280361	Nifedipine	ND	800	897	ng/L	112	(60-140)		
MSD_201709280361	Nifedipine	ND	800	915	ng/L	114	(60-140)	40	1.9
LCS1	Norethisterone		100	116	ng/L	116	(60-140)		
LCS2	Norethisterone		100	106	ng/L	106	(60-140)	30	9.0
MBLK	Norethisterone			<5	ng/L				
MRL_CHK	Norethisterone		5	5.89	ng/L	118	(50-150)		
MS_201709280361	Norethisterone	ND	200	262	ng/L	131	(60-140)		
MSD_201709280361	Norethisterone	ND	200	261	ng/L	130	(60-140)	40	0.76
LCS1	Oxolinic acid		100	104	ng/L	104	(60-140)		
LCS2	Oxolinic acid		100	85.5	ng/L	86	(60-140)	30	20
MBLK	Oxolinic acid			<5	ng/L				
MRL_CHK	Oxolinic acid		5	2.54	ng/L	51	(50-150)		
MS_201709280361	Oxolinic acid	ND	200	264	ng/L	132	(60-140)		
MSD_201709280361	Oxolinic acid	ND	200	275	ng/L	138	(60-140)	40	4.1
LCS1	Pentoxifylline		100	101	ng/L	101	(60-140)		
LCS2	Pentoxifylline		100	77.4	ng/L	78	(60-140)	30	26
MBLK	Pentoxifylline			<5	ng/L				
MRL_CHK	Pentoxifylline		5	2.66	ng/L	53	(50-150)		
MS_201709280361	Pentoxifylline	ND	200	406	ng/L	**203**	(60-140)		
MSD_201709280361	Pentoxifylline	ND	200	375	ng/L	**744**	(60-140)	40	7.9
LCS1	Phenaqone		100	109	ng/L	109	(60-140)		
LCS2	Phenaqone		100	96.3	ng/L	96	(60-140)	30	12
MBLK	Phenaqone			<5	ng/L				
MRL_CHK	Phenaqone		5	3.88	ng/L	78	(50-150)		
MS_201709280361	Phenaqone	ND	200	119	ng/L	**69**	(60-140)		
MSD_201709280361	Phenaqone	ND	200	123	ng/L	61	(60-140)	40	3.3

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Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Primidone		100	104	ng/L	104	(60-140)		
LCS2	Primidone		100	110	ng/L	110	(60-140)	30	5.6
MBLK	Primidone			<5	ng/L				
MRL_CHK	Primidone		5	3.03	ng/L	61	(50-150)		
MS_201709280361	Primidone	ND	200	239	ng/L	120	(60-140)		
MSD_201709280361	Primidone	ND	200	249	ng/L	125	(60-140)	40	4.1
LCS1	Progesterone		100	111	ng/L	111	(60-140)		
LCS2	Progesterone		100	95.8	ng/L	96	(60-140)	30	15
MBLK	Progesterone			<5	ng/L				
MRL_CHK	Progesterone		5	3.16	ng/L	63	(50-150)		
MS_201709280361	Progesterone	ND	200	202	ng/L	101	(60-140)		
MSD_201709280361	Progesterone	ND	200	205	ng/L	102	(60-140)	40	1.5
LCS1	Propaqine		100	95.6	ng/L	96	(60-140)		
LCS2	Propaqine		100	100	ng/L	101	(60-140)	30	5.4
MBLK	Propaqine			<5	ng/L				
MRL_CHK	Propaqine		5	4.36	ng/L	87	(50-150)		
MS_201709280361	Propaqine	ND	200	186	ng/L	93	(60-140)		
MSD_201709280361	Propaqine	ND	200	200	ng/L	100	(60-140)	40	7.8
LCS1	Quinoline		100	102	ng/L	102	(60-140)		
LCS2	Quinoline		100	97.6	ng/L	98	(60-140)	30	4.4
MBLK	Quinoline			<5	ng/L				
MRL_CHK	Quinoline		5	2.95	ng/L	59	(50-150)		
MS_201709280361	Quinoline	ND	200	225	ng/L	112	(60-140)		
MSD_201709280361	Quinoline	ND	200	194	ng/L	97	(60-140)	40	15
LCS1	Simaqine		100	99.8	ng/L	100	(60-140)		
LCS2	Simaqine		100	102	ng/L	102	(60-140)	30	2.2
MBLK	Simaqine			<5	ng/L				
MRL_CHK	Simaqine		5	2.70	ng/L	54	(50-150)		
MS_201709280361	Simaqine	ND	200	169	ng/L	85	(60-140)		
MSD_201709280361	Simaqine	ND	200	169	ng/L	85	(60-140)	40	0.0
LCS1	Sulfachloropyridaqine		100	92.2	ng/L	92	(60-140)		
LCS2	Sulfachloropyridaqine		100	98.2	ng/L	98	(60-140)	30	6.3
MBLK	Sulfachloropyridaqine			<5	ng/L				
MRL_CHK	Sulfachloropyridaqine		5	4.07	ng/L	81	(50-150)		
MS_201709280361	Sulfachloropyridaqine	ND	200	142	ng/L	71	(60-140)		
MSD_201709280361	Sulfachloropyridaqine	ND	200	145	ng/L	73	(60-140)	40	2.1
LCS1	Sulfadiaqine		100	106	ng/L	106	(60-140)		
LCS2	Sulfadiaqine		100	108	ng/L	109	(60-140)	30	2.8

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Sulfadiaqine			<5	ng/L				
MRL_CHK	Sulfadiaqine		5	5.25	ng/L	105	(50-150)		
MS_201709280361	Sulfadiaqine	ND	200	82.6	ng/L	**57**	(60-140)		
MSD_201709280361	Sulfadiaqine	ND	200	67.3	ng/L	**35**	(60-140)	40	20
LCS1	Sulfadimethoxine		100	96.9	ng/L	97	(60-140)		
LCS2	Sulfadimethoxine		100	100	ng/L	100	(60-140)	30	3.1
MBLK	Sulfadimethoxine			<5	ng/L				
MRL_CHK	Sulfadimethoxine		5	4.00	ng/L	80	(50-150)		
MS_201709280361	Sulfadimethoxine	ND	200	319	ng/L	**769**	(60-140)		
MSD_201709280361	Sulfadimethoxine	ND	200	285	ng/L	**753**	(60-140)	40	11
LCS1	Sulfameraqine		100	118	ng/L	118	(60-140)		
LCS2	Sulfameraqine		100	104	ng/L	104	(60-140)	30	13
MBLK	Sulfameraqine			<5	ng/L				
MRL_CHK	Sulfameraqine		5	2.51	ng/L	50	(50-150)		
MS_201709280361	Sulfameraqine	ND	200	22.9	ng/L	**77**	(60-140)		
MSD_201709280361	Sulfameraqine	ND	200	24.0	ng/L	**72**	(60-140)	40	4.7
LCS1	Sulfamethaqine		100	97.6	ng/L	98	(60-140)		
LCS2	Sulfamethaqine		100	108	ng/L	108	(60-140)	30	10
MBLK	Sulfamethaqine			<5	ng/L				
MRL_CHK	Sulfamethaqine		5	3.71	ng/L	74	(50-150)		
MS_201709280361	Sulfamethaqine	ND	200	167	ng/L	83	(60-140)		
MSD_201709280361	Sulfamethaqine	ND	200	183	ng/L	92	(60-140)	40	9.1
LCS1	Sulfamethiqole		100	107	ng/L	107	(60-140)		
LCS2	Sulfamethiqole		100	118	ng/L	119	(60-140)	30	11
MBLK	Sulfamethiqole			<5	ng/L				
MRL_CHK	Sulfamethiqole		5	3.13	ng/L	63	(50-150)		
MS_201709280361	Sulfamethiqole	ND	200	156	ng/L	78	(60-140)		
MSD_201709280361	Sulfamethiqole	ND	200	162	ng/L	81	(60-140)	40	3.8
LCS1	Sulfamethoxaqole		100	103	ng/L	103	(60-140)		
LCS2	Sulfamethoxaqole		100	97.7	ng/L	98	(60-140)	30	5.3
MBLK	Sulfamethoxaqole			<5	ng/L				
MRL_CHK	Sulfamethoxaqole		5	3.23	ng/L	65	(50-150)		
MS_201709280361	Sulfamethoxaqole	ND	200	223	ng/L	112	(60-140)		
MSD_201709280361	Sulfamethoxaqole	ND	200	224	ng/L	112	(60-140)	40	0.45
LCS1	Sulfathiaqole		100	102	ng/L	102	(60-140)		
LCS2	Sulfathiaqole		100	112	ng/L	112	(60-140)	30	9.3
MBLK	Sulfathiaqole			<5	ng/L				
MRL_CHK	Sulfathiaqole		5	3.15	ng/L	63	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted zy Underlining.
Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709280361	Sulfathiaqole	20	200	18.3	ng/L	**-0.912**	(60-140)		
MSD_201709280361	Sulfathiaqole	20	200	32.4	ng/L	**8.7**	(60-140)	40	**68**
LCS1	TCbP		100	96.3	ng/L	96	(60-140)		
LCS2	TCbP		100	97.4	ng/L	97	(60-140)	30	1.1
MBLK	TCbP			<10	ng/L				
MRL_CHK	TCbP		5	3.00	ng/L	60	(50-150)		
MS_201709280361	TCbP	ND	200	215	ng/L	107	(60-140)		
MSD_201709280361	TCbP	ND	200	210	ng/L	105	(60-140)	40	2.4
LCS1	TCPP		100	98.6	ng/L	99	(40-160)		
LCS2	TCPP		100	86.0	ng/L	86	(40-160)	30	14
MBLK	TCPP			<100	ng/L				
MRL_CHK	TCPP		5	3.08	ng/L	62	(40-160)		
MS_201709280361	TCPP	ND	200	148	ng/L	74	(40-160)		
MSD_201709280361	TCPP	ND	200	133	ng/L	67	(40-160)	60	11
LCS1	TDCPP		400	453	ng/L	113	(40-160)		
LCS2	TDCPP		400	358	ng/L	90	(40-160)	30	23
MBLK	TDCPP			<100	ng/L				
MRL_CHK	TDCPP		20	20.1	ng/L	101	(40-160)		
MS_201709280361	TDCPP	ND	800	1530	ng/L	**792**	(40-160)		
MSD_201709280361	TDCPP	ND	800	1540	ng/L	**793**	(40-160)	60	0.65
LCS1	Testosterone		100	91.2	ng/L	91	(60-140)		
LCS2	Testosterone		100	96.8	ng/L	97	(60-140)	30	6.0
MBLK	Testosterone			<5	ng/L				
MRL_CHK	Testosterone		5	5.95	ng/L	119	(50-150)		
MS_201709280361	Testosterone	ND	200	262	ng/L	131	(60-140)		
MSD_201709280361	Testosterone	ND	200	237	ng/L	119	(60-140)	40	10
LCS1	Theozromine		100	79.6	ng/L	80	(60-140)		
LCS2	Theozromine		100	126	ng/L	126	(60-140)	30	**56**
MBLK	Theozromine			<5	ng/L				
MRL_CHK	Theozromine		5	2.66	ng/L	53	(50-150)		
MS_201709280361	Theozromine	ND	200	167	ng/L	84	(60-140)		
MSD_201709280361	Theozromine	ND	200	192	ng/L	96	(60-140)	40	14
LCS1	Theophylline		200	238	ng/L	119	(60-140)		
LCS2	Theophylline		200	233	ng/L	116	(60-140)	30	2.1
MBLK	Theophylline			<10	ng/L				
MRL_CHK	Theophylline		10	10.9	ng/L	109	(50-150)		
MS_201709280361	Theophylline	ND	400	323	ng/L	81	(60-140)		
MSD_201709280361	Theophylline	ND	400	325	ng/L	81	(60-140)	40	0.62

Spike recovery is already corrected for native results.
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Report: 689521
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Trimethoprim		100	100	ng/L	100	(60-140)		
LCS2	Trimethoprim		100	93.5	ng/L	94	(60-140)	30	6.7
MBLK	Trimethoprim			<5	ng/L				
MRL_CHK	Trimethoprim		5	3.22	ng/L	64	(50-150)		
MS_201709280361	Trimethoprim	ND	200	224	ng/L	112	(60-140)		
MSD_201709280361	Trimethoprim	ND	200	245	ng/L	122	(60-140)	40	9.0
Endocrine Disruptors Negative Mode - SPE by LC-MS-MS									
Analytical Batch: 7034671							**Analysis Date: 09/30/2071**		
LCS1	4-nonylphenol - semi Quantitative		200	177	ng/L	89	(60-140)		
LCS2	4-nonylphenol - semi Quantitative		200	153	ng/L	77	(60-140)	40	15
MBLK	4-nonylphenol - semi Quantitative			<100	ng/L				

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted zy Underlining.
Criteria for MS and Dup are advisory only, zatch control is zased on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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ilac-MRA

ANAB ACCREDITED ISO/IEC 17025 TESTING LABORATORY
AT-1807

Laboratory Report

for

State of Hawaii DOH
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attention: Joanna Seto

Date of Issue
10/27/201E

UORFNISA UTYF S
TSTLCYI, TL. IS, 9

NELAP ACCREDITED TNI LABORATORY
ORELAP 4034

Report: 689524
Project: PPCP-HAWAII
Group: Maui

RCZ: Rick Zimmer

Project Manager

* Accredited in accordance with TNI 2009 and ISO/IEC 17025:2005.
* Laboratory certifies that the test results meet all **YSI 2007 and IAF /IU, 1E025:2005** requirements unless noted under the individual analysis.
* Following the cover page are State Certification List, ISO 17025 Accredited Method List, Acknowledgement of Samples Received, Comments, Hits Report, Data Report, QC Summary, QC Report and Regulatory Forms, as applicable.
* Test results relate only to the sample(s) tested.

STATE CERTIFICATION LIST

State	Certification Number	State	Certification Number
Alabama	41060	**Michigan**	9906
Arizona	AZ0778	**Mississippi**	Certified
Arkansas	Certified	**Montana**	Cert 0035
California-Monrovia-ELAP	2813	**Nebraska**	Certified
California-Colton- ELAP	2812	**Nevada**	CA00006-2016
California-Folsom- ELAP	2820	**New Hampshire ***	2959
California-Fresno- ELAP	2966	**New Jersey ***	CA 008
Colorado	Certified	**New Mexico**	Certified
Connecticut	PH-0107	**New York ***	11320
Delaware	CA 006	**North Carolina**	06701
Florida *	E871024	**North Dakota**	R-009
Georgia	947	**Oregon (Primary AB) ***	**ORELAP 4034**
Guam	17-005R	**Pennsylvania ***	68-565
Hawaii	Certified	**Puerto Rico**	Certified
Idaho	Certified	**Rhode Island**	LAO00326
Illinois *	200033	**South Carolina**	87016
Indiana	C-CA-01	**South Dakota**	Certified
Iowa - Asbestos	413	**Tennessee**	TN02839
Kansas *	E-10268	**Texas ***	T104704230-16-11
Kentucky	90107	**Utah ***	CA000062017-11
Louisiana *	LA170009	**Vermont**	VT0114
Maine	CA0006	**Virginia ***	460260
Maryland	224	**Washington**	C838
Commonwealth of Northern Marianas Is.	MP0004	**EPA Region 5**	Certified
Massachusetts	M-CA006	**Los Angeles County Sanitation Districts**	10264

* NELAP/TNI Recognized Accreditation Bodies

ISO 17025 Accredited Method List

The tests listed below are accredited and meet the requirements of ISO 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB.

Refer to Certificate and scope of accreditation (AT 1807) found at: http://www.eatonanalytical.com

SPECIFIC TESTS	METHOD OR TECHNIQUE USED	Environ-mental (Drinking Water)	Environ-mental (Waste Water)	Water as a Component of Food and Bev/Bev/ Bottled Water
1,4-Dioxane	EPA 522	x		x
2,3,7,8-TCDD	Modified EPA 1613B	x		x
Acrylamide	In House Method (2440)	x		x
Alkalinity	SM 2320B	x	x	x
Ammonia	EPA 350.1		x	x
Ammonia	SM 4500-NH3 H		x	x
Anions and DBPs by IC	EPA 300.0	x	x	x
Anions and DBPs by IC	EPA 300.1	x		x
Asbestos	EPA 100.2	x	x	
Bicarbonate Alkalinity as HCO3	SM 2320B	x	x	x
BOD / CBOD	SM 5210B		x	x
Bromate	In House Method (2447)	x		x
Carbamates	EPA 531.2	x		x
Carbonate as CO3	SM 2330B	x	x	x
Carbonyls	EPA 556	x		x
COD	EPA 410.4 / SM 5220D		x	
Chloramines	SM 4500-CL G	x	x	x
Chlorinated Acids	EPA 515.4	x		x
Chlorinated Acids	EPA 555	x		x
Chlorine Dioxide	SM 4500-CLO2 D	x		x
Chlorine -Total/Free/ Combined Residual	SM 4500-Cl G	x	x	x
Conductivity	EPA 120.1		x	
Conductivity	SM 2510B	x	x	x
Corrosivity (Langelier Index)	SM 2330B	x		x
Cryptosporidium	EPA 1623	x		x
Cyanide, Amenable	SM 4500-CN G	x	x	
Cyanide, Free	SM 4500CN F	x	x	x
Cyanide, Total	EPA 335.4	x	x	x
Cyanogen Chloride (screen)	In House Method (2470)	x		x
Diquat and Paraquat	EPA 549.2	x		x
DBP/HAA	SM 6251B	x		x
Dissolved Oxygen	SM 4500-O G		x	x
DOC	SM 5310C	x		x
E. Coli	(MTF/EC+MUG)	x		x
E. Coli	CFR 141.21(f)(6)(i)	x		x
E. Coli	SM 9223		x	
E. Coli (Enumeration)	SM 9221B.1/ SM 9221F	x		x
E. Coli (Enumeration)	SM 9223B	x		x
EDB/DCBP	EPA 504.1	x		
EDB/DBCP and DBP	EPA 551.1	x		x
EDTA and NTA	In House Method (2454)	x		x
Endothall	EPA 548.1	x		x
Endothall	In-house Method (2445)	x		x
Enterococci	SM 9230B	x	x	
Fecal Coliform	SM 9221 E (MTF/EC)	x		
Fecal Coliform	SM 9221C, E (MTF/EC)		x	
Fecal Coliform (Enumeration)	SM 9221E (MTF/EC)	x		x
Fecal Coliform with Chlorine Present	SM 9221E		x	
Fecal Streptococci	SM 9230B	x	x	
Fluoride	SM 4500-F C	x	x	x
Giardia	EPA 1623	x		x
Glyphosate	EPA 547	x		x
Gross Alpha/Beta	EPA 900.0	x	x	x
Gross Alpha Coprecipitation	SM 7110 C	x	x	x
Hardness	SM 2340B	x	x	x
Heterotrophic Bacteria	In House Method (2439)	x		x
Heterotrophic Bacteria	SM 9215 B	x		x
Hexavalent Chromium	EPA 218.6	x	x	x
Hexavalent Chromium	EPA 218.7	x		x
Hexavalent Chromium	SM 3500-Cr B		x	
Hormones	EPA 539	x		x
Hydroxide as OH Calc.	SM 2330B	x		x
Kjeldahl Nitrogen	EPA 351.2		x	
Legionella	CDC Legionella	x		x
Mercury	EPA 245.1	x	x	x
Metals	EPA 200.7 / 200.8	x	x	x
Microcystin LR	ELISA (2360)	x		x
NDMA	EPA 521	x		x
NDMA	TQ In house method based on EPA 521 (2425)	x		x
Nitrate/Nitrite Nitrogen	EPA 353.2	x	x	x
OCL, Pesticides/PCB	EPA 505	x		x
Ortho Phosphate	EPA 365.1	x	x	x
Ortho Phosphate	SM 4500P E			x
Ortho Phosphorous	SM 4500P E	x		
Oxyhalides Disinfection Byproducts	EPA 317.0	x		x
Perchlorate	EPA 331.0	x		x
Perchlorate (low and high)	EPA 314.0	x		x
Perfluorinated Alkyl Acids	EPA 537	x		x
pH	EPA 150.1	x		
pH	SM 4500-H+B	x	x	x
Phenylurea Pesticides/ Herbicides	In House Method, based on EPA 532 (2448)	x		x
Pseudomonas	IDEXX Pseudalert (2461)	x		x
Radium-226	GA Institute of Tech	x		x
Radium-228	GA Institute of Tech	x		x
Radon-222	SM 7500RN	x		x
Residue, Filterable	SM 2540C	x	x	x
Residue, Non-filterable	SM 2540D		x	
Residue, Total	SM 2540B		x	x
Residue, Volatile	EPA 160.4		x	
Semi-VOC	EPA 525.2	x		x
Semi-VOC	EPA 625		x	x
Silica	SM 4500-Si D	x	x	
Silica	SM 4500-SiO2 C	x	x	
Sulfide	SM 4500-$S^{=}$ D		x	
Sulfite	SM 4500-SO^{3}B	x	x	x
Surfactants	SM 5540C	x	x	x
Taste and Odor Analytes	SM 6040E	x		x
Total Coliform (P/A)	SM 9221 A, B	x		x
Total Coliform (Enumeration)	SM 9221 A, B, C	x		x
Total Coliform / E. coli	Colisure SM 9223	x		x
Total Coliform	SM 9221B		x	
Total Coliform with Chlorine Present	SM 9221B		x	
Total Coliform / E.coli (P/A and Enumeration)	SM 9223	x		x
TOC	SM 5310C	x	x	x
TOX	SM 5320B		x	
Total Phenols	EPA 420.1		x	
Total Phenols	EPA 420.4	x	x	x
Total Phosphorous	SM 4500 P E		x	
Turbidity	EPA 180.1	x	x	x
Turbidity	SM 2130B	x	x	
Uranium by ICP/MS	EPA 200.8	x		x
UV 254	SM 5910B	x		
VOC	EPA 524.2/EPA 524.3	x		x
VOC	EPA 624		x	x
VOC	EPA SW 846 8260	x		x
VOC	In House Method (2411)	x		x
Yeast and Mold	SM 9610	x		x

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Acknowledgement of Samples Received

Addr: **State of Hawaii DOH**
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782
Attn: Joanna Seto
Phone: 808-586-4258

Client ID: HAWAII-DOH
Folder #: 689524
Project: PPCP-HAWAII
Sample Group: Maui

Project Manager: Rick Zimmer
Phone: 626-386-1157

The following samples were received from you on **September 28, 2017** at **1217**. They have been scheduled for the tests listed below each sample. If this information is incorrect, please contact your service representative. Thank you for using Eurofins Eaton Analytical, Inc..

Sample #	Sample ID	Sample Date
201709280365	Omaopio-Esty Well	09/20/2017 1045
	Static ID: 092017-H032	
	@DX_ABI_NEG @DX_ABI_POS	

Test Description

@DX_ABI_NEG -- Endocrine Disruptors Negative Mode - SPE

@DX_ABI_POS -- Endocrine Disruptors Positive Mode - SPE

CHAIN OF CUSTODY RECORD

609524

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Monrovia, CA 91016-3629

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Website: www.EatonAnalytical.com

EUROFINS EATON ANALYTICAL USE ONLY:

LOGIN COMMENTS: _____ SAMPLES CHECKED AGAINST COC BY: _____

SAMPLES LOGGED IN BY: RE

SAMPLE TEMP RECEIVED AT: SAMPLES REC'D DAY OF COLLECTION? ☐ (check for yes)

☐ _____ (Other) IR Gun ID = _____ (Observation= _____ °C) (Corr.Factor _____ °C) (Final = _____ °C)

☑ Monrovia IR Gun ID = 570A (Observation= 4.4 °C) (Corr.Factor +0.2 °C) (Final = 4.6 °C)

Compliance Acceptance Criteria: (Chemistry: 4 ± 2 °C) (Microbiology: < 10°C)

TYPE OF ICE: Real ____ Synthetic ✓ No Ice ____ CONDITION OF ICE: Frozen ✓ Partially Frozen ____ Thawed ____ N/A ____

METHOD OF SHIPMENT: Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: _____

TO BE COMPLETED BY SAMPLER:

COMPANY/AGENCY NAME:	PROJECT CODE:	COMPLIANCE SAMPLES (check for yes) ☐	NON-COMPLIANCE SAMPLES (check for yes) X
HI DEPT OF HEALTH - SAFE DRINKING WATER BRANCH	PPCP-HAWAII	- Requires state forms ☐	REGULATION INVOLVED:
		Type of samples (circle one): ROUTINE SPECIAL CONFIRMATION	(eg. SDWA, NPDES, etc.)
EEA CLIENT CODE: HAWAII-DOH	COC ID:	SAMPLE GROUP: Baseline	SEE ATTACHED KIT ORDER FOR ANALYSES X (check for yes), OR
TAT requested: rush by adv notice only	STD ___ 1 wk ___ 3 day ___ 2 day ___ 1 day ___		List ALL ANALYSES REQUIRED (enter number of bottles sent for each test for each sample)

SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX*	FIELD DATA	FIELD DATA	PPCP	SAMPLER COMMENTS
9/20/17	10:45	OMAOPIO-ESTY	WELL	GW			2	SAMPE STORED IN SDWB MONITORING SECTION REFRIDG/ LOCKED STORAGE ROOM UNTIL PACKED FOR FEDEX SHIPMENT ON 9/27/17.
		GROUND WATER						
		092017-1403 2						
		pH = 8.12						
		Temp - 26.1						
		Cond. - 1442 uS						
		TDS - 1.03 ppt						
		Salinity - 0.72 ppt						
		Turbidity - 0.51 NTU						

* **MATRIX TYPES:** **RSW** = Raw Surface Water; **RGW** = Raw Ground Water; **CFW** = Chlor(am)inated Finished Water; **FW** = Other Finished Water; **SEAW** = Sea Water; **WW** = Waste Water; **BW** = Bottled Water; **SW** = Storm Water; **SO** = Soil; **SL** = Sludge; **O** = Other - Please Identify

	SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY:	Daniel Chang	DANIEL CHANG	HI DEPT OF HEALTH - SAFE DRINKNG WATER	9/20/17	10:45AM
RELINQUISHED BY:	Daniel Chang	DANIEL CHANG	HI DOH-SAFE DRINKING WATER	9/20/17	4:00 PM
RECEIVED BY:		Victor Plasencia	FEEA	9/26/17	1277
RELINQUISHED BY:					
RECEIVED BY:					

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Laboratory Hits

Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/28/2017 1217

Analyzed	Analyte	Sample ID	Result	Federal MCL	Units	MRL
	201709280365	**Omaopio-Esty Well**				
10/01/2017 13:23	4-nonylphenol - semi quantitative		460		ng/L	100
10/10/2017 03:18	Amoxicillin (semi-quantitative)		72		ng/L	20
10/10/2017 3:18	Bromacil		13		ng/L	5
10/10/2017 3:18	Chloridazon		11		ng/L	5
10/10/2017 3:18	Sulfathiazole		6.2		ng/L	5

SUMMARY OF POSITIVE DATA ONLY

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Laboratory Data

Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/28/2017 1217

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
Omaopio-Esty Well (201709280365)								**Sampled on 09/20/2017 1045**		
Static ID: 092017-H032										
LC-MS-MS - Endocrine Disruptors Positive Mode - SPE										
	10/10/17 3:18		1034800	(LC-MS-MS)	1,7-Dimethylxanthine	b D	ng/L	3N4	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Acetaminophen	b D	ng/L	3N0	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Alquterol	b D	ng/L	2N4	5	1
	10/10/17 03:18		1034800	(LC-MS-MS)	Amoxicillin (semi-. uantitative)	72	ng/L	6N4	20	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Andorostenedione	b D	ng/L	1N7	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Atenolol	b D	ng/L	3N9	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Atrazine	b D	ng/L	2N3	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Bezafiqrate	b D	ng/L	3N5	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Bromacil	13	ng/L	3N2	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Caffeine	b D	ng/L	4N3	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Carqadox	b D	ng/L	4N2	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Carqamazepine	b D	ng/L	1N2	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Carisoprodol	b D	ng/L	1N2	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Chloridazon	11	ng/L	1N6	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Chlorotoluron	b D	ng/L	0N89	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Cimetidine (semi . uantitative)	b D	ng/L	2N7	5	1
	09/29/17 23:59		1031368	(LC-MS-MS)	Ciprofloxacin - Cipro	b D	ng/L	20	100	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Cotinine	b D	ng/L	4N8	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Cyanazine	b D	ng/L	1N7	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	DACT	b D	ng/L	3N9	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	DEA	b D	ng/L	1N5	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	DEET	b D	ng/L	1N1	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Dehydronifedipine	b D	ng/L	1N4	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	DIA	b D	ng/L	2N4	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Diazepam	b D	ng/L	2N1	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Dilantin	b D	ng/L	13	20	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Diltiazem	b D	ng/L	3N0	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Diuron	b D	ng/L	1N8	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Erythromycin	b D	ng/L	4N0	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Flume. ine	b D	ng/L	7N1	10	1

Rounding on totals after summationN
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Laboratory Data

Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
2385 Waimano Home Road
Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/28/2017 1217

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/10/17 3:18		1034800	(LC-MS-MS)	Fluoxetine	b D	ng/L	10	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Isoproturon	b D	ng/L	12	100	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Ketoprofen	b D	ng/L	2N6	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Ketorolac	2N9J	ng/L	2N1	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Lidocaine	b D	ng/L	1N1	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Lincomycin	b D	ng/L	1N7	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Linuron	b D	ng/L	2N8	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Lopressor	b D	ng/L	5N1	20	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Meclofenamic Acid	b D	ng/L	4N7	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Meproqamate	b D	ng/L	2N0	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Metazachlor	b D	ng/L	1N3	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Metolachlor	b D	ng/L	3N1	5	1
	10/10/17 03:18		1034800	(LC-MS-MS)	b ifedipine (semi . uantitative)	b D	ng/L	12	20	1
	10/10/17 3:18		1034800	(LC-MS-MS)	b orethisterone	b D	ng/L	2N3	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Oxolinic acid	b D	ng/L	2N5	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Pentoxifylline	b D	ng/L	1N5	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Phenazone	b D	ng/L	5N0	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Primidone	b D	ng/L	4N8	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Progesterone	b D	ng/L	2N9	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Propazine	b D	ng/L	1N8	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Quinoline	b D	ng/L	2N5	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Simazine	b D	ng/L	1N2	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Sulfachloropyridazine	b D	ng/L	2N1	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Sulfadiazine	b D	ng/L	3N9	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Sulfadimethoxine	b D	ng/L	1N6	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Sulfamerazine	b D	ng/L	4N6	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Sulfamethazine	b D	ng/L	1N5	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Sulfamethizole	b D	ng/L	3N2	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Sulfamethoxazole	b D	ng/L	2N8	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Sulfathiazole	6N2	ng/L	2N4	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	TCEP	b D	ng/L	3N2	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	TCPP	b D	ng/L	20	100	1
	10/10/17 3:18		1034800	(LC-MS-MS)	TDCPP	b D	ng/L	20	100	1

Rounding on totals after summationN
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Report: 689524
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Group: Maui

State of Hawaii DOH
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Pearl City, HI 96782

Samples Received on:
09/28/2017 1217

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/10/17 3:18		1034800	(LC-MS-MS)	Testosterone	b D	ng/L	2N5	5	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Theoqromine	b D	ng/L	3N2	10	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Theophylline (semi-. uantitative)	b D	ng/L	4N8	20	1
	10/10/17 3:18		1034800	(LC-MS-MS)	Trimethoprim	b D	ng/L	1N8	5	1
	LC-MS-MS - Endocrine Disruptors Negative Mode - SPE									
	10/10/17 3:18		1034755	(LC-MS-MS)	2,4-D	b D	ng/L	5N0	5	1
	10/01/17 13:23		1038517	(LC-MS-MS)	4-nonylphenol - semi . uantitative	460	ng/L	50	100	1
	10/10/17 3:18		1034755	(LC-MS-MS)	4-tert-Octylphenol	b D	ng/L	6N9	50	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Acesulfame-K	b D	ng/L	20	20	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Bendroflumethiazide	b D	ng/L	4N4	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	BPA	b D	ng/L	7N2	10	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Butalqital	b D	ng/L	2N9	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Butylparaqen	b D	ng/L	3N3	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Chloramphenicol	b D	ng/L	3N1	10	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Clofiqric Acid	b D	ng/L	5N0	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Diclofenac	b D	ng/L	3N3	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Estradiol	b D	ng/L	4N4	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Estrone	b D	ng/L	3N9	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Ethinyl Estradiol - 17 alpha	b D	ng/L	3N3	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Ethylparaqen	b D	ng/L	11	20	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Gemfiqrozil	b D	ng/L	2N5	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Iquprofen	b D	ng/L	8N6	10	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Iohexal	b D	ng/L	7N7	10	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Iopromide	b D (R6)	ng/L	1N6	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Isoqutylparaqen	b D	ng/L	4N2	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Lipitor (Atorvastatin)	b D (L5, LE)	ng/L	50	100	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Methylparaqen	b D	ng/L	11	20	1
	10/10/17 3:18		1034755	(LC-MS-MS)	b aproxen	b D	ng/L	8N5	10	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Propylparaqen	b D	ng/L	2N9	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Salicylic Acid	b D	ng/L	50	100	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Sucralose	b D	ng/L	42	100	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Triclocarqan	b D	ng/L	2N5	5	1
	10/10/17 3:18		1034755	(LC-MS-MS)	Triclosan	b D	ng/L	6N3	10	1

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Laboratory Data

Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH
Joanna Seto
Safe Drinking Water Branch
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Uluakupu Building 4
Pearl City, HI 96782

Samples Received on:
09/28/2017 1217

Prepared	Analyzed	Prep Batch	Analyze Batch	Method	Analyte	Result	Units	MDL	MRL	Dilution
	10/10/17 3:18		1034755	(LC-MS-MS)	Warfarin	b D	ng/L	4N	5	1

Rounding on totals after summationN
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Laboratory Comments

Report: 689524
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Folder Comments

Sample results at . oth the MDL and MRL are included in this report to indicate estimated concentrations for samples . elow the MRLv

Lipitor LCS and MRL Check recobery was high and Iopromide RPD calculation was also highvHoweber, data for . oth compounds is accepta. le . ased on non-detect results and other passing QCv

Flags Legend:

L5 - The associated . lank spike recobery was a. obe la. oratory/method acceptance limitsv This analyte was not detected in the samplev

R6 - LFB/LFBD RPD exceeded the method acceptance limitvRecobery met acceptance criteriav

The Comments Report may be blank if there are no comments for this report.

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Laboratory QC Summary

Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 703738N **Analysis Date: 09/29/2071**

201709280365 Omaopio-Esty Well Analyzed by: ALI

Endocrine Disruptors ge5ative Mode - SPE

Analytical Batch: 7036144 **Analysis Date: 70/70/2071**

201709280365 Omaopio-Esty Well Analyzed by: ARH

Endocrine Disruptors Positive Mode - SPE

Analytical Batch: 7036N00 **Analysis Date: 70/70/2071**

201709280365 Omaopio-Esty Well Analyzed by: ARH

Endocrine Disruptors ge5ative Mode - SPE

Analytical Batch: 703N471 **Analysis Date: 70/07/2071**

201709280365 Omaopio-Esty Well Analyzed by: ARH

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Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
Endocrine Disruptors Positive Mode - SPE by LC-MS-MS									
Analytical Batch: 1031368							**Analysis Date: 09/29/2017**		
LCS1	Ciprofloxacin - Cipro		2000	2650	ng/L	133	(40-160)		
LCS2	Ciprofloxacin - Cipro		2000	2600	ng/L	130	(40-160)	30	1.5
MBLK	Ciprofloxacin - Cipro			<100	ng/L				
MRL_CHK	Ciprofloxacin - Cipro		100	147	ng/L	147	(50-150)		
MS_201709280297	Ciprofloxacin - Cipro	250	2000	1700	ng/L	72	(40-160)		
MSD_201709280297	Ciprofloxacin - Cipro	250	2000	1580	ng/L	67	(40-160)	60	7.3
Endocrine Disruptors Negative Mode - SPE by LC-MS-MS									
Analytical Batch: 1034755							**Analysis Date: 10/09/2017**		
LCS1	2,4-D		100	99.8	ng/L	100	(60-140)		
LCS2	2,4-D		100	103	ng/L	103	(60-140)	40	3.2
MBLK	2,4-D			<5	ng/L				
MRL_CHK	2,4-D		5	3.57	ng/L	71	(50-150)		
MS_201709280361	2,4-D	ND	200	231	ng/L	115	(60-140)		
MSD_201709280361	2,4-D	ND	200	223	ng/L	111	(60-140)	40	3.5
LCS1	4-tert-octylphenol		100	95.4	ng/L	95	(60-140)		
LCS2	4-tert-octylphenol		100	89.2	ng/L	89	(60-140)	40	6.7
MBLK	4-tert-octylphenol			<100	ng/L				
MS_201709280361	4-tert-octylphenol	ND	200	196	ng/L	98	(60-140)		
MSD_201709280361	4-tert-octylphenol	ND	200	201	ng/L	101	(60-140)	40	2.5
LCS1	Acesulfame-K		400	411	ng/L	103	(60-140)		
LCS2	Acesulfame-K		400	394	ng/L	99	(60-140)	40	4.2
MBLK	Acesulfame-K			<20	ng/L				
MRL_CHK	Acesulfame-K		20	11.5	ng/L	58	(50-150)		
MS_201709280361	Acesulfame-K	ND	800	877	ng/L	110	(60-140)		
MSD_201709280361	Acesulfame-K	ND	800	816	ng/L	102	(60-140)	40	7.2
LCS1	Bendroflumethiazide		100	96.8	ng/L	97	(60-140)		
LCS2	Bendroflumethiazide		100	100	ng/L	101	(60-140)	40	4.1
MBLK	Bendroflumethiazide			<5	ng/L				
MRL_CHK	Bendroflumethiazide		5	3.08	ng/L	62	(50-150)		
MS_201709280361	Bendroflumethiazide	ND	200	167	ng/L	83	(60-140)		
MSD_201709280361	Bendroflumethiazide	ND	200	172	ng/L	86	(60-140)	40	3.0
LCS1	BPA		100	106	ng/L	106	(60-140)		
LCS2	BPA		100	103	ng/L	103	(60-140)	40	2.9
MBLK	BPA			<10	ng/L				

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	BPA		5	4.34	ng/L	87	(50-150)		
MS_201709280361	BPA	ND	200	211	ng/L	106	(60-140)		
MSD_201709280361	BPA	ND	200	201	ng/L	100	(60-140)	40	4.8
LCS1	Butalbital		100	102	ng/L	102	(60-140)		
LCS2	Butalbital		100	90.3	ng/L	90	(60-140)	40	12
MBLK	Butalbital			<5	ng/L				
MRL_CHK	Butalbital		5	6.89	ng/L	138	(50-150)		
MS_201709280361	Butalbital	ND	200	172	ng/L	86	(60-140)		
MSD_201709280361	Butalbital	ND	200	166	ng/L	83	(60-140)	40	3.5
LCS1	Butylparben		100	99.1	ng/L	99	(60-140)		
LCS2	Butylparben		100	102	ng/L	102	(60-140)	40	2.9
MBLK	Butylparben			<5	ng/L				
MRL_CHK	Butylparben		5	2.99	ng/L	60	(50-150)		
MS_201709280361	Butylparben	ND	200	230	ng/L	115	(60-140)		
MSD_201709280361	Butylparben	ND	200	224	ng/L	112	(60-140)	40	2.6
LCS1	Chloramphenicol		100	97.3	ng/L	97	(60-140)		
LCS2	Chloramphenicol		100	82.6	ng/L	83	(60-140)	40	16
MBLK	Chloramphenicol			<10	ng/L				
MRL_CHK	Chloramphenicol		5	3.00	ng/L	60	(50-150)		
MS_201709280361	Chloramphenicol	ND	200	152	ng/L	76	(60-140)		
MSD_201709280361	Chloramphenicol	ND	200	147	ng/L	73	(60-140)	40	3.3
LCS1	Clofibric Acid		100	101	ng/L	101	(60-140)		
LCS2	Clofibric Acid		100	104	ng/L	104	(60-140)	40	2.9
MBLK	Clofibric Acid			<5	ng/L				
MRL_CHK	Clofibric Acid		5	2.72	ng/L	55	(50-150)		
MS_201709280361	Clofibric Acid	ND	200	247	ng/L	123	(60-140)		
MSD_201709280361	Clofibric Acid	ND	200	233	ng/L	117	(60-140)	40	5.8
LCS1	Diclofenac		100	103	ng/L	103	(60-140)		
LCS2	Diclofenac		100	113	ng/L	113	(60-140)	40	9.3
MBLK	Diclofenac			<5	ng/L				
MRL_CHK	Diclofenac		5	2.82	ng/L	56	(50-150)		
MS_201709280361	Diclofenac	ND	200	233	ng/L	116	(60-140)		
MSD_201709280361	Diclofenac	ND	200	233	ng/L	116	(60-140)	40	0.0
LCS1	Estradiol		100	101	ng/L	101	(60-140)		
LCS2	Estradiol		100	96.7	ng/L	97	(60-140)	40	4.3
MBLK	Estradiol			<5	ng/L				
MRL_CHK	Estradiol		5	6.83	ng/L	137	(50-150)		
MS_201709280361	Estradiol	ND	200	189	ng/L	93	(60-140)		

Spike recovery is already corrected for native results.
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Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
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Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MSD_201709280361	Estradiol	ND	200	194	ng/L	96	(60-140)	40	2.6
LCS1	Estrone		100	91.6	ng/L	92	(60-140)		
LCS2	Estrone		100	98.7	ng/L	99	(60-140)	40	7.3
MBLK	Estrone			<5	ng/L				
MRL_CHK	Estrone		5	4.34	ng/L	87	(50-150)		
MS_201709280361	Estrone	ND	200	187	ng/L	92	(60-140)		
MSD_201709280361	Estrone	ND	200	189	ng/L	93	(60-140)	40	1.1
LCS1	Ethinyl Estradiol - 17 alpha		100	106	ng/L	107	(60-140)		
LCS2	Ethinyl Estradiol - 17 alpha		100	100	ng/L	100	(60-140)	40	6.8
MBLK	Ethinyl Estradiol - 17 alpha			<5	ng/L				
MRL_CHK	Ethinyl Estradiol - 17 alpha		5	4.89	ng/L	98	(50-150)		
MS_201709280361	Ethinyl Estradiol - 17 alpha	ND	200	252	ng/L	126	(60-140)		
MSD_201709280361	Ethinyl Estradiol - 17 alpha	ND	200	165	ng/L	82	(60-140)	40	**42**
LCS1	Ethylparaben		400	401	ng/L	100	(60-140)		
LCS2	Ethylparaben		400	430	ng/L	108	(60-140)	40	7.0
MBLK	Ethylparaben			<20	ng/L				
MRL_CHK	Ethylparaben		20	12.6	ng/L	63	(50-150)		
MS_201709280361	Ethylparaben	ND	800	1020	ng/L	128	(60-140)		
MSD_201709280361	Ethylparaben	ND	800	1000	ng/L	125	(60-140)	40	2.0
LCS1	Gemfibrozil		100	115	ng/L	115	(60-140)		
LCS2	Gemfibrozil		100	123	ng/L	123	(60-140)	40	6.7
MBLK	Gemfibrozil			<5	ng/L				
MRL_CHK	Gemfibrozil		5	5.72	ng/L	114	(50-150)		
MS_201709280361	Gemfibrozil	ND	200	304	ng/L	**151**	(60-140)		
MSD_201709280361	Gemfibrozil	ND	200	312	ng/L	**155**	(60-140)	40	2.6
LCS1	Ibuprofen		200	192	ng/L	96	(60-140)		
LCS2	Ibuprofen		200	203	ng/L	102	(60-140)	40	5.6
MBLK	Ibuprofen			<15	ng/L				
MRL_CHK	Ibuprofen		10	7.89	ng/L	79	(50-150)		
MS_201709280361	Ibuprofen	ND	400	427	ng/L	107	(60-140)		
MSD_201709280361	Ibuprofen	ND	400	421	ng/L	105	(60-140)	40	1.4
LCS1	Iohexal		200	193	ng/L	97	(60-140)		
LCS2	Iohexal		200	192	ng/L	96	(60-140)	40	0.52
MBLK	Iohexal			<10	ng/L				
MRL_CHK	Iohexal		10	7.26	ng/L	73	(50-150)		
MS_201709280361	Iohexal	ND	400	60.1	ng/L	**15**	(50-150)		
MSD_201709280361	Iohexal	ND	400	240	ng/L	60	(50-150)	50	**120**
LCS1	Iopromide		100	90.3	ng/L	90	(60-140)		

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Laboratory QC

Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS2	Iopromide		100	138	ng/L	139	(60-140)	40	**43**
MBLK	Iopromide			<5	ng/L				
MRL_CHK	Iopromide		5	2.57	ng/L	51	(50-150)		
MS_201709280361	Iopromide	ND	200	257	ng/L	128	(50-150)		
MSD_201709280361	Iopromide	ND	200	222	ng/L	111	(50-150)	50	15
LCS1	Isobutylparaben		100	99.1	ng/L	99	(60-140)		
LCS2	Isobutylparaben		100	102	ng/L	102	(60-140)	40	2.9
MBLK	Isobutylparaben			<5	ng/L				
MRL_CHK	Isobutylparaben		5	2.99	ng/L	60	(50-150)		
MS_201709280361	Isobutylparaben	ND	200	230	ng/L	115	(60-140)		
MSD_201709280361	Isobutylparaben	ND	200	224	ng/L	112	(60-140)	40	2.6
LCS1	Lipitor (Atorvastain)		100	154	ng/L	**154**	(60-140)		
LCS2	Lipitor (Atorvastain)		100	160	ng/L	**160**	(60-140)	40	3.8
MBLK	Lipitor (Atorvastain)			<5	ng/L				
MRL_CHK	Lipitor (Atorvastain)		5	8.90	ng/L	**178**	(50-150)		
MS_201709280361	Lipitor (Atorvastain)	ND	200	82.4	ng/L	**41**	(60-140)		
MSD_201709280361	Lipitor (Atorvastain)	ND	200	115	ng/L	**58**	(60-140)	40	33
LCS1	Methylparaben		400	410	ng/L	103	(60-140)		
LCS2	Methylparaben		400	440	ng/L	110	(60-140)	40	7.1
MBLK	Methylparaben			<20	ng/L				
MRL_CHK	Methylparaben		20	13.2	ng/L	66	(50-150)		
MS_201709280361	Methylparaben	ND	800	916	ng/L	115	(60-140)		
MSD_201709280361	Methylparaben	ND	800	895	ng/L	112	(60-140)	40	2.3
LCS1	Naproxen		200	194	ng/L	97	(60-140)		
LCS2	Naproxen		200	205	ng/L	103	(60-140)	40	5.5
MBLK	Naproxen			<10	ng/L				
MRL_CHK	Naproxen		10	6.83	ng/L	68	(50-150)		
MS_201709280361	Naproxen	ND	400	392	ng/L	98	(60-140)		
MSD_201709280361	Naproxen	ND	400	402	ng/L	101	(60-140)	40	2.5
LCS1	Propylparaben		100	107	ng/L	107	(60-140)		
LCS2	Propylparaben		100	112	ng/L	112	(60-140)	40	4.6
MBLK	Propylparaben			<5	ng/L				
MRL_CHK	Propylparaben		5	2.66	ng/L	53	(50-150)		
MS_201709280361	Propylparaben	ND	200	252	ng/L	126	(60-140)		
MSD_201709280361	Propylparaben	ND	200	242	ng/L	121	(60-140)	40	4.0
LCS1	Salicylic Acid		2000	2030	ng/L	101	(60-140)		
LCS2	Salicylic Acid		2000	2130	ng/L	106	(60-140)	40	4.8
MBLK	Salicylic Acid			<100	ng/L				

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Laboratory QC

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Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MRL_CHK	Salicylic Acid		100	125	ng/L	125	(50-150)		
MS_201709280361	Salicylic Acid	ND	4000	3760	ng/L	94	(60-140)		
MSD_201709280361	Salicylic Acid	ND	4000	3470	ng/L	87	(60-140)	40	8.0
LCS1	Sucralose		2000	2730	ng/L	136	(60-140)		
LCS2	Sucralose		2000	2700	ng/L	135	(60-140)	40	1.1
MBLK	Sucralose			<100	ng/L				
MRL_CHK	Sucralose		100	135	ng/L	135	(50-150)		
MS_201709280361	Sucralose	ND	4000	9570	ng/L	**239**	(60-140)		
MSD_201709280361	Sucralose	ND	4000	8110	ng/L	**203**	(60-140)	40	17
LCS1	Triclocarban		100	94.1	ng/L	94	(60-140)		
LCS2	Triclocarban		100	120	ng/L	120	(60-140)	40	24
MBLK	Triclocarban			<5	ng/L				
MRL_CHK	Triclocarban		5	4.93	ng/L	99	(50-150)		
MS_201709280361	Triclocarban	ND	200	276	ng/L	138	(60-140)		
MSD_201709280361	Triclocarban	ND	200	342	ng/L	**171**	(60-140)	40	21
LCS1	Triclosan		200	216	ng/L	108	(60-140)		
LCS2	Triclosan		200	204	ng/L	102	(60-140)	40	5.7
MBLK	Triclosan			<10	ng/L				
MRL_CHK	Triclosan		10	7.07	ng/L	71	(50-150)		
MS_201709280361	Triclosan	ND	400	360	ng/L	90	(60-140)		
MSD_201709280361	Triclosan	ND	400	364	ng/L	91	(60-140)	40	1.1
LCS1	Warfarin		100	93.0	ng/L	93	(60-140)		
LCS2	Warfarin		100	101	ng/L	101	(60-140)	40	8.3
MBLK	Warfarin			<5	ng/L				
MRL_CHK	Warfarin		5	2.57	ng/L	51	(50-150)		
MS_201709280361	Warfarin	ND	200	325	ng/L	**162**	(60-140)		
MSD_201709280361	Warfarin	ND	200	286	ng/L	**143**	(60-140)	40	13

Endocrine Disruptors Positive Mode - SPE by LC-MS-MS

Analytical Batch: 1034800 **Analysis Date: 01/10/2017**

LCS1	1,7-Dimethylxanthine		100	86.1	ng/L	86	(60-140)		
LCS2	1,7-Dimethylxanthine		100	96.9	ng/L	97	(60-140)	30	12
MBLK	1,7-Dimethylxanthine			<5	ng/L				
MRL_CHK	1,7-Dimethylxanthine		5	4.44	ng/L	89	(50-150)		
MS_201709280361	1,7-Dimethylxanthine	ND	200	133	ng/L	67	(60-140)		
MSD_201709280361	1,7-Dimethylxanthine	ND	200	123	ng/L	61	(60-140)	40	7.8
LCS1	Acetaminophen		100	99.4	ng/L	99	(60-140)		
LCS2	Acetaminophen		100	96.3	ng/L	96	(60-140)	30	3.2

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Acetaminophen			<5	ng/L				
MRL_CHK	Acetaminophen		5	2.86	ng/L	57	(50-150)		
MS_201709280361	Acetaminophen	ND	200	174	ng/L	87	(60-140)		
MSD_201709280361	Acetaminophen	ND	200	180	ng/L	90	(60-140)	40	3.4
LCS1	Albuterol		100	97.7	ng/L	98	(60-140)		
LCS2	Albuterol		100	115	ng/L	115	(60-140)	30	16
MBLK	Albuterol			<5	ng/L				
MRL_CHK	Albuterol		5	2.50	ng/L	50	(50-150)		
MS_201709280361	Albuterol	ND	200	181	ng/L	90	(60-140)		
MSD_201709280361	Albuterol	ND	200	133	ng/L	67	(60-140)	40	31
LCS1	Amoxicillin (semi-quantitative)		400	395	ng/L	99	(60-140)		
LCS2	Amoxicillin (semi-quantitative)		400	362	ng/L	90	(60-140)	30	8.7
MBLK	Amoxicillin (semi-quantitative)			<20	ng/L				
MRL_CHK	Amoxicillin (semi-quantitative)		20	22.1	ng/L	111	(50-150)		
LCS1	Andorostenedione		100	91.5	ng/L	92	(60-140)		
LCS2	Andorostenedione		100	107	ng/L	107	(60-140)	30	16
MBLK	Andorostenedione			<5	ng/L				
MRL_CHK	Andorostenedione		5	2.60	ng/L	52	(50-150)		
MS_201709280361	Andorostenedione	ND	200	259	ng/L	130	(60-140)		
MSD_201709280361	Andorostenedione	ND	200	231	ng/L	115	(60-140)	40	11
LCS1	Atenolol		100	91.8	ng/L	92	(60-140)		
LCS2	Atenolol		100	94.6	ng/L	95	(60-140)	30	3.0
MBLK	Atenolol			<5	ng/L				
MRL_CHK	Atenolol		5	2.99	ng/L	60	(50-150)		
MS_201709280361	Atenolol	ND	200	237	ng/L	118	(60-140)		
MSD_201709280361	Atenolol	ND	200	233	ng/L	116	(60-140)	40	1.7
LCS1	Atrazine		100	98.0	ng/L	98	(60-140)		
LCS2	Atrazine		100	105	ng/L	105	(60-140)	30	6.9
MBLK	Atrazine			<5	ng/L				
MRL_CHK	Atrazine		5	3.25	ng/L	65	(50-150)		
MS_201709280361	Atrazine	ND	200	137	ng/L	69	(60-140)		
MSD_201709280361	Atrazine	ND	200	140	ng/L	70	(60-140)	40	2.2
LCS1	Bezafibrate		100	102	ng/L	102	(60-140)		
LCS2	Bezafibrate		100	116	ng/L	116	(60-140)	30	13
MBLK	Bezafibrate			<5	ng/L				
MRL_CHK	Bezafibrate		5	3.02	ng/L	60	(50-150)		
MS_201709280361	Bezafibrate	ND	200	289	ng/L	**144**	(60-140)		
MSD_201709280361	Bezafibrate	ND	200	285	ng/L	**143**	(60-140)	40	1.4

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Bromacil		100	104	ng/L	105	(60-140)		
LCS2	Bromacil		100	116	ng/L	116	(60-140)	30	9.9
MBLK	Bromacil			<5	ng/L				
MRL_CHK	Bromacil		5	3.01	ng/L	60	(50-150)		
MS_201709280361	Bromacil	ND	200	224	ng/L	112	(60-140)		
MSD_201709280361	Bromacil	ND	200	215	ng/L	107	(60-140)	40	4.1
LCS1	Caffeine		100	99.1	ng/L	99	(60-140)		
LCS2	Caffeine		100	68.5	ng/L	69	(60-140)	30	**37**
MBLK	Caffeine			<5	ng/L				
MRL_CHK	Caffeine		5	4.93	ng/L	99	(50-150)		
MS_201709280361	Caffeine	ND	200	27.3	ng/L	**14**	(60-140)		
MSD_201709280361	Caffeine	ND	200	27.3	ng/L	**14**	(60-140)	40	0.0
LCS1	Carbadox		100	97.3	ng/L	97	(60-140)		
LCS2	Carbadox		100	107	ng/L	107	(60-140)	30	9.5
MBLK	Carbadox			<5	ng/L				
MRL_CHK	Carbadox		5	3.18	ng/L	64	(50-150)		
MS_201709280361	Carbadox	ND	200	248	ng/L	123	(60-140)		
MSD_201709280361	Carbadox	ND	200	221	ng/L	109	(60-140)	40	12
LCS1	Carbamazepine		100	113	ng/L	113	(60-140)		
LCS2	Carbamazepine		100	101	ng/L	101	(60-140)	30	11
MBLK	Carbamazepine			<5	ng/L				
MRL_CHK	Carbamazepine		5	3.47	ng/L	69	(50-150)		
MS_201709280361	Carbamazepine	ND	200	186	ng/L	93	(60-140)		
MSD_201709280361	Carbamazepine	ND	200	199	ng/L	100	(60-140)	40	6.8
LCS1	Carisoprodol		100	102	ng/L	102	(60-140)		
LCS2	Carisoprodol		100	97.5	ng/L	98	(60-140)	30	4.5
MBLK	Carisoprodol			<5	ng/L				
MRL_CHK	Carisoprodol		5	4.10	ng/L	82	(50-150)		
MS_201709280361	Carisoprodol	ND	200	322	ng/L	**161**	(60-140)		
MSD_201709280361	Carisoprodol	ND	200	330	ng/L	**165**	(60-140)	40	2.5
LCS1	Chloridazon		100	102	ng/L	102	(60-140)		
LCS2	Chloridazon		100	98.6	ng/L	99	(60-140)	30	3.4
MBLK	Chloridazon			<5	ng/L				
MRL_CHK	Chloridazon		5	3.13	ng/L	63	(50-150)		
MS_201709280361	Chloridazon	24	200	156	ng/L	66	(60-140)		
MSD_201709280361	Chloridazon	24	200	164	ng/L	70	(60-140)	40	5.0
LCS1	Chlorotoluron		100	105	ng/L	105	(60-140)		
LCS2	Chlorotoluron		100	119	ng/L	119	(60-140)	30	13

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Chlorotoluron			<5	ng/L				
MRL_CHK	Chlorotoluron		5	3.21	ng/L	64	(50-150)		
MS_201709280361	Chlorotoluron	ND	200	231	ng/L	115	(60-140)		
MSD_201709280361	Chlorotoluron	ND	200	232	ng/L	116	(60-140)	40	0.43
LCS1	Cimetidine		100	94.2	ng/L	94	(60-140)		
LCS2	Cimetidine		100	97.4	ng/L	97	(60-140)	30	3.3
MBLK	Cimetidine			<5	ng/L				
MRL_CHK	Cimetidine		5	5.54	ng/L	111	(50-150)		
MS_201709280361	Cimetidine	ND	200	0	ng/L	**0**	(60-140)		
MSD_201709280361	Cimetidine	ND	200	0	ng/L	**0**	(60-140)	40	**1000**
LCS1	Cotinine		200	208	ng/L	104	(60-140)		
LCS2	Cotinine		200	205	ng/L	102	(60-140)	30	1.5
MBLK	Cotinine			<10	ng/L				
MRL_CHK	Cotinine		10	6.04	ng/L	61	(50-150)		
MS_201709280361	Cotinine	ND	400	390	ng/L	98	(60-140)		
MSD_201709280361	Cotinine	ND	400	345	ng/L	86	(60-140)	40	12
LCS1	Cyanazine		100	108	ng/L	109	(60-140)		
LCS2	Cyanazine		100	106	ng/L	106	(60-140)	30	2.8
MBLK	Cyanazine			<5	ng/L				
MRL_CHK	Cyanazine		5	3.76	ng/L	75	(50-150)		
MS_201709280361	Cyanazine	ND	200	340	ng/L	**170**	(60-140)		
MSD_201709280361	Cyanazine	ND	200	324	ng/L	**162**	(60-140)	40	4.8
LCS1	DACT		100	98.9	ng/L	99	(60-140)		
LCS2	DACT		100	89.4	ng/L	89	(60-140)	30	10
MBLK	DACT			<5	ng/L				
MRL_CHK	DACT		5	3.94	ng/L	79	(50-150)		
MS_201709280361	DACT	ND	200	132	ng/L	66	(60-140)		
MSD_201709280361	DACT	ND	200	126	ng/L	63	(60-140)	40	4.7
LCS1	DEA		100	106	ng/L	106	(60-140)		
LCS2	DEA		100	108	ng/L	108	(60-140)	30	1.9
MBLK	DEA			<5	ng/L				
MRL_CHK	DEA		5	2.82	ng/L	56	(50-150)		
MS_201709280361	DEA	ND	200	195	ng/L	98	(60-140)		
MSD_201709280361	DEA	ND	200	173	ng/L	87	(60-140)	40	12
LCS1	DEET		40	38.5	ng/L	96	(60-140)		
LCS2	DEET		40	36.0	ng/L	90	(60-140)	30	6.4
MBLK	DEET			<10	ng/L				
MRL_CHK	DEET		2	1.43	ng/L	71	(50-150)		

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Report: 689524
Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709280361	DEET	ND	80	79.8	ng/L	100	(60-140)		
MSD_201709280361	DEET	ND	80	72.3	ng/L	90	(60-140)	40	9.9
LCS1	Dehydronifedipine		100	112	ng/L	113	(60-140)		
LCS2	Dehydronifedipine		100	109	ng/L	109	(60-140)	30	3.6
MBLK	Dehydronifedipine			<5	ng/L				
MRL_CHK	Dehydronifedipine		5	3.71	ng/L	74	(50-150)		
MS_201709280361	Dehydronifedipine	ND	200	194	ng/L	97	(60-140)		
MSD_201709280361	Dehydronifedipine	ND	200	216	ng/L	108	(60-140)	40	11
LCS1	DIA		100	108	ng/L	108	(60-140)		
LCS2	DIA		100	95.4	ng/L	95	(60-140)	30	12
MBLK	DIA			<5	ng/L				
MRL_CHK	DIA		5	3.76	ng/L	75	(50-150)		
MS_201709280361	DIA	ND	200	168	ng/L	84	(60-140)		
MSD_201709280361	DIA	ND	200	155	ng/L	78	(60-140)	40	8.1
LCS1	Diazepam		100	107	ng/L	107	(60-140)		
LCS2	Diazepam		100	115	ng/L	115	(60-140)	30	7.2
MBLK	Diazepam			<5	ng/L				
MRL_CHK	Diazepam		5	2.91	ng/L	58	(50-150)		
MS_201709280361	Diazepam	ND	200	222	ng/L	111	(60-140)		
MSD_201709280361	Diazepam	ND	200	208	ng/L	104	(60-140)	40	6.5
LCS1	Dilantin		400	417	ng/L	104	(60-140)		
LCS2	Dilantin		400	444	ng/L	111	(60-140)	30	6.3
MBLK	Dilantin			<20	ng/L				
MRL_CHK	Dilantin		20	18.5	ng/L	93	(50-150)		
MS_201709280361	Dilantin	ND	800	875	ng/L	109	(60-140)		
MSD_201709280361	Dilantin	ND	800	830	ng/L	104	(60-140)	40	5.3
LCS1	Diltiazem		100	99.0	ng/L	99	(60-140)		
LCS2	Diltiazem		100	85.2	ng/L	85	(60-140)	30	15
MBLK	Diltiazem			<5	ng/L				
MRL_CHK	Diltiazem		5	3.58	ng/L	72	(50-150)		
MS_201709280361	Diltiazem	ND	200	357	ng/L	**178**	(60-140)		
MSD_201709280361	Diltiazem	ND	200	325	ng/L	**162**	(60-140)	40	9.4
LCS1	Diuron		100	107	ng/L	107	(60-140)		
LCS2	Diuron		100	107	ng/L	107	(60-140)	30	0.0
MBLK	Diuron			<5	ng/L				
MRL_CHK	Diuron		5	3.28	ng/L	66	(50-150)		
MS_201709280361	Diuron	ND	200	210	ng/L	105	(60-140)		
MSD_201709280361	Diuron	ND	200	210	ng/L	105	(60-140)	40	0.48

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Erythromycin		200	237	ng/L	119	(60-140)		
LCS2	Erythromycin		200	206	ng/L	103	(60-140)	30	14
MBLK	Erythromycin			<10	ng/L				
MRL_CHK	Erythromycin		10	6.49	ng/L	65	(50-150)		
MS_201709280361	Erythromycin	ND	400	728	ng/L	**182**	(60-140)		
MSD_201709280361	Erythromycin	ND	400	669	ng/L	**167**	(60-140)	40	8.4
LCS1	Flumeqine		200	199	ng/L	99	(60-140)		
LCS2	Flumeqine		200	175	ng/L	87	(60-140)	30	13
MBLK	Flumeqine			<10	ng/L				
MRL_CHK	Flumeqine		10	10.9	ng/L	109	(50-150)		
MS_201709280361	Flumeqine	ND	400	234	ng/L	**59**	(60-140)		
MSD_201709280361	Flumeqine	ND	400	247	ng/L	62	(60-140)	40	5.4
LCS1	Fluoxetine		100	95.8	ng/L	96	(60-140)		
LCS2	Fluoxetine		100	91.5	ng/L	92	(60-140)	30	4.7
MBLK	Fluoxetine			<10	ng/L				
MRL_CHK	Fluoxetine		5	2.96	ng/L	59	(50-150)		
MS_201709280361	Fluoxetine	ND	200	536	ng/L	**268**	(60-140)		
MSD_201709280361	Fluoxetine	ND	200	486	ng/L	**243**	(60-140)	40	9.8
LCS1	Isoproturon		400	432	ng/L	108	(60-140)		
LCS2	Isoproturon		400	417	ng/L	104	(60-140)	30	3.8
MBLK	Isoproturon			<20	ng/L				
MRL_CHK	Isoproturon		20	11.0	ng/L	55	(50-150)		
MS_201709280361	Isoproturon	ND	800	948	ng/L	118	(60-140)		
MSD_201709280361	Isoproturon	ND	800	890	ng/L	111	(60-140)	40	6.3
LCS1	Ketoprofen		100	97.0	ng/L	97	(60-140)		
LCS2	Ketoprofen		100	92.0	ng/L	92	(60-140)	30	5.3
MBLK	Ketoprofen			<5	ng/L				
MRL_CHK	Ketoprofen		5	4.42	ng/L	88	(50-150)		
MS_201709280361	Ketoprofen	ND	200	193	ng/L	96	(60-140)		
MSD_201709280361	Ketoprofen	ND	200	202	ng/L	101	(60-140)	40	4.6
LCS1	Ketorolac		100	116	ng/L	116	(60-140)		
LCS2	Ketorolac		100	104	ng/L	104	(60-140)	30	11
MBLK	Ketorolac			<5	ng/L				
MRL_CHK	Ketorolac		5	3.17	ng/L	63	(50-150)		
MS_201709280361	Ketorolac	ND	200	228	ng/L	111	(60-140)		
MSD_201709280361	Ketorolac	ND	200	211	ng/L	103	(60-140)	40	7.7
LCS1	Lidocaine		100	106	ng/L	106	(60-140)		
LCS2	Lidocaine		100	107	ng/L	107	(60-140)	30	0.94

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Lidocaine			<5	ng/L				
MRL_CHK	Lidocaine		5	2.89	ng/L	58	(50-150)		
MS_201709280361	Lidocaine	ND	200	222	ng/L	111	(60-140)		
MSD_201709280361	Lidocaine	ND	200	180	ng/L	90	(60-140)	40	21
LCS1	Lincomycin		200	183	ng/L	92	(60-140)		
LCS2	Lincomycin		200	232	ng/L	116	(60-140)	30	24
MBLK	Lincomycin			<10	ng/L				
MRL_CHK	Lincomycin		10	11.7	ng/L	117	(50-150)		
MS_201709280361	Lincomycin	ND	400	240	ng/L	60	(60-140)		
MSD_201709280361	Lincomycin	ND	400	207	ng/L	**52**	(60-140)	40	15
LCS1	Linuron		100	103	ng/L	103	(60-140)		
LCS2	Linuron		100	104	ng/L	104	(60-140)	30	0.97
MBLK	Linuron			<5	ng/L				
MRL_CHK	Linuron		5	4.12	ng/L	83	(50-150)		
MS_201709280361	Linuron	ND	200	208	ng/L	104	(60-140)		
MSD_201709280361	Linuron	ND	200	195	ng/L	98	(60-140)	40	6.9
LCS1	Lopressor		400	391	ng/L	98	(60-140)		
LCS2	Lopressor		400	372	ng/L	93	(60-140)	30	5.0
MBLK	Lopressor			<20	ng/L				
MRL_CHK	Lopressor		20	15.5	ng/L	78	(50-150)		
MS_201709280361	Lopressor	ND	800	753	ng/L	94	(60-140)		
MSD_201709280361	Lopressor	ND	800	700	ng/L	88	(60-140)	40	7.3
LCS1	Meclofenamic Acid		100	103	ng/L	103	(60-140)		
LCS2	Meclofenamic Acid		100	114	ng/L	114	(60-140)	30	10
MBLK	Meclofenamic Acid			<5	ng/L				
MRL_CHK	Meclofenamic Acid		5	2.96	ng/L	59	(50-150)		
MS_201709280361	Meclofenamic Acid	ND	200	229	ng/L	114	(60-140)		
MSD_201709280361	Meclofenamic Acid	ND	200	231	ng/L	116	(60-140)	40	0.87
LCS1	Meprobamate		100	113	ng/L	113	(60-140)		
LCS2	Meprobamate		100	106	ng/L	106	(60-140)	30	6.4
MBLK	Meprobamate			<5	ng/L				
MRL_CHK	Meprobamate		5	4.98	ng/L	100	(50-150)		
MS_201709280361	Meprobamate	ND	200	253	ng/L	126	(60-140)		
MSD_201709280361	Meprobamate	ND	200	291	ng/L	**146**	(60-140)	40	14
LCS1	Metazachlor		100	114	ng/L	114	(60-140)		
LCS2	Metazachlor		100	105	ng/L	105	(60-140)	30	8.2
MBLK	Metazachlor			<5	ng/L				
MRL_CHK	Metazachlor		5	3.13	ng/L	63	(50-150)		

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Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709280361	Metazachlor	ND	200	247	ng/L	124	(60-140)		
MSD_201709280361	Metazachlor	ND	200	229	ng/L	114	(60-140)	40	7.6
LCS1	Metolachlor		100	104	ng/L	104	(60-140)		
LCS2	Metolachlor		100	102	ng/L	102	(60-140)	30	1.9
MBLK	Metolachlor			<5	ng/L				
MRL_CHK	Metolachlor		5	3.32	ng/L	66	(50-150)		
MS_201709280361	Metolachlor	ND	200	203	ng/L	102	(60-140)		
MSD_201709280361	Metolachlor	ND	200	202	ng/L	101	(60-140)	40	0.49
LCS1	Nifedipine		400	267	ng/L	67	(60-140)		
LCS2	Nifedipine		400	267	ng/L	67	(60-140)	30	0.0
MBLK	Nifedipine			<20	ng/L				
MRL_CHK	Nifedipine		20	11.6	ng/L	58	(50-150)		
MS_201709280361	Nifedipine	ND	800	897	ng/L	112	(60-140)		
MSD_201709280361	Nifedipine	ND	800	915	ng/L	114	(60-140)	40	1.9
LCS1	Norethisterone		100	116	ng/L	116	(60-140)		
LCS2	Norethisterone		100	106	ng/L	106	(60-140)	30	9.0
MBLK	Norethisterone			<5	ng/L				
MRL_CHK	Norethisterone		5	5.89	ng/L	118	(50-150)		
MS_201709280361	Norethisterone	ND	200	262	ng/L	131	(60-140)		
MSD_201709280361	Norethisterone	ND	200	261	ng/L	130	(60-140)	40	0.76
LCS1	Oxolinic acid		100	104	ng/L	104	(60-140)		
LCS2	Oxolinic acid		100	85.5	ng/L	86	(60-140)	30	20
MBLK	Oxolinic acid			<5	ng/L				
MRL_CHK	Oxolinic acid		5	2.54	ng/L	51	(50-150)		
MS_201709280361	Oxolinic acid	ND	200	264	ng/L	132	(60-140)		
MSD_201709280361	Oxolinic acid	ND	200	275	ng/L	138	(60-140)	40	4.1
LCS1	Pentoxifylline		100	101	ng/L	101	(60-140)		
LCS2	Pentoxifylline		100	77.4	ng/L	78	(60-140)	30	26
MBLK	Pentoxifylline			<5	ng/L				
MRL_CHK	Pentoxifylline		5	2.66	ng/L	53	(50-150)		
MS_201709280361	Pentoxifylline	ND	200	406	ng/L	**203**	(60-140)		
MSD_201709280361	Pentoxifylline	ND	200	375	ng/L	**188**	(60-140)	40	7.9
LCS1	Phenazone		100	109	ng/L	109	(60-140)		
LCS2	Phenazone		100	96.3	ng/L	96	(60-140)	30	12
MBLK	Phenazone			<5	ng/L				
MRL_CHK	Phenazone		5	3.88	ng/L	78	(50-150)		
MS_201709280361	Phenazone	ND	200	119	ng/L	**59**	(60-140)		
MSD_201709280361	Phenazone	ND	200	123	ng/L	61	(60-140)	40	3.3

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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Primidone		100	104	ng/L	104	(60-140)		
LCS2	Primidone		100	110	ng/L	110	(60-140)	30	5.6
MBLK	Primidone			<5	ng/L				
MRL_CHK	Primidone		5	3.03	ng/L	61	(50-150)		
MS_201709280361	Primidone	ND	200	239	ng/L	120	(60-140)		
MSD_201709280361	Primidone	ND	200	249	ng/L	125	(60-140)	40	4.1
LCS1	Progesterone		100	111	ng/L	111	(60-140)		
LCS2	Progesterone		100	95.8	ng/L	96	(60-140)	30	15
MBLK	Progesterone			<5	ng/L				
MRL_CHK	Progesterone		5	3.16	ng/L	63	(50-150)		
MS_201709280361	Progesterone	ND	200	202	ng/L	101	(60-140)		
MSD_201709280361	Progesterone	ND	200	205	ng/L	102	(60-140)	40	1.5
LCS1	Propazine		100	95.6	ng/L	96	(60-140)		
LCS2	Propazine		100	100	ng/L	101	(60-140)	30	5.4
MBLK	Propazine			<5	ng/L				
MRL_CHK	Propazine		5	4.36	ng/L	87	(50-150)		
MS_201709280361	Propazine	ND	200	186	ng/L	93	(60-140)		
MSD_201709280361	Propazine	ND	200	200	ng/L	100	(60-140)	40	7.8
LCS1	Quinoline		100	102	ng/L	102	(60-140)		
LCS2	Quinoline		100	97.6	ng/L	98	(60-140)	30	4.4
MBLK	Quinoline			<5	ng/L				
MRL_CHK	Quinoline		5	2.95	ng/L	59	(50-150)		
MS_201709280361	Quinoline	ND	200	225	ng/L	112	(60-140)		
MSD_201709280361	Quinoline	ND	200	194	ng/L	97	(60-140)	40	15
LCS1	Simazine		100	99.8	ng/L	100	(60-140)		
LCS2	Simazine		100	102	ng/L	102	(60-140)	30	2.2
MBLK	Simazine			<5	ng/L				
MRL_CHK	Simazine		5	2.70	ng/L	54	(50-150)		
MS_201709280361	Simazine	ND	200	169	ng/L	85	(60-140)		
MSD_201709280361	Simazine	ND	200	169	ng/L	85	(60-140)	40	0.0
LCS1	Sulfachloropyridazine		100	92.2	ng/L	92	(60-140)		
LCS2	Sulfachloropyridazine		100	98.2	ng/L	98	(60-140)	30	6.3
MBLK	Sulfachloropyridazine			<5	ng/L				
MRL_CHK	Sulfachloropyridazine		5	4.07	ng/L	81	(50-150)		
MS_201709280361	Sulfachloropyridazine	ND	200	142	ng/L	71	(60-140)		
MSD_201709280361	Sulfachloropyridazine	ND	200	145	ng/L	73	(60-140)	40	2.1
LCS1	Sulfadiazine		100	106	ng/L	106	(60-140)		
LCS2	Sulfadiazine		100	108	ng/L	109	(60-140)	30	2.8

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QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MBLK	Sulfadiazine			<5	ng/L				
MRL_CHK	Sulfadiazine		5	5.25	ng/L	105	(50-150)		
MS_201709280361	Sulfadiazine	ND	200	82.6	ng/L	**41**	(60-140)		
MSD_201709280361	Sulfadiazine	ND	200	67.3	ng/L	**34**	(60-140)	40	20
LCS1	Sulfadimethoxine		100	96.9	ng/L	97	(60-140)		
LCS2	Sulfadimethoxine		100	100	ng/L	100	(60-140)	30	3.1
MBLK	Sulfadimethoxine			<5	ng/L				
MRL_CHK	Sulfadimethoxine		5	4.00	ng/L	80	(50-150)		
MS_201709280361	Sulfadimethoxine	ND	200	319	ng/L	**159**	(60-140)		
MSD_201709280361	Sulfadimethoxine	ND	200	285	ng/L	**143**	(60-140)	40	11
LCS1	Sulfamerazine		100	118	ng/L	118	(60-140)		
LCS2	Sulfamerazine		100	104	ng/L	104	(60-140)	30	13
MBLK	Sulfamerazine			<5	ng/L				
MRL_CHK	Sulfamerazine		5	2.51	ng/L	50	(50-150)		
MS_201709280361	Sulfamerazine	ND	200	22.9	ng/L	**11**	(60-140)		
MSD_201709280361	Sulfamerazine	ND	200	24.0	ng/L	**12**	(60-140)	40	4.7
LCS1	Sulfamethazine		100	97.6	ng/L	98	(60-140)		
LCS2	Sulfamethazine		100	108	ng/L	108	(60-140)	30	10
MBLK	Sulfamethazine			<5	ng/L				
MRL_CHK	Sulfamethazine		5	3.71	ng/L	74	(50-150)		
MS_201709280361	Sulfamethazine	ND	200	167	ng/L	83	(60-140)		
MSD_201709280361	Sulfamethazine	ND	200	183	ng/L	92	(60-140)	40	9.1
LCS1	Sulfamethizole		100	107	ng/L	107	(60-140)		
LCS2	Sulfamethizole		100	118	ng/L	119	(60-140)	30	11
MBLK	Sulfamethizole			<5	ng/L				
MRL_CHK	Sulfamethizole		5	3.13	ng/L	63	(50-150)		
MS_201709280361	Sulfamethizole	ND	200	156	ng/L	78	(60-140)		
MSD_201709280361	Sulfamethizole	ND	200	162	ng/L	81	(60-140)	40	3.8
LCS1	Sulfamethoxazole		100	103	ng/L	103	(60-140)		
LCS2	Sulfamethoxazole		100	97.7	ng/L	98	(60-140)	30	5.3
MBLK	Sulfamethoxazole			<5	ng/L				
MRL_CHK	Sulfamethoxazole		5	3.23	ng/L	65	(50-150)		
MS_201709280361	Sulfamethoxazole	ND	200	223	ng/L	112	(60-140)		
MSD_201709280361	Sulfamethoxazole	ND	200	224	ng/L	112	(60-140)	40	0.45
LCS1	Sulfathiazole		100	102	ng/L	102	(60-140)		
LCS2	Sulfathiazole		100	112	ng/L	112	(60-140)	30	9.3
MBLK	Sulfathiazole			<5	ng/L				
MRL_CHK	Sulfathiazole		5	3.15	ng/L	63	(50-150)		

Spike recovery is already corrected for native results.
Spikes which exceed Limits and Method Blanks with positive results are highlighted by Underlining.
Criteria for MS and Dup are advisory only, batch control is based on LCS. Criteria for duplicates are advisory only, unless otherwise specified in the method.
RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
(S) - Indicates surrogate compound.
(I) - Indicates internal standard compound.

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Project: PPCP-HAWAII
Group: Maui

State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
MS_201709280361	Sulfathiazole	20	200	18.3	ng/L	**-0.972**	(60-140)		
MSD_201709280361	Sulfathiazole	20	200	32.4	ng/L	**6.1**	(60-140)	40	**56**
LCS1	TCEP		100	96.3	ng/L	96	(60-140)		
LCS2	TCEP		100	97.4	ng/L	97	(60-140)	30	1.1
MBLK	TCEP			<10	ng/L				
MRL_CHK	TCEP		5	3.00	ng/L	60	(50-150)		
MS_201709280361	TCEP	ND	200	215	ng/L	107	(60-140)		
MSD_201709280361	TCEP	ND	200	210	ng/L	105	(60-140)	40	2.4
LCS1	TCPP		100	98.6	ng/L	99	(40-160)		
LCS2	TCPP		100	86.0	ng/L	86	(40-160)	30	14
MBLK	TCPP			<100	ng/L				
MRL_CHK	TCPP		5	3.08	ng/L	62	(40-160)		
MS_201709280361	TCPP	ND	200	148	ng/L	74	(40-160)		
MSD_201709280361	TCPP	ND	200	133	ng/L	67	(40-160)	60	11
LCS1	TDCPP		400	453	ng/L	113	(40-160)		
LCS2	TDCPP		400	358	ng/L	90	(40-160)	30	23
MBLK	TDCPP			<100	ng/L				
MRL_CHK	TDCPP		20	20.1	ng/L	101	(40-160)		
MS_201709280361	TDCPP	ND	800	1530	ng/L	**192**	(40-160)		
MSD_201709280361	TDCPP	ND	800	1540	ng/L	**193**	(40-160)	60	0.65
LCS1	Testosterone		100	91.2	ng/L	91	(60-140)		
LCS2	Testosterone		100	96.8	ng/L	97	(60-140)	30	6.0
MBLK	Testosterone			<5	ng/L				
MRL_CHK	Testosterone		5	5.95	ng/L	119	(50-150)		
MS_201709280361	Testosterone	ND	200	262	ng/L	131	(60-140)		
MSD_201709280361	Testosterone	ND	200	237	ng/L	119	(60-140)	40	10
LCS1	Theobromine		100	79.6	ng/L	80	(60-140)		
LCS2	Theobromine		100	126	ng/L	126	(60-140)	30	**45**
MBLK	Theobromine			<5	ng/L				
MRL_CHK	Theobromine		5	2.66	ng/L	53	(50-150)		
MS_201709280361	Theobromine	ND	200	167	ng/L	84	(60-140)		
MSD_201709280361	Theobromine	ND	200	192	ng/L	96	(60-140)	40	14
LCS1	Theophylline		200	238	ng/L	119	(60-140)		
LCS2	Theophylline		200	233	ng/L	116	(60-140)	30	2.1
MBLK	Theophylline			<10	ng/L				
MRL_CHK	Theophylline		10	10.9	ng/L	109	(50-150)		
MS_201709280361	Theophylline	ND	400	323	ng/L	81	(60-140)		
MSD_201709280361	Theophylline	ND	400	325	ng/L	81	(60-140)	40	0.62

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RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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State of Hawaii DOH

QC Type	Analyte	Native	Spiked	Recovered	Units	Yield (%)	Limits (%)	RPDLimit (%)	RPD%
LCS1	Trimethoprim		100	100	ng/L	100	(60-140)		
LCS2	Trimethoprim		100	93.5	ng/L	94	(60-140)	30	6.7
MBLK	Trimethoprim			<5	ng/L				
MRL_CHK	Trimethoprim		5	3.22	ng/L	64	(50-150)		
MS_201709280361	Trimethoprim	ND	200	224	ng/L	112	(60-140)		
MSD_201709280361	Trimethoprim	ND	200	245	ng/L	122	(60-140)	40	9.0
Endocrine Disruptors Negative Mode - SPE by LC-MS-MS									
Analytical Batch: 1038517							**Analysis Date: 09/30/2017**		
LCS1	4-nonylphenol - semi quantitative		200	177	ng/L	89	(60-140)		
LCS2	4-nonylphenol - semi quantitative		200	153	ng/L	77	(60-140)	40	15
MBLK	4-nonylphenol - semi quantitative			<100	ng/L				

Spike recovery is already corrected for native results.
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RPD not calculated for LCS2 when different a concentration than LCS1 is used.
RPD not calculated for Duplicates when the result is not five times the MRL (Minimum Reporting Level).
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APPENDIX VI

Upcountry Maui Nitrogen Groundwater Flow and Transport Model Description

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Appendix VI is still under development

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