PHASE I ENVIRONMENTAL MONITORING:
April 2010 Assessment of Water Samples

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INTRODUCTION

The Boston University (BU) team, in collaboration with the Compliance Advisor/Ombudsman of IFC and MIGA (CAO), conducted a targeted water sampling effort on April 27-28, 2010 at the request of dialogue table participants. The effort focused on six locations identified by ASOCHIVIDA members during focus groups conducted by BU/CAO as being of principal concern and where there is a known community and/or worker exposure to water. Samples were analyzed at the ALS Laboratory Group's environmental laboratory in Houston, Texas (ALS).

This first phase was intended to screen a small number of water samples for a large number of contaminants, including heavy metals, pesticides, herbicides and commonly-used industrial organic compounds (including semi-volatile organic compounds [SVOCs] and volatile organic compounds [VOCs]). Water quality is a reflection of activities on land that generate pollution. For example, chemicals that run off from agricultural fields collect in streams, ditches and ponds. Thus water quality is a good and measurable indicator of overall environmental conditions because it is a reflection of everything that has happened on the surrounding land. The sampling effort focused on areas where there is a high probability that a large number of people could be exposed through contact with the water on and near Ingenio San Antonio property (ISA).

METHODS

Study Team

The sampling team consisted of BU study team members (Oriana Ramirez and Juan Jose Amador), the CAO technical advisor (David Atkins) and a field assistant from Nicaragua (Valeria Delgado from the National Autonomous University of Nicaragua Center for Investigation of Aquatic Resources [UNAN-CIRA]). The following observers from Nicaragua Sugar Estates Limited (NSEL) and ASOCHIVIDA accompanied the field team during sample collection:

- NSEL: Eng. Luis Cepeda, manager of water resources; Eng. Ivette Reyes, environmental coordinator; Eng. Luis Enrique Martinez, human resources and designated veedor (overseer) for this assessment.
- ASOCHIVIDA board members: Salvador Soto Borrad, Donald Cortes, Ezequiel Ramirez Salgado, Cecilio José Ferrufino Rojas

Sample Locations

BU and CAO conducted interviews with ASOCHIVIDA members in February 2010 to identify locations where community or former worker concerns exist. These interviews identified the following locations:

- Rio Guanacastal
- Rio Cuitanca
- Rio Zopilotera
- Rio Jordan
- La Cachacera (residual waters from the liquor factory)
- Fosa Septica of the liquor factory (Reparto Well, Chichigalpa)
- La Mierdosa (residual waters inside ISA)

- Presas (water reservoirs): El Galillo, 3 Rios, Zepeda and others at communities such as El Carmen (Martirio), Santa Isabel, Santa Teresa, San Luis, San Rafael, El Polvón, El Chorizo, Jericó
- Pista de Aterrizaje del Avión in ISA (landing strip).

The BU/CAO team visited all potential sampling sites on April 27, 2010 to identify and select a subset of six locations. The reconnaissance was conducted in consultation with observers from ASOCHIVIDA and NSEL. The team was given complete access to ISA property during the reconnaissance, and the team was able to visit each potential sample location as listed below (note: all GPS coordinates are WGS84 datum):

1) Pozo El Gobierno
    a. Hand dug well with brocale, near former Colonias; still used as water supply by workers
    b. Water level was about 5 m below the surface
    c. GPS location: N-12˚27’28.2”; W-87˚03’03.2”
2) Lago Jericho
    a. Part of Tres Rios System
    b. Receives process water from the factory
    c. Also has received runoff from the fields
    d. Water is used for gravity irrigation
    e. A canal with very black water and strong smell feeds this Lago.
    f. People are in contact with this water when working on irrigation.
    g. GPS location: N-12˚29’39.3”; W-87˚03’54.9”
3) Presa San Rafael
    a. Part of Tres Rios System
    b. Contains black, strong-smelling water
    c. GPS location: N-12˚29’39.3”; W87˚05’25.3”
4) Rio Jordan
    a. Contains clean water – observed some small fish
    b. ASOCHIVIDA reports they used to swim and collect water here
    c. GPS location: N-12˚29’02.6”; W-87˚05’39.9”
5) La Mierdosa
    a. Also part of Tres Rios System
    b. Full of black, bubbling muck – bagasso
    c. GPS location: N-12˚30’30.3”; W87˚-03’51.6”
6) Lago Zepeda
    a. Downstream from Chichigalpa
    b. Contains water from the Fosa Septica
    c. Used for irrigation
    d. GPS location: N-12˚31’28.9”; W87˚02’27.2”
7) El Martirio/Presa Martirio
    a. Contains discharge from the sugar plant (bagasso)
    b. Canal GPS location: N-12˚32’18.8”; W-87˚05’10.7”
    c. Presa GPS location: N-12˚32’23.1”; W-87˚05’08.0”
8) Colonia el Carmen

    a. Only a field now--no place to sample
9) Zapilote in Chichigalpa
    a. Located below the Licorera
    b. Very low flow of clear water
    c. GPS location: N-12˚34'20.3"; W-87˚01'22.8"
10) Chichigalpa wastewater treatment plant discharge
    a. Discharge contains domestic water from treatment plant and Licorera
    b. Pipe to surface GPS location: N-12˚33'30.7"; W-87˚01'26.7"
    c. Confluence GPS location: N-12˚33'29.8"; W-87˚01'25.6"
11) Rio Guanacastal
    a. Same stream as Rio Chichigalpa but lower down and on ISA property
    b. No GPS signal
12) Landing strip
    a. No surface water or wells in this area.
    b. Observed well at house near landing strip
    c. GPS location: N-12˚32'24.7"; W-87˚02'06.8"
13) El Chorizo – la Cachacera (Lago)
    a. Contains untreated sewage water from Reparto Las Palmeras and water from Licorera
    b. GPS location: N-12˚33'19.3"; W-87˚02'06.0"
14) El Galillo
    a. Deep groundwater is pumped to surface and held in this impoundment
    b. Many people live around the impoundment and use it for swimming and bathing.
    c. GPS location: N-12˚33'11.2"; W-87˚02'16.3"
15) Rio Cuitanca
    a. GPS location: N-12˚32'39.4"; W-87˚03'-09.3"

After the field tour, the BU/CAO team discussed priority locations with ASOCHIVIDA and NSEL. ASOCHIVIDA board members identified a new priority location that was not on the original list – Pozo El Parqueo – during these discussions. This well is located in a parking area on ISA property where water trucks are filled. ASOCHIVIDA members also said they used to fill their water canisters (pichingas) from this deep well. The final list of six priority locations that were sampled during this effort, together with GPS locations, follows:

1) Pozo el Parqueo: N-12˚31'42.3"; W-87˚02'59.0"
2) Pozo el Gobierno: N-12˚27'28.2"; W-87˚03'03.2"
3) Lago San Rafael: N-12˚29'39.3"; W87˚05'25.3"
4) Lago Jericho: N-12˚29'39.3"; W-87˚03'54.9"
5) Lago el Martirio: N-12˚32'19.7"; W-87˚05'10.8"
6) Pozo el Galillo: N-12˚32'39.4"; W-87˚03'-09.3"

Sample Collection

ALS provided the following materials (sent from their laboratory facility in Houston, Texas) and logistical support for sample collection and shipment:

1. Sample containers
2. Chain of custody forms

3. Sample labels
4. Shipping containers (coolers)
5. Shipment of sample bottles in coolers to Manaagua (materials received by Juan Jose Amador of the BU team)
6. Necessary paperwork for import of samples from Nicaragua to the United States (e.g., USDA soil import permits, etc.)
7. Logistics for transfer of samples at the Houston airport from the BU/CAO team to the analytical laboratory.

Some of the samples (metals, VOCs, and EDB/DBCP) required that a small amount of either nitric or hydrochloric acid be added to the bottle before collection. Because these acids are controlled substances that require national permits to procure and handle, the BU/CAO team worked with the UNAN-CIRA laboratory for procurement. The materials available from UNAN-CIRA were sourced in the US and met the stringent quality criteria required for the project.

All samples were collected on April 28, 2010. At the beginning of the day, the BU/CAO team calibrated the field parameter instrument (a Hanna brand digital multimeter) using the following standards: 3-point pH calibration (pH 4.0, 7.0 and 10.0), Conductivity standard (1409 µs/cm read 1414 µs/cm), and dissolved oxygen (read 99.9% at saturation).

The BU/CAO team selected the sample collection order. At each location, the team first measured field parameters and then filled sample collection bottles. Bottles were either filled directly from the source if a stream of water from the source could be directed into the bottle (e.g., a well with a faucet) or in Whirl-Pak® disposable, sterile sample collection vessels attached to a sample holder if the sample collection device needed to be lowered to the water source. Samples were collected as whole water and not filtered. Filled sample bottles were labeled with the sample number, time and date and placed on ice in coolers. A new sample collection vessel was used at each location, and all sample bottles received from ALS were new. Sample locations, collection methods and numbers follow:

1. Pozo El Parqueo. Bottles were filled directly from the water tap. The sample was collected at 10:10 am and given the sample number 100001.
2. Pozo El Gobierno. The Whirl-Pak® sample collection vessel was lowered into the well using a string. The sample was collected at 11:10 am and given the sample number 100002.
3. Presa San Rafael. The Whirl-Pak® sample collection vessel was attached to a pole and lowered to the water surface. The sample was collected at 12:15 pm and given the sample number 100003.
4. Lago Jericho. The Whirl-Pak® sample collection vessel was attached to a pole and lowered to the water surface. The sample was collected at 1:20 pm and given the sample number 100004.
5. Lago Martirio. The Whirl-Pak® sample collection vessel was attached to a pole and lowered to the water surface. The sample was collected at 2:15 pm and given the sample number 100005.

6. Pozo Galillo. The Whirl-Pak® sample collection vessel was attached to a pole and placed under the stream from the well discharge pipe. The sample was collected at 2:50 pm and given the sample number 100006.

Sample Transport and Custody

The sample collection was completed on April 28, 2010 and the BU/CAO team returned with the samples to Managua on the same day. Samples were stored overnight in refrigerators in a locked room at UNAN-CIRA in Managua. The next morning (April 29, 2010), Mr. Atkins, Dr. Amador and Ms. Delgado packed five sample coolers containing the six samples for shipment. The coolers were taken to the airport in Managua after they were packed, where Mr. Atkins checked the coolers as baggage for his international flight from Managua to Houston, Texas. In Houston, Mr. Atkins reclaimed the coolers, took them through airport customs, and met a representative from ALS Environmental Laboratory at the airport terminal. The coolers were loaded onto the ALS delivery van and taken to the laboratory the evening of April 29, 2010. The total time between sample collection and delivery to the laboratory was less than 36 hours and the samples arrived in good condition and at the specified temperature (4 deg-C), with only one exception. One sample bottle broke during shipment (sample number 100005, Lago El Martirio, SVOCs) but this broken bottle only resulted in missing SVOC data at this one location. All other chemicals (e.g., VOCs, metals, pesticides, herbicides, etc.) were analyzed for this location.

Sample Analysis

The samples were analyzed at ALS Environmental Laboratory in Houston, Texas. ALS is an international laboratory network with very high-level capabilities. The sampling team has worked with ALS on other projects, and the sample results have passed rigorous quality control tests. In addition, ALS is one of only eleven laboratories in the United States to be accepted into the US Environmental Protection Agency's (EPA) rigorous Contract Laboratories Program.

Samples were analyzed for common water contaminants (including US EPA Priority Pollutants) as well as chemicals that have been identified by NSEL or ASOCHIVIDA to be used currently or in the past in the area (see the Appendix for complete list of analyzed chemicals).

Priority Pollutants are a set of chemical pollutants US EPA regulates, and for which US EPA has published analytical test methods. The list includes 126 chemicals that have been reported as found in water with a frequency of occurrence of at least 2.5%. In addition, the chemicals were produced in significant quantities and thus are relatively common in the environment. These pollutants also have water quality criteria as stated in the US EPA National Primary Drinking Water Regulations (maximum contaminant levels or MCLs) and/or the US EPA National Recommended Water Quality Criteria. According to current scientific knowledge, consumption of water containing concentrations of chemicals below these criteria would not likely harm human health.

Samples were also analyzed for select chemicals that are not included in the Priority Pollutant list but that have been identified as contaminants of interest by NSEL or ASOCHIVIDA. The analyses included chemicals than may not have been used in the area, but the analytical method for each class of compound (e.g., VOCs, SVOCs, pesticides, herbicides, etc.) includes multiple compounds for the same cost as identifying the concentration of one compound. In total, the

concentrations of nearly 200 different chemical compounds were evaluated at each sampling location (see Appendix).

Table 1 presents a list of parameters, US EPA Analytical Methods, total number of compounds tested for each analysis method, sample container volume and type, and sample preservation methods.

Table 1. Summary of chemical analyses

Parameters	US EPA Analytical Method	Number of compounds	Sample container volume	Sample container type	Preservation reagent	Quantity	Acceptable Holding time
Metals	6020/7000	14	500 mL	P	HNO_3 pH < 2	2 mL	6 months
VOCs	8260C	48	2x40 mL	V-TLC	HCl pH<2	0.2 mL	14 days
SVOCs	8270D	65	1000 mL	V-TLC-Amb	na		7 days
Organochlorine Pesticides	8081A	22	1000 mL	V-TLC-Amb	na		7 days
Organophosphorus Pesticides	8141	20	1000 mL	V-TLC-Amb	na		7 days
Chlorinated Herbicides	8151A	10	1000 mL	V-TLC-Amb	na		7 days
EDB/DBCP	8011	1	2X40 mL	V-TLC-Amb	HCL pH<2	0.2 mL	7 days
Diquat/Paraquat	549.2	2	1000 mL	V-TLC-Amb	na		7 days
Glyphosate	547	1	250 mL	V-TLC-Amb	na		7 days
Total Compounds:		183					

Notes:
P = polyethylene
V-TLC-Amb = glass, teflon lined cap, amber
HNO_3 is 50% DI, 50% acid
HCl is 50% DI, 50% acid

Methods Implemented to Guarantee the Credibility of Sample Results

The sampling team incorporated several methods to ensure that sample results are reliable, including:

- The laboratory (ALS) is independent of CAO, IFC, BU, NSEL, and ASOCHIVIDA.
- The samples were labeled in such a way that the laboratory did not know where they were collected (e.g., each sample was identified by a number rather than the site name), and hence what sort of results to expect.
- The samples and shipping coolers were in the physical control of the BU/CAO team at all times between sample collection and receipt at the laboratory, with the exception of the time the samples were being handled by baggage personnel at the Managua and Houston airports and stored in the cargo hold of the airplane.
- The BU/CAO team sealed the coolers with special 'custody seals' to ensure that they were not tampered with during this period. The custody seals were intact when the coolers were delivered to the laboratory at the Houston airport, demonstrating that sample custody was maintained.
- The program included analysis of a quality control sample that contains a known quantity of pesticides and herbicides. This sample serves as a check to see if the laboratory reported the correct values. Results of the quality control samples were within acceptable tolerance limits for the pesticides and herbicides analyzed, indicating the laboratory was able to accurately measure a known quantity of these chemicals, and that results for the samples collected are reliable.

RESULTS

Each of the six water samples was analyzed for six field parameters (dissolved oxygen, pH, temperature, specific conductivity, total dissolved solids, and oxidation/reduction potential [redox]) and the following 183 chemicals[1]:

- 14 *Metals*, including antimony, arsenic, beryllium, **cadmium**, chromium, copper, **lead**, nickel, selenium, silver, thallium, **uranium**, zinc and mercury;
- 48 *Volatile Organic Compounds* (VOCs), including common industrial solvents and chemicals;
- 65 *Semi-Volatile Organic Compounds* (SVOCs), including Atrazine and common industrial solvents and chemicals;
- 22 *Organochlorine Pesticides*, including DDT, Lindane, Dieldrin, Chlordane, Endosulfan and Toxaphene, as well as others;
- 20 *Organophosphorus Pesticides*, including **Diazinon,** Chlorpyrifos, Parathion and others;
- 13 *Herbicides*, including **2,4-D**, **Paraquat**, and **Glyphosate;**
- One *Nematicide*, **DBCP** (Nemagon).

Chemicals in bold type in the list above have been identified in the Industrial Hygiene/Occupational Health Assessment as having some kidney effects under certain exposure scenarios (BUSPH 2010). In addition, glyphosate and 2,4-D are two of the extensively used agrichemicals at ISA.

Table 2 presents water quality parameters collected with the field instrument at each of the six sampling locations during the time of water sample collection. Dissolved oxygen (DO), pH, specific conductance (SC), total dissolved solids (TDS), salinity and redox potential are listed below. These parameters alone do not indicate whether the water evaluated is appropriate for human contact or consumption, but rather help analysts interpret the results of chemical analyses of the water. For example, chemicals and metals are found in different forms in water depending on the dissolved oxygen, pH and temperature measurements of the water (e.g., metals will exist in different forms depending on whether water is acidic or basic). Oxygen levels of three of the samples were low because the samples had a high concentration of organic matter that consumes oxygen. Some pH values were slightly acidic, which is consistent with the high organic acid content of these samples. SC and TDS are measures of the salt content of water. Water with a TDS concentration of less than 500 ppm (parts per million) is generally considered to have a salt content low enough that the water would not taste salty. Analytical laboratory results were consistent with field parameter measurements. For example, the samples with low dissolved oxygen and slightly depressed pH (Lago San Rafael, Lago Jericho and Lago El Martirio) also had detected (but low-level) concentrations of organic acids and solvents that would consume oxygen and lower the pH. These locations also contained factory process water that was high in bagasso, a waste product high in organic acid content and oxygen consumption potential.

[1] The SVOC bottle broke for sample number 100005, Lago El Martirio, but all other chemicals were analyzed.

Table 2. Summary of water quality parameters

Sample location	Sample ID	Time	DO (%)	DO (ppm)	pH	Temp (°C)	Measured SC (us/cm)	Corrected SC at 25C (us/cm)	TDS (ppm)	Salinity (ppt)	Redox (mV)
Pozo El Parqueo	100001	10:10 AM	37%	2.87	6.34	31.28	721	644	322	0.31	801.4
Pozo El Gobierno	100002	11:10 AM	45%	3.42	6.55	29.26	641	593	296	0.28	170.8
Lago San Rafael	100003	12:15 PM	15%	1.09	5.58	32.81	903	787	394	0.38	-135
Lago Jericho	100004	1:20 PM	15%	1	5.3	36.82	1139	932	465	0.45	-98
Lago El Martirio	100005	2:15 PM	0%	0	5.68	32.44	1666	1460	680	0.66	-147.8
Pozo Galillo	100006	2:50 AM	66%	4.78	6.19	29.35	630	581	291	0.28	89.9

For the six water samples, ALS produced 1,033 individual results for the chemicals listed above (original laboratory data sheets are available from BU by request). In the vast majority of instances (1,011 of the 1,033 total analyses or 98%), the concentration of each individual chemical was below the analytical detection limit. The analytical detection limit is the lowest concentration of the chemical that can be distinguished from a sample that does not contain the chemical.

Table 3 presents the 22 analyses that were identified in water samples at concentrations above detection limits. The detected concentrations are listed for the chemicals at each location, but it should be noted that the use of sophisticated analytical methods allows us to obtain very low detection limits and therefore detect low levels of contaminants in water. Therefore, the mere fact that a contaminant was identified at a level above the detection limit does not mean it poses a health risk at the detected concentration.

To help provide some perspective as to whether any of the 22 analyses with a concentration above the detection limit may pose a health risk, we have also provided the US EPA Maximum Contaminant Level (MCL) or Risk-Based Concentration (RBC) for each contaminant identified at the 6 sampling locations. The US EPA MCLs are the maximum allowable amounts of contaminants in drinking water in the United States, and were established to protect the public against consumption of contaminated drinking water that might present a risk to human health. For contaminants without an established MCL (since they are not available for all contaminants), risk-based concentration (RBC) guidelines are provided. The RBCs are similar to the MCLs, but unlike the MCLs, are not legally enforceable. The MCL and RBC concentrations were compared to the concentrations of the identified chemicals at each of the 6 locations. The contaminants 3-methylphenol and 4-methylphenol are listed together because they were analyzed together.

Table 3. Summary of chemicals detected in water samples

Sample ID	Location	Location type	Chemical	Detected Conc. (mg/L)	EPA Conc. (mg/L)	EPA MCL or RBC
100001	Pozo El Parqueo	deep groundwater	delta-BHC	0.000073	0.0004	MCL
100002	Pozo El Gobierno	shallow groundwater	delta-BHC	0.000071	0.0004	MCL
			Zinc	0.264	5	MCL
			Acetone	0.018	5.5	RBC
100003	Presa San Rafael	surface water	3&4 methylphenol	0.021	0.46 (4-methylphenol)	RBC
			Phenol	0.0062	0.4	MCL
			Acetone	0.043	5.5	RBC
			Toluene	0.02	1.0	MCL
100004	Presa Jericho	surface water	beta-BHC	0.000054	0.0004	MCL
			Heptachlor	0.000068	0.0004	MCL
			Copper	0.0198	1.3	MCL
			Zinc	0.0302	5	MCL
			3&4 methylphenol	0.111	0.46 (4-methylphenol)	RBC
			Phenol	0.024	0.4	MCL
			2-butanone	0.043	1.9	RBC
			Acetone	0.13	5.5	RBC
			Toluene	0.042	1.0	MCL
100005	Presa el Martirio	surface water	2,4-DB	0.00056	0.07	MCL
			Zinc	0.113	5.0	MCL
			2-butanone	0.18	1.9	RBC
			Acetone	0.13	5.5	RBC
100006	Pozo el Galillo	deep groundwater	delta-BHC	0.000073	0.0004	MCL

Table 3 shows that eleven separate chemicals were detected, some in more than one location. For each of the 22 analyses with a concentration above the detection limit, the concentration is well below the MCL or RBC, indicating that the water would meet USEPA criteria. In addition, none of the chemicals detected are on the list of chemicals identified by the Industrial Hygiene/Occupational Health Study to have kidney effects (BUSPH 2010).

Of the eleven chemicals detected, zinc and copper are naturally occurring metals.

BHCs (delta and beta) are compounds related to the organochlorine insecticide Lindane (gamma-BHC). Heptachlor is also an organochlorine insecticide that was widely used in the United States until the late 1970s. Neither Heptachlor nor Lindane have been identified by NSEL as chemicals used at ISA. Lindane has, however, been detected frequently in groundwater in the Western Zone of Nicaragua both on and off ISA property (personal communication, Aurelia Delgado, UNAN-CIRA). 2,4-DB is a chlorinated herbicide used to control weeds in alfalfa, peanut,

soybean and other crops[2]. It is a different herbicide that 2,4-D, the agrichemical most commonly used at ISA.

Phenol and methylphenol are widely occurring in natural environments and are common manufactured compounds. Butanone (methyl ethyl ketone), acetone (the active ingredient in nail polish remover) and toluene are some of the mostly widely used organic solvents in industry.

As described above, the concentrations of the eleven chemicals that were detected at one or more locations were well below the USEPA water quality criteria (MCL or RBC), indicating that the water meets USEPA limits. In addition, none of the other 172 chemicals analyzed were found to be above detection limits at any of the six locations (see the Appendix for a complete list of chemicals and detection limits).

Accordingly, at the time samples were collected at the six locations included in the first phase of the environmental sampling program, none of the chemicals analyzed were present at concentrations above US EPA drinking water criteria and therefore are not believed to be harmful to human health.

The first phase of environmental sampling was designed as a screening investigation that would look for many contaminants in water at a single point in time and at a small number of locations. The most important limitations of this phase are the limited geographic scope (only six locations on ISA property), temporal scope (one point in time), and types of media (only water). The next phase of environmental sampling will be designed to look for fewer contaminants at a larger number of locations, and likely in additional media (e.g., soil and water).

REFERENCE

BUSPH. 2010. Industrial Hygiene/Occupational Health Assessment: Evaluating Potential Hazards Associated with Chemicals and Work Practices at the Ingenio San Antonio (Chichigalpa, Nicaragua). Boston University School of Public Health.

[2] http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/24db-ext.html

APPENDIX: Summary of Analytes and Detection Limits by Method

Test Name	Test Number	Analyte	CAS	Detection Limit	Units
TCL Volatiles	SW8260	1,1,1-Trichloroethane	71-55-6	5.0	µg/L
TCL Volatiles	SW8260	1,1,2,2-Tetrachloroethane	79-34-5	5.0	µg/L
TCL Volatiles	SW8260	1,1,2-Trichlor-1,2,2-trifluoroethane	76-13-1	5.0	µg/L
TCL Volatiles	SW8260	1,1,2-Trichloroethane	79-00-5	5.0	µg/L
TCL Volatiles	SW8260	1,1-Dichloroethane	75-34-3	5.0	µg/L
TCL Volatiles	SW8260	1,1-Dichloroethene	75-35-4	5.0	µg/L
TCL Volatiles	SW8260	1,2,4-Trichlorobenzene	120-82-1	5.0	µg/L
TCL Volatiles	SW8260	1,2-Dibromo-3-chloropropane	96-12-8	5.0	µg/L
TCL Volatiles	SW8260	1,2-Dibromoethane	106-93-4	5.0	µg/L
TCL Volatiles	SW8260	1,2-Dichlorobenzene	95-50-1	5.0	µg/L
TCL Volatiles	SW8260	1,2-Dichloroethane	107-06-2	5.0	µg/L
TCL Volatiles	SW8260	1,2-Dichloropropane	78-87-5	5.0	µg/L
TCL Volatiles	SW8260	1,3-Dichlorobenzene	541-73-1	5.0	µg/L
TCL Volatiles	SW8260	1,4-Dichlorobenzene	106-46-7	5.0	µg/L
TCL Volatiles	SW8260	2-Butanone	78-93-3	10	µg/L
TCL Volatiles	SW8260	2-Hexanone	591-78-6	10	µg/L
TCL Volatiles	SW8260	4-Methyl-2-pentanone	108-10-1	10	µg/L
TCL Volatiles	SW8260	Acetone	67-64-1	10	µg/L
TCL Volatiles	SW8260	Benzene	71-43-2	5.0	µg/L
TCL Volatiles	SW8260	Bromodichloromethane	75-27-4	5.0	µg/L
TCL Volatiles	SW8260	Bromoform	75-25-2	5.0	µg/L
TCL Volatiles	SW8260	Bromomethane	74-83-9	5.0	µg/L
TCL Volatiles	SW8260	Carbon disulfide	75-15-0	10	µg/L
TCL Volatiles	SW8260	Carbon tetrachloride	56-23-5	5.0	µg/L
TCL Volatiles	SW8260	Chlorobenzene	108-90-7	5.0	µg/L
TCL Volatiles	SW8260	Chloroethane	75-00-3	5.0	µg/L
TCL Volatiles	SW8260	Chloroform	67-66-3	5.0	µg/L
TCL Volatiles	SW8260	Chloromethane	74-87-3	5.0	µg/L
TCL Volatiles	SW8260	cis-1,2-Dichloroethene	156-59-2	5.0	µg/L
TCL Volatiles	SW8260	cis-1,3-Dichloropropene	10061-01-5	5.0	µg/L
TCL Volatiles	SW8260	Cyclohexane	110-82-7	5.0	µg/L
TCL Volatiles	SW8260	Dibromochloromethane	124-48-1	5.0	µg/L
TCL Volatiles	SW8260	Dichlorodifluoromethane	75-71-8	5.0	µg/L
TCL Volatiles	SW8260	Dichloromethane	75-09-2	10	µg/L
TCL Volatiles	SW8260	Ethylbenzene	100-41-4	5.0	µg/L
TCL Volatiles	SW8260	Isopropylbenzene	98-82-8	5.0	µg/L
TCL Volatiles	SW8260	Methyl acetate	79-20-9	5.0	µg/L
TCL Volatiles	SW8260	Methyl tert-butyl ether	1634-04-4	5.0	µg/L
TCL Volatiles	SW8260	Methylcyclohexane	108-87-2	5.0	µg/L
TCL Volatiles	SW8260	Styrene	100-42-5	5.0	µg/L
TCL Volatiles	SW8260	Tetrachloroethene	127-18-4	5.0	µg/L
TCL Volatiles	SW8260	Toluene	108-88-3	5.0	µg/L
TCL Volatiles	SW8260	trans-1,2-Dichloroethene	156-60-5	5.0	µg/L
TCL Volatiles	SW8260	trans-1,3-Dichloropropene	10061-02-6	5.0	µg/L

Test Name	Test Number	Analyte	CAS	Detection Limit	Units
TCL Volatiles	SW8260	Trichloroethene	79-01-6	5.0	µg/L
TCL Volatiles	SW8260	Trichlorofluoromethane	75-69-4	5.0	µg/L
TCL Volatiles	SW8260	Vinyl chloride	75-01-4	2.0	µg/L
TCL Volatiles	SW8260	Xylenes, Total	1330-20-7	15	µg/L
EDB-DBCP	SW8011	1,2-Dibromo-3-chloropropane	96-12-8	0.021	µg/L
Metals	SW6020	Antimony	7440-36-0	0.00500	mg/L
Metals	SW6020	Arsenic	7440-38-2	0.00500	mg/L
Metals	SW6020	Beryllium	7440-41-7	0.00200	mg/L
Metals	SW6020	Cadmium	7440-43-9	0.00200	mg/L
Metals	SW6020	Chromium	7440-47-3	0.00500	mg/L
Metals	SW6020	Copper	7440-50-8	0.00500	mg/L
Metals	SW6020	Lead	7439-92-1	0.00500	mg/L
Metals	SW6020	Nickel	7440-02-0	0.00500	mg/L
Metals	SW6020	Selenium	7782-49-2	0.00500	mg/L
Metals	SW6020	Silver	7440-22-4	0.00500	mg/L
Metals	SW6020	Thallium	7440-28-0	0.00200	mg/L
Metals	SW6020	Uranium	7440-61-1	0.00500	mg/L
Metals	SW6020	Zinc	7440-66-6	0.00500	mg/L
Mercury	SW7470	Mercury	7439-97-6	0.000200	mg/L
Organochlorine Pesticides	SW8081	4,4´-DDD	72-54-8	0.10	µg/L
Organochlorine Pesticides	SW8081	4,4´-DDE	72-55-9	0.10	µg/L
Organochlorine Pesticides	SW8081	4,4´-DDT	50-29-3	0.10	µg/L
Organochlorine Pesticides	SW8081	Aldrin	309-00-2	0.050	µg/L
Organochlorine Pesticides	SW8081	alpha-BHC	319-84-6	0.050	µg/L
Miscellaneous Pesticides	SW8081	alpha-Chlordane	5103-71-9	0.050	µg/L
Organochlorine Pesticides	SW8081	beta-BHC	319-85-7	0.050	µg/L
Organochlorine Pesticides	SW8081	Chlordane	57-74-9	0.50	µg/L
Organochlorine Pesticides	SW8081	delta-BHC	319-86-8	0.050	µg/L
Organochlorine Pesticides	SW8081	Dieldrin	60-57-1	0.10	µg/L
Organochlorine Pesticides	SW8081	Endosulfan I	959-98-8	0.050	µg/L
Organochlorine Pesticides	SW8081	Endosulfan II	33213-65-9	0.10	µg/L
Organochlorine Pesticides	SW8081	Endosulfan sulfate	1031-07-8	0.10	µg/L
Organochlorine Pesticides	SW8081	Endrin	72-20-8	0.10	µg/L
Organochlorine Pesticides	SW8081	Endrin aldehyde	7421-93-4	0.10	µg/L
Organochlorine Pesticides	SW8081	Endrin ketone	53494-70-5	0.10	µg/L
Organochlorine Pesticides	SW8081	gamma-BHC	58-89-9	0.050	µg/L
Miscellaneous Pesticides	SW8081	gamma-Chlordane	5103-74-2	0.050	µg/L

Test Name	Test Number	Analyte	CAS	Detection Limit	Units
Organochlorine Pesticides	SW8081	Heptachlor	76-44-8	0.050	µg/L
Organochlorine Pesticides	SW8081	Heptachlor epoxide	1024-57-3	0.050	µg/L
Organochlorine Pesticides	SW8081	Methoxychlor	72-43-5	0.50	µg/L
Organochlorine Pesticides	SW8081	Toxaphene	8001-35-2	0.50	µg/L
Semivolatiles	SW8270	1,1´-Biphenyl	92-52-4	5.0	µg/L
Semivolatiles	SW8270	2,4,5-Trichlorophenol	95-95-4	5.0	µg/L
Semivolatiles	SW8270	2,4,6-Trichlorophenol	88-06-2	5.0	µg/L
Semivolatiles	SW8270	2,4-Dichlorophenol	120-83-2	5.0	µg/L
Semivolatiles	SW8270	2,4-Dimethylphenol	105-67-9	5.0	µg/L
Semivolatiles	SW8270	2,4-Dinitrophenol	51-28-5	5.0	µg/L
Semivolatiles	SW8270	2,4-Dinitrotoluene	121-14-2	5.0	µg/L
Semivolatiles	SW8270	2,6-Dinitrotoluene	606-20-2	5.0	µg/L
Semivolatiles	SW8270	2-Chloronaphthalene	91-58-7	5.0	µg/L
Semivolatiles	SW8270	2-Chlorophenol	95-57-8	5.0	µg/L
Semivolatiles	SW8270	2-Methylnaphthalene	91-57-6	5.0	µg/L
Semivolatiles	SW8270	2-Methylphenol	95-48-7	5.0	µg/L
Semivolatiles	SW8270	2-Nitroaniline	88-74-4	5.0	µg/L
Semivolatiles	SW8270	2-Nitrophenol	88-75-5	5.0	µg/L
Semivolatiles	SW8270	3&4-Methylphenol	106-44-5	5.0	µg/L
Semivolatiles	SW8270	3,3´-Dichlorobenzidine	91-94-1	5.0	µg/L
Semivolatiles	SW8270	3-Nitroaniline	99-09-2	5.0	µg/L
Semivolatiles	SW8270	4,6-Dinitro-2-methylphenol	534-52-1	5.0	µg/L
Semivolatiles	SW8270	4-Bromophenyl phenyl ether	101-55-3	5.0	µg/L
Semivolatiles	SW8270	4-Chloro-3-methylphenol	59-50-7	5.0	µg/L
Semivolatiles	SW8270	4-Chloroaniline	106-47-8	5.0	µg/L
Semivolatiles	SW8270	4-Chlorophenyl phenyl ether	7005-72-3	5.0	µg/L
Semivolatiles	SW8270	4-Nitroaniline	100-01-6	5.0	µg/L
Semivolatiles	SW8270	4-Nitrophenol	100-02-7	5.0	µg/L
Semivolatiles	SW8270	Acenaphthene	83-32-9	5.0	µg/L
Semivolatiles	SW8270	Acenaphthylene	208-96-8	5.0	µg/L
Semivolatiles	SW8270	Acetophenone	98-86-2	5.0	µg/L
Semivolatiles	SW8270	Anthracene	120-12-7	5.0	µg/L
Semivolatiles	SW8270	Atrazine	1912-24-9	5.0	µg/L
Semivolatiles	SW8270	Benz(a)anthracene	56-55-3	5.0	µg/L
Semivolatiles	SW8270	Benzaldehyde	100-52-7	5.0	µg/L
Semivolatiles	SW8270	Benzo(a)pyrene	50-32-8	5.0	µg/L
Semivolatiles	SW8270	Benzo(b)fluoranthene	205-99-2	5.0	µg/L
Semivolatiles	SW8270	Benzo(g,h,i)perylene	191-24-2	5.0	µg/L
Semivolatiles	SW8270	Benzo(k)fluoranthene	207-08-9	5.0	µg/L
Semivolatiles	SW8270	Bis(2-chloroethoxy)methane	111-91-1	5.0	µg/L
Semivolatiles	SW8270	Bis(2-chloroethyl)ether	111-44-4	5.0	µg/L
Semivolatiles	SW8270	Bis(2-chloroisopropyl)ether	108-60-1	5.0	µg/L
Semivolatiles	SW8270	Bis(2-ethylhexyl)phthalate	117-81-7	5.0	µg/L
Semivolatiles	SW8270	Butyl benzyl phthalate	85-68-7	5.0	µg/L

Test Name	Test Number	Analyte	CAS	Detection Limit	Units
Semivolatiles	SW8270	Caprolactam	105-60-2	5.0	µg/L
Semivolatiles	SW8270	Carbazole	86-74-8	5.0	µg/L
Semivolatiles	SW8270	Chrysene	218-01-9	5.0	µg/L
Semivolatiles	SW8270	Di-n-butyl phthalate	84-74-2	5.0	µg/L
Semivolatiles	SW8270	Di-n-octyl phthalate	117-84-0	5.0	µg/L
Semivolatiles	SW8270	Dibenz(a,h)anthracene	53-70-3	5.0	µg/L
Semivolatiles	SW8270	Dibenzofuran	132-64-9	5.0	µg/L
Semivolatiles	SW8270	Diethyl phthalate	84-66-2	5.0	µg/L
Semivolatiles	SW8270	Dimethyl phthalate	131-11-3	5.0	µg/L
Semivolatiles	SW8270	Fluoranthene	206-44-0	5.0	µg/L
Semivolatiles	SW8270	Fluorene	86-73-7	5.0	µg/L
Semivolatiles	SW8270	Hexachlorobenzene	118-74-1	5.0	µg/L
Semivolatiles	SW8270	Hexachlorobutadiene	87-68-3	5.0	µg/L
Semivolatiles	SW8270	Hexachlorocyclopentadiene	77-47-4	5.0	µg/L
Semivolatiles	SW8270	Hexachloroethane	67-72-1	5.0	µg/L
Semivolatiles	SW8270	Indeno(1,2,3-cd)pyrene	193-39-5	5.0	µg/L
Semivolatiles	SW8270	Isophorone	78-59-1	5.0	µg/L
Semivolatiles	SW8270	N-Nitrosodi-n-propylamine	621-64-7	5.0	µg/L
Semivolatiles	SW8270	N-Nitrosodiphenylamine	86-30-6	5.0	µg/L
Semivolatiles	SW8270	Naphthalene	91-20-3	5.0	µg/L
Semivolatiles	SW8270	Nitrobenzene	98-95-3	5.0	µg/L
Semivolatiles	SW8270	Pentachlorophenol	87-86-5	5.0	µg/L
Semivolatiles	SW8270	Phenanthrene	85-01-8	5.0	µg/L
Semivolatiles	SW8270	Phenol	108-95-2	5.0	µg/L
Semivolatiles	SW8270	Pyrene	129-00-0	5.0	µg/L
Chlorinated Herbicides	SW8151	2,4,5-T	93-76-5	0.10	µg/L
Chlorinated Herbicides	SW8151	2,4,5-TP (Silvex)	93-72-1	0.10	µg/L
Chlorinated Herbicides	SW8151	2,4-D	94-75-7	0.20	µg/L
Chlorinated Herbicides	SW8151	2,4-DB	94-82-6	0.20	µg/L
Chlorinated Herbicides	SW8151	Dalapon	75-99-0	0.10	µg/L
Chlorinated Herbicides	SW8151	Dicamba	1918-00-9	0.10	µg/L
Chlorinated Herbicides	SW8151	Dichlorprop	120-36-5	0.20	µg/L
Chlorinated Herbicides	SW8151	Dinoseb	88-85-7	0.10	µg/L
Chlorinated Herbicides	SW8151	MCPA	94-74-6	20	µg/L
Chlorinated Herbicides	SW8151	MCPP	7085-19-0	20	µg/L

Test Name	Test Number	Analyte	CAS	Detection Limit	Units
Organophosphorus Pesticides	SW8141	Dichlovos	62-73-7	1	µg/L
Organophosphorus Pesticides	SW8141	Mevinphos	7786-34-7	1	µg/L
Organophosphorus Pesticides	SW8141	Demonton O+S	8065-48-3	1	µg/L
Organophosphorus Pesticides	SW8141	Ethoprop	13194-48-4	1	µg/L
Organophosphorus Pesticides	SW8141	Naled	300-76-5	3	µg/L
Miscellaneous Pesticides	SW8141	Phorate	298-02-2	1	µg/L
Organophosphorus Pesticides	SW8141	Diazinon	333-41-5	1	µg/L
Organophosphorus Pesticides	SW8141	Disulfoton	298-04-4	4	µg/L
Organophosphorus Pesticides	SW8141	Methyl Parathion	298-00-0	1	µg/L
Organophosphorus Pesticides	SW8141	Ronnel	299-84-3	1	µg/L
Organophosphorus Pesticides	SW8141	Fenthion	55-38-9	1	µg/L
Organophosphorus Pesticides	SW8141	Chlorpyrifos	2921-88-2	1	µg/L
Organophosphorus Pesticides	SW8141	Trichloronate	327-98-0	1	µg/L
Organophosphorus Pesticides	SW8141	Merphos A+B	150-50-5	2	µg/L
Organophosphorus Pesticides	SW8141	Tetrachlorvinphos	22248-79-9	1	µg/L
Organophosphorus Pesticides	SW8141	Tokuthion	34643-46-4	1	µg/L
Organophosphorus Pesticides	SW8141	Fensulfothion	115-90-2	1	µg/L
Organophosphorus Pesticides	SW8141	Sulprofos	35400-43-2	1	µg/L
Organophosphorus Pesticides	SW8141	Methyl Azinphos	86-50-0	2	µg/L
Organophosphorus Pesticides	SW8141	Coumaphos	56-72-4	2	µg/L
Diquat and Paraquat	549.2	Diquat	85-00-7	0.4	µg/L
Diquat and Paraquat	549.2	Paraquat	1910-42-5	0.8	µg/L
Glyphosate	547	Glyphosate	1071-83-6	6	µg/L