

MULTI-CITY STUDY
FIELD REPORT FOR COLUMBUS GEORGIA AND PORT ST. LUCIE
FLORIDA – BATTELLE DUXBURY ACTIVITIES

For

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Prepared by

Kelly A. Irizarry

Battelle
397 Washington Street
Duxbury, MA 02332
(617) 934-0571

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1. INTRODUCTION

The objective of the sampling task in this study is to collect representative samples for trace-level analysis of FOSE-based fluorochemical (FC) residuals, to assess sources, dispersion in the environment, and human exposure via the food chain. The cities selected for sample collection will be considered 'study' or 'control' cities. 'Study' cities are considered those areas with FC production facilities or large FC consumers. 'Control' cities do not contain FC production or consumption facilities and are matched to study cities based on general location, population size, and drinking water source.

During the initial phase of the study, phone calls were made to municipal agencies requesting access to various matrices of interest. Based upon the level of cooperation received from the municipal agencies, appropriate sampling strategies were developed. The Quality Assurance Project Plan (QAPP) and the Survey Plan contain the appropriate information concerning the matrices for collection and methods to be utilized for this process.

The full project sampling scope is accomplished using two field teams: 1) Battelle's Duxbury Personnel collect drinking water, POTW, landfill and urban air samples, and 2) Battelle's Marine Sciences Laboratory (MSL) personnel collect surface water microlayer, bulk water and finfish samples. This report summarizes the Duxbury team effort. A separate report summarizes the MSL activities.

1.1 Survey Specific Approval

In Columbus GA, approval was obtained for sample collection at the Publicly Owned Treatment Works (POTW), municipal drinking water plant, the municipal landfill, and the Columbus Fire Department (for atmospheric sampling). In Port St. Lucie FL, approval was obtained for the POTW, municipal drinking water plant, the municipal landfill and the Port St. Lucie Fire Department (for atmospheric sampling). Table 1 highlights the cities visited during this survey and the approvals granted by municipal departments.

Table 1. Municipalities Sampled and Approvals Granted During Survey

City	Study or Control	Fire Department (Air Sampling)	POTW	Drinking Water Plant	Municipal Landfill
Columbus GA	Control	✓	✓	✓	✓
Port St. Lucie, FL	Control	✓	✓	✓	✓

2. METHODS

The collection of environmental samples was conducted according to Standard Operation Procedures (SOP's). The SOP's used in the Multi-City Study were written by Battelle and are used to train personnel prior to field activities and also serve as reference documents while in the field. These documents, along with the QAPP, serve as the guidance documents for the collection of field samples. The methods used for collection are summarized below.

The collection of position data (latitude and longitude) was completed at the Columbus and Port St. Lucie sampling location using a Garmin 12XL GPS unit according to Battelle SOP 3-164-01. Instrument accuracy was validated by comparing an acquired position versus a position of known location. The collection of air samples was completed using a General Metals Model PS-1 atmospheric sampler. The sampling was conducted according to Battelle SOP M3-MC-F-1.1. The use of this system allows the separate collection of particulate and vapor phase compounds using a glass-fiber filter for particulate matter and Polyurethane foam (PUF) for the vapor phase. Water samples from drinking water supplies, POTW's, and landfills were collected according to SOP M3-F-2.0. Surface water samples were collected via direct submersion, tap water and drinking water supplied by the municipal plant were collected via a valve system, and effluent was collected using either a bucket or small sampling beaker. Sediment samples were collected using a stainless steel spoon, according to Battelle SOP M3-F-7.0. Sludge in Columbus was collected using a valve system. Sludge in Port St. Lucie was collected using a small collection bucket.

3. CHRONOLOGY

Tables 2 through 6 describe the events that occurred each day of the survey. Sample matrix collection times have been transcribed from the sample log; all other times have been estimated based on the events that transpired during the survey. All times are recorded in Eastern Daylight Time.

Table 2. Chronology of Events on July 26, 1999

0815-1500	Battelle Duxbury personnel depart Boston
	Arrive in Columbus,GA
	Pick up rental vehicle and proceed to Federal Express to pick up supplies
	Proceed to meet with Chief Waters, Columbus Fire Department. Discuss location of Atmospheric sampler, we agree on Station #1
	Arrive at fire station #1 and place air sampling unit behind building for sample collection
1620	Conduct calibration of air sampler and start sampling for 12hr period
1650	Made phone calls for the collection of water samples on July 27 th
1700	Return to hotel

Table 3. Chronology of Events on July 27, 1999

0820	Arrive at Fire Station #1; collect filter and PUF sample. Cleaned sampler and collected quality control samples
	Site 2 tap water samples collected at Station #1 following the completion of air sampling
0950	Arrive at Columbus Water Works, contacted Jim Patterson for collection of Drinking water samples. Finished water collected at the facility, untreated water collected at the pumping station at the Dam
1030	Site 1 Surface water and sediment samples collected outside of the pumping station at the Dam
1100	Site 2 surface water and sediments samples collected at the Municipal Marina
1115	Site 3 surface water and sediments samples collected at the Municipal Marina
1140	Site 3 Tap water taken from restroom of Municipal Marina
1215	Arrived at Stonewoods Farm where the Quiet body of water was collected
1415	Arrived at the Pine Grove Land fill. With the assistance of Mr. Ralph Jackson, sample was collected from leachate well, directly into sample bottle
1600	Arrived at Columbus wastewater Treatment Plant. Talked with Mr. Tom West. Effluent samples collected via plastic container
1630	Collected sludge sample via collection valve
1700-1900	Arrived at the Holiday Inn Columbus collected site 1 Tap water
	Began spiking field spike samples
	Prep sample coolers for final shipment to designated sites
	Arrive at Federal Express for the shipment of samples

Table 4. Chronology of Events on July 28, 1999

1115-1720	Depart Columbus for W. Palm Beach
	Arrive W. Palm Beach
	Pick up van, head to Port St. Lucie. Made call to Ron Parish to make arrangements for air sampler set up
	Checked into hotel. Headed to station #5 to set up air sampler
	Set up air sampler
	Started air sampler for the period of 12 hours

Table 5. Chronology of Events on July 29, 1999

0800-0820	Arrive station # 5 collect filter and PUF sample. Cleaned sampler and collected quality control samples
	Site 2 Tap water samples collected from outside faucet at station #5
0930	Arrive Port St. Lucie Drinking Water Plant. With the approval of Gary Basham, untreated water was collected from outside faucet, finished water was collected in the lab
1130	Arrived at Northport WWTP effluent collect via collection bucket. Sludge was taken from Chlorine contact chamber via small collection bucket
1205	Arrived at Port St. Lucie Landfill. Contacted Ron Roberts who gave approval to sample leachate from the leachate pond via bucket
1345	Site 1 surface water / sediment collected from Pendarvis Cove Park
1345	Site 3 Tap water collected from restroom of Pendarvis Cove Park
1415	Site 2 Surface water / sediment collected from Martin County Marina

1500	Quiet Body of water collected at a pond on the corner of SW Mapped Rd. and SW Chapman Way
1530	Site 3 Surface water / sediment collected from the North side of Roosevelt drawbridge, Stuart FL
1730-1800	Site 1 Tap water collected from Holiday Inn Port. St. Lucie
	Packed coolers with ice in preparation for shipment on July 30 th

Table 6. Chronology of Events on July 30, 1999

0800-1600	Arrive at Federal Express to ship samples. Samples shipped successfully
	Drive to W. Palm Beach for a 10 am flight to Orlando Florida
	Leave Orlando Florida for Boston
	Arrive at Logan International Airport Boston

4. RESULTS

This survey, as part of the Multi-City Study, resulted in the collection of the samples described in Tables 3-5 of the QAPP and Amendment 1 to Revision 1. The following sections describe the results of the sample collection effort that occurred during this survey.

4.1 Sample Matrix Availability

Per client instructions no food items were collected during survey. Due to scheduling and permit issues no finfish were collected during this survey. The collection of POTW influent did not occur at either Columbus or Port St. Lucie due to health concerns. Both POTW influent streams available for sampling contained biological hazards. The staff at facilities in both cities indicated that the chlorination process occurs following secondary treatment.

Also collected, but not included in the QAPP, was a sample of quiet/undisturbed surface water. This sample is intended for use in a long-term transport study that is currently being conducted. The sampling location in Port St. Lucie was altered, with the approval of the project manager (Marcia Nishioka), from the original site due to a distance of 40 miles each way to the sample site. In Columbus, the sample site was located on private property. Permission was granted by one of the residents of Stone Woods Farm.

4.2 Onsite Observations

Columbus, GA: The POTW diffuses its water 100 feet from the river. The landfill leachate pond is gravity fed into a confined manhole, which was not accessible due to safety reasons. Leachate was collected using modified collection methods. Quiescent water was collected from private property after receiving permission from a resident of the property. Mr. Jesse Eldridge (3M client) was present at all sampling sites. The POTW sludge is dried and put out in the fields

to be mixed with soil on site. Drinking water influent was sampled from a pumping station about 1.5 miles from the drinking water plant.

The air sampler at this site was positioned approximately 1.5 feet from the 2-story fire station (station #1) located at 201 10th Street. The surface water collected at each of 3 sites located within Oliver Lake in every case was collected within 2m of shore in ca. 0.5m depth. Re-suspended bottom sediments were avoided in each case.

Port St. Lucie, FL: Surface water was taken from brackish (slightly saline) waters, indicating some tidal/seawater influence at this location within the river/estuary system. Multiple oyster shells and mangrove were observed. The WWTP is a much smaller facility than the drinking water plant. Mr. Gary Basham is the director of both facilities. With complete cooperation, all samples were collected successfully.

The air sampler in Port St. Lucie was positioned approximately 3 feet from the 2-story fire station (station #5) located at 1616 Port St. Lucie Boulevard. The surface water collected at each of the 3 sites within the Port St. Lucie River System was collected in each case within 2m of shore in ca. 0.05m depth. Re-suspended bottom sediments were avoided in each case.

Table 7. Collected Samples from Columbus Georgia

Matrix	Sample ID	Volume Collected (L) *Sediment Mass (g)	Location Collected
Drinking Water Unprocessed	MC-515B	1	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-516B	1	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-517B	1	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-518B	1 (spike 100 ng)	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-519B	1	Pumping Station @ the Dam
Drinking Water Unprocessed Field Bl.	MC-520B	Blank	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-515K	1	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-516K	1	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-517K	1	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-518K	1 (spike 100 ng)	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-519K	1	Pumping Station @ the Dam
Drinking Water Unprocessed Field Bl.	MC-520K	Blank	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-515H	1	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-517H	1	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-518H	1 (spike 100 ng)	Pumping Station @ the Dam
Drinking Water Unprocessed	MC-519H	1	Pumping Station @ the Dam
Drinking Water Unprocessed Field Bl.	MC-520H	Blank	Pumping Station @ the Dam
Drinking Water Processed	MC-521B	1	Columbus Water Works
Drinking Water Processed	MC-522B	1	Columbus Water Works
Drinking Water Processed	MC-523B	1	Columbus Water Works
Drinking Water Processed	MC-524B	1 (spike 100 ng)	Columbus Water Works
Drinking Water Processed	MC-525B	1	Columbus Water Works
Drinking Water Processed	MC-521K	1	Columbus Water Works
Drinking Water Processed	MC-522K	1	Columbus Water Works
Drinking Water Processed	MC-523K	1	Columbus Water Works
Drinking Water Processed	MC-524K	1 (spike 100 ng)	Columbus Water Works
Drinking Water Processed	MC-525K	1	Columbus Water Works

Matrix	Sample ID	Volume Collected (L) *Sediment Mass (g)	Location Collected
Drinking Water Processed	MC-521H	1	Columbus Water Works
Drinking Water Processed	MC-523H	1	Columbus Water Works
Drinking Water Processed	MC-524H	1 (spike 100 ng)	Columbus Water Works
Drinking Water Processed	MC-525H	1	Columbus Water Works
Tap Water Site #1	MC-526B	1	Holiday Inn
Tap Water Site #1	MC-527B	1	Holiday Inn
Tap Water Site #1	MC-528B	1	Holiday Inn
Tap Water Site #1	MC-529B	1 (spike 100 ng)	Holiday Inn
Tap Water Site #1	MC-530B	1	Holiday Inn
Tap Water Field Blank	MC-533B	Blank	Holiday Inn
Tap Water Field Blank	MC-534B	Blank	Holiday Inn
Tap Water Site #1	MC-526K	1	Holiday Inn
Tap Water Site #1	MC-527K	1	Holiday Inn
Tap Water Site #1	MC-528K	1	Holiday Inn
Tap Water Site #1	MC-529K	1 (spike 100 ng)	Holiday Inn
Tap Water Site #1	MC-530K	1	Holiday Inn
Tap Water Field Blank	MC-533K	Blank	Holiday Inn
Tap Water Field Blank	MC-534K	Blank	Holiday Inn
Tap Water Site #1	MC-526H	1	Holiday Inn
Tap Water Site #1	MC-528H	1	Holiday Inn
Tap Water Site #1	MC-529H	1 (spike 100 ng)	Holiday Inn
Tap Water Site #1	MC-530H	1	Holiday Inn
Tap Water Field Blank	MC-533H	Blank	Holiday Inn
Tap Water Field Blank	MC-534H	Blank	Holiday Inn
Tap Water Site #2	MC-531B	1	CFD Station #1
Tap Water Site #2	MC-531K	1	CFD Station #1
Tap Water Site #2	MC-531H	1	CFD Station #1
Tap Water Site #3	MC-532B	1	Metropolitan Boat Ramp
Tap Water Site #3	MC-532K	1	Metropolitan Boat Ramp
Tap Water Site #3	MC-532H	1	Metropolitan Boat Ramp
Surface Water Site #1	MC-501B	1	Pumping Station behind the Dam
Surface Water Site #1	MC-502B	1	Pumping Station behind the Dam
Surface Water Site #1	MC-503B	1	Pumping Station behind the Dam
Surface Water Site #1	MC-504B	1 (spike 100 ng)	Pumping Station behind the Dam
Surface Water Site #1	MC-505B	1	Pumping Station behind the Dam
Surface Water Field Blank	MC-508B	Blank	Pumping Station behind the Dam
Surface Water Field Blank	MC-509B	Blank	Pumping Station behind the Dam
Surface Water Site #1	MC-501K	1	Pumping Station behind the Dam
Surface Water Site #1	MC-502K	1	Pumping Station behind the Dam
Surface Water Site #1	MC-503K	1	Pumping Station behind the Dam
Surface Water Site #1	MC-504K	1 (spike 100 ng)	Pumping Station behind the Dam
Surface Water Site #1	MC-505K	1	Pumping Station behind the Dam
Surface Water Field Blank	MC-508K	Blank	Pumping Station behind the Dam
Surface Water Field Blank	MC-509K	Blank	Pumping Station behind the Dam
Surface Water Site #1	MC-501H	1	Pumping Station behind the Dam
Surface Water Site #1	MC-503H	1	Pumping Station behind the Dam
Surface Water Site #1	MC-504H	1 (spike 100 ng)	Pumping Station behind the Dam
Surface Water Site #1	MC-505H	1	Pumping Station behind the Dam
Surface Water Field Blank	MC-508H	Blank	Pumping Station behind the Dam
Surface Water Site #2	MC-506B	1	Municipal Marina
Surface Water Site #2	MC-506K	1	Municipal Marina

Matrix	Sample ID	Volume Collected (L) *Sediment Mass (g)	Location Collected
Surface Water Site #2	MC-506H	1	Municipal Marina
Surface Water Site #3	MC-507B	1	Municipal Marina
Surface Water Site #3	MC-507K	1	Municipal Marina
Surface Water Site #3	MC-507H	1	Municipal Marina
Sediment Site #1	MC-510B	200*	Pumping Station behind the Dam
Sediment Site #1	MC-510K	200*	Pumping Station behind the Dam
Sediment Site #2	MC-511B	200*	Municipal Marina
Sediment Site #2	MC-511K	200*	Municipal Marina
Sediment Site #3	MC-512B	200*	Municipal Marina
Sediment Site #3	MC-512K	200*	Municipal Marina
Sediment Field Blank	MC-513B	Blank	Municipal Marina
Sediment Field Blank	MC-513K	Blank	Municipal Marina
Sediment Field Blank	MC-514B	Blank	Municipal Marina
Sediment Field Blank	MC-514K	Blank	Municipal Marina
POTW Effluent	MC-539B	1	Columbus WWTP
POTW Effluent	MC-540B	1	Columbus WWTP
POTW Effluent	MC-541B	1 (spike 1000 ng)	Columbus WWTP
POTW Effluent	MC-542B	1	Columbus WWTP
POTW Effluent Field Blank	MC-543B	Blank	Columbus WWTP
POTW Effluent Field Blank	MC-543K	Blank	Columbus WWTP
POTW Effluent Field Blank	MC-543H	Blank	Columbus WWTP
POTW Effluent	MC-539K	1	Columbus WWTP
POTW Effluent	MC-540K	1	Columbus WWTP
POTW Effluent	MC-541K	1 (spike 1000 ng)	Columbus WWTP
POTW Effluent	MC-542K	1	Columbus WWTP
POTW Effluent	MC-539H	1	Columbus WWTP
POTW Effluent	MC-541H	1 (spike 1000 ng)	Columbus WWTP
POTW Effluent	MC-542H	1	Columbus WWTP
POTW Sludge	MC-544B	200*	Columbus WWTP
POTW Sludge	MC-544K	200*	Columbus WWTP
POTW Sludge Field Blank	MC-545B	Blank	Columbus WWTP
POTW Sludge Field Blank	MC-545K	Blank	Columbus WWTP
Urban Air (Vapor)	MC-546B	1 PUF	CFD Station #1
Urban Air (Particulate)	MC-547B	1 Filter	CFD Station #1
Urban Air Field Spike	MC-548B	1PUF (spike 100 ng)	CFD Station #1
Urban Air Field Spike	MC-549B	1Filter (spike 100 ng)	CFD Station #1
Urban Air Field Blank	MC-550B	1PUF	CFD Station #1
Urban Air Field Blank	MC-551B	1Filter	CFD Station #1
Landfill Leachate	MC-535B	1	Pine Grove Landfill
Landfill Leachate	MC-535K	1	Pine Grove Landfill
Landfill Leachate	MC-535H	1	Pine Grove Landfill
Landfill Leachate Field Blank	MC-536B	Blank	Pine Grove Landfill
Landfill Leachate Field Blank	MC-536K	Blank	Pine Grove Landfill
Landfill Leachate Field Blank	MC-536H	Blank	Pine Grove Landfill
Quiet Surface Water	MC-584B	1	Stone Wood Farm
Quiet Surface Water	MC-584K	1	Stone Wood Farm
Quiet Surface Water	MC-584H	1	Stone Wood Farm
Columbus Trip Blank	MC-585B	1	Battelle, Duxbury
Columbus Trip Blank	MC-586B	1	Battelle, Duxbury

Table 8. Collected Samples from Port St. Lucie FL

Matrix	Sample ID	Volume Collected (L) *Sediment Mass (g)	Location Collected
Drinking Water Unprocessed	MC-615B	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-616B	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-617B	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-618B	1 (spike 100 ng)	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-619B	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-615K	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-616K	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-617K	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-618K	1 (spike 100 ng)	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-619K	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed Field Bl.	MC-620B	Blank	St. Lucie Drinking Water Facility
Drinking Water Unprocessed Field Bl.	MC-620K	Blank	St. Lucie Drinking Water Facility
Drinking Water Unprocessed Field Bl.	MC-620H	Blank	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-615H	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-617H	1	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-618H	1 (spike 100 ng)	St. Lucie Drinking Water Facility
Drinking Water Unprocessed	MC-619H	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-621B	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-622B	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-623B	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-624B	1 (spike 100 ng)	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-625B	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-621K	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-622K	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-623K	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-624K	1 (spike 100 ng)	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-625K	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-621H	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-623H	1	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-624H	1 (spike 100 ng)	St. Lucie Drinking Water Facility
Drinking Water Processed	MC-625H	1	St. Lucie Drinking Water Facility
Tap Water Site #1	MC-626B	1	Holiday Inn
Tap Water Site #1	MC-627B	1	Holiday Inn
Tap Water Site #1	MC-628B	1	Holiday Inn
Tap Water Site #1	MC-629B	1 (spike 100 ng)	Holiday Inn
Tap Water Site #1	MC-630B	1	Holiday Inn
Tap Water Site #1	MC-626K	1	Holiday Inn
Tap Water Site #1	MC-627K	1	Holiday Inn
Tap Water Site #1	MC-628K	1	Holiday Inn
Tap Water Site #1	MC-629K	1 (spike 100 ng)	Holiday Inn
Tap Water Site #1	MC-630K	1	Holiday Inn
Tap Water Site #1	MC-626H	1	Holiday Inn
Tap Water Site #1	MC-628H	1	Holiday Inn
Tap Water Site #1	MC-629H	1 (spike 100 ng)	Holiday Inn
Tap Water Site #1	MC-630H	1	Holiday Inn
Tap Water Site #2	MC-631B	1	Port St. Lucie FD Station #5
Tap Water Site #2	MC-631K	1	Port St. Lucie FD Station #5
Tap Water Site #2	MC-631H	1	Port St. Lucie FD Station #5
Tap Water Site #3	MC-632B	1	Pendarvis Park Martin County
Tap Water Site #3	MC-632K	1	Pendarvis Park Martin County

Matrix	Sample ID	Volume Collected (L) *Sediment Mass (g)	Location Collected
Tap Water Site #3	MC-632H	1	Pendarvis Park Martin County
Tap Water Field Blank	MC-633B	Blank	Pendarvis Park Martin County
Tap Water Field Blank	MC-633K	Blank	Pendarvis Park Martin County
Tap Water Field Blank	MC633H	Blank	Pendarvis Park Martin County
Tap Water Field Blank	MC-634B	Blank	Pendarvis Park Martin County
Tap Water Field Blank	MC-634K	Blank	Pendarvis Park Martin County
Surface Water Site #1	MC-601B	1	Pendarvis Park Martin County
Surface Water Site #1	MC-602B	1	Pendarvis Park Martin County
Surface Water Site #1	MC-603B	1	Pendarvis Park Martin County
Surface Water Site #1	MC-604B	1 (spike 100 ng)	Pendarvis Park Martin County
Surface Water Site #1	MC-605B	1	Pendarvis Park Martin County
Surface Water Field Blank	MC-608B	Blank	Pendarvis Park Martin County
Surface Water Field Blank	MC-608K	Blank	Pendarvis Park Martin County
Surface Water Field Blank	MC-608H	Blank	Pendarvis Park Martin County
Surface Water Field Blank	MC-609B	Blank	Pendarvis Park Martin County
Surface Water Field Blank	MC-609K	Blank	Pendarvis Park Martin County
Surface Water Site #1	MC-601K	1	Pendarvis Park Martin County
Surface Water Site #1	MC-602K	1	Pendarvis Park Martin County
Surface Water Site #1	MC-603K	1	Pendarvis Park Martin County
Surface Water Site #1	MC-604K	1 (spike 100 ng)	Pendarvis Park Martin County
Surface Water Site #1	MC-605K	1	Pendarvis Park Martin County
Surface Water Site #1	MC-601H	1	Pendarvis Park Martin County
Surface Water Site #1	MC-603H	1	Pendarvis Park Martin County
Surface Water Site #1	MC-604H	1 (spike 100 ng)	Pendarvis Park Martin County
Surface Water Site #1	MC-605H	1	Pendarvis Park Martin County
Surface Water Site #2	MC-606B	1	Martin County Marina
Surface Water Site #2	MC-606K	1	Martin County Marina
Surface Water Site #2	MC-606H	1	Martin County Marina
Surface Water Site #3	MC-607B	1	Stuart Harbor
Surface Water Site #3	MC-607K	1	Stuart Harbor
Surface Water Site #3	MC-607H	1	Stuart Harbor
Sediment Site #1	MC-610B	200*	Pendarvis Park Martin County
Sediment Site #1	MC-610K	200*	Pendarvis Park Martin County
Sediment Site #2	MC-611B	200*	Martin County Marina
Sediment Site #2	MC-611K	200*	Martin County Marina
Sediment Site #3	MC-612B	200*	Stuart Harbor
Sediment Site #3	MC-612K	200*	Stuart Harbor
Sediment Field Blank	MC-613B	Blank	Stuart Harbor
Sediment Field Blank	MC-613K	Blank	Stuart Harbor
Sediment Field Blank	MC-614B	Blank	Stuart Harbor
Sediment Field Blank	MC-614K	Blank	Stuart Harbor
POTW Effluent	MC-639B	1	North Port WWTP
POTW Effluent	MC-640B	1	North Port WWTP
POTW Effluent	MC-641B	1 (spike 1000 ng)	North Port WWTP
POTW Effluent	MC-642B	1	North Port WWTP
POTW Effluent	MC-639K	1	North Port WWTP
POTW Effluent	MC-640K	1	North Port WWTP
POTW Effluent	MC-641K	1 (spike 1000 ng)	North Port WWTP
POTW Effluent	MC-642K	1	North Port WWTP
POTW Effluent	MC-639H	1	North Port WWTP
POTW Effluent Field Blank	MC-643B	Blank	North Port WWTP

Matrix	Sample ID	Volume Collected (L) *Sediment Mass (g)	Location Collected
POTW Effluent Field Blank	MC-643K	Blank	North Port WWTP
POTW Effluent Field Blank	MC-643H	Blank	North Port WWTP
POTW Effluent	MC-640H	1	North Port WWTP
POTW Effluent	MC-641H	1 (spike 1000 ng)	North Port WWTP
POTW Effluent	MC-642H	1	North Port WWTP
POTW Sludge	MC-644B	200*	North Port WWTP
POTW Sludge	MC-644K	200*	North Port WWTP
POTW Sludge Field Blank	MC-645B	Blank	North Port WWTP
POTW Sludge Field Blank	MC-645K	Blank	North Port WWTP
Urban Air (Vapor)	MC-646B	1PUF	Port St. Lucie FD Station #5
Urban Air (Particulate)	MC-647B	1Filter	Port St. Lucie FD Station #5
Urban Air (Vapor) Field Spike	MC-648B	1PUF (spike 100 ng)	Port St. Lucie FD Station #5
Urban Air (Particulate) Field Spike	MC-649B	1Filter (spike 100 ng)	Port St. Lucie FD Station #5
Urban Air (Vapor) Field Blank	MC-650B	1PUF	Port St. Lucie FD Station #5
Urban Air (Particulate) Field Blank	MC-651B	1Filter	Port St. Lucie FD Station #5
Landfill Leachate	MC-635B	1	Port St. Lucie Landfill
Landfill Leachate	MC-635K	1	Port St. Lucie Landfill
Landfill Leachate	MC-635H	1	Port St. Lucie Landfill
Landfill Leachate Field Blank	MC-636B	Blank	Port St. Lucie Landfill
Landfill Leachate Field Blank	MC-636K	Blank	Port St. Lucie Landfill
Landfill Leachate Field Blank	MC-636H	Blank	Port St. Lucie Landfill
Quiet Surface Water	MC-684B	1	Mapp Rd./SW Chapman Way
Quiet Surface Water	MC-684K	1	Mapp Rd./SW Chapman Way
Quiet Surface Water	MC-684H	1	Mapp Rd./SW Chapman Way
Port St. Lucie Trip Blank	MC-685B	1	Battelle, Duxbury
Port St. Lucie Trip Blank	MC-686B	1	Battelle, Duxbury

4.3 Instrumentation Results

Air samples were collected using a General Metals Model PS-1 air sampler. According to SOP M3-MC-F1.1, the air sampler calibration is acceptable if it is within 10% of the expected results. To determine the acceptable results a calibration was conducted in Duxbury prior to the initiation of the study. The initial calibration curve resulted in a R^2 value of 0.995. The calibration curves generated in Columbus and Port St. Lucie had R^2 values of 0.999 and 0.995 respectively. The percent difference in recorded values from the initial calibration ranged from 0.0% to -6.73% for Columbus and 0.0% to 5.26% for Port St Lucie.

Site locations were determined using a Garmin 12X L GPS. The accuracy of the GPS unit was verified prior to departure from Duxbury by comparing a verified location on Battelle property versus the location determined by the instrument. The distance between the benchmark and instrument value was 32.19 meters.

The GPS operation was verified in Columbus GA using a benchmark at the Pine Grove Landfill. Following shipment to Georgia the instrument was reinitialized automatically. This was conducted at the fire station on July 26th. Within several minutes of the process, the unit was displaying maps and locations of the local area, which indicated that it was working properly. The results of the verifications for each sampling day are presented in Table 11.

The coordinates for the benchmark were in northing and easting. They were recorded on the log forms in this format and were converted to latitude and longitude by Ned Morse of Battelle Duxbury Operations. The result of the verification for Columbus was a difference of 10 meters between the benchmark value and the instrument value. The readings were then entered into the GPS and calculated in latitude and longitude.

No benchmark reference verification was obtained from Port St. Lucie. The Garmin 12XL Operators Manual states that if two cities are within 500 miles of each other, a second verification is not needed. Because Port St. Lucie FL is within 500 miles of Columbus GA, a second verification was not conducted and no position for this city was obtained.

According the QAPP, the minimum distance between sediment sampling site positions should be ≥ 500 feet. The following results have been calculated using the Garmin GPS. The distance from Columbus Site 1 to Site 2 is 1378 ft., the distance from Site 2 to Site 3 is 787 ft. and the distance from Site 1 to Site 3 is 2132 ft. The distance from Port St. Lucie Site 1 to Site 2 is 1574 ft.; the distance from Site 2 to Site 3 is 7808.8 ft. and the distance from Site 1 to Site 3 is 6496 ft.

Table 9. Sampling Site Positions in Columbus GA

Sampling Location	Latitude	Longitude	Address
Fire Station #1, Tap water site #2	N 32°27'55.5"	W 84°59'22.1"	201 10 th Avenue
Holiday Inn, Tap water site #1	N 32°28'18.7"	W 84°59'20.0"	1325 Veterans PKWY
Metro Boat Ramp	N 32°31'19.0"	W 84°59'29.3"	River Road
Pumping Station Site #1	N 32°31'03.8"	W 84°59'46.6"	River Road
Municipal Marina Site #2	N 32°31'12.8"	W 84°59'34.6"	River Road
Municipal Marina Tap water Site #3	N 32°31'19.0"	W 84°59'29.3"	Oliver Lake \River Rd.
Columbus Water works (effluent)	N 32°31'03.5"	W 84°59'14.7"	River Road
Columbus Water Works (influent)	N 32°31'02.1"	W 84°59'47.8"	Pumping station at Dam \River Rd.
Columbus WWTP	N 32°24'35.2"	W 84°58'44.7"	S. Lumkin Rd.
Quiet Water Stonewoods Farm	N 32°34'17.3"	W 85°00'48.6"	Better's Lake
Pine Grove Landfill	N 32°28'56.3"	W 84°51'17.0"	7160 Sacerdate Lane.

Table 10. Sampling Site Positions in Port St. Lucie, FL

Sampling Location	Latitude	Longitude	Address
Holiday Inn Site #1 Tap	N 27°16'46.2"	W 80°17'30.1"	S. Federal Hwy
Fire Station #5 Site #2 Tap	N 27°16'21.8"	W 80°18'14.6"	1616 Port St. Lucie Blvd
Pendarvis Park Site #3 Tap	N 27°11'15.2"	W 80°16'12.9"	Martin county, Pendarvais Park
Northport WWTP	N 27°20'10.7"	W 80°21'08.7"	281 St. James Ave
Drinking Water Plant	N 27°18'32.1"	W 80°20'37.8"	1001 S. Prineville Rd
Port St. Lucie Landfill	N 27°23'21.4"	W 80°23'53.1"	6120 Glades Cutoff Rd
Quiet Water Palm City, FL.	N 27°11'00.1"	W 80°16'20.4"	Mapp Rd \SW Chapman Way
Pendarvis site #1	N 27°11'15.2"	W 80°16'12.9"	Pendarvis Cove Park
Municipal Marina site #2	N 27°11'00.1"	W 80°16'08.7"	Martin County Marina
Stuart Harbor site #3	N 27°12'13.6"	W 80°15'43.0"	North side of Roosevelt draw bridge

Table 11. GPS Position Verification Results

Calibration Locations	Columbus GA	Port St. Lucie
Waypoint Position at Landfill (Accepted)	N 32°29'18.96"/W 84°51'10.48"	Not needed cities are within 500 miles of each other
GPS Derived Position (Measured)	N 32°29'18.83" / W 84°51'09.9"	
Difference	0.1 kilometers - bearing 00°	

4.4 Communications

There were no pertinent conversations surrounding the collection of samples at the various facilities that were sampled. Contacts and employees of the facilities in both cities were very helpful to our sampling process. During the course of collecting surface water samples in both Columbus and Port St. Lucie, members of the general public inquired about the sampling effort. In each case a general answer was offered and all interested parties were satisfied.

5. DEVIATIONS AND CORRECTIVE ACTIONS

During the collection of samples from Columbus, GA and Port St. Lucie, FL the following QAPP deviations were encountered

- POTW inlet samples were not collected in either city, due to health risks.
- A final lpm reading was not documented for the air sampler at the end of the collection period. Thus only the initial value was used to determine the "average" flow rate.
- The client requested that food items not be collected.
- Weather notations were not included in the field record.
- Manufacturer labels were used because of problems with the Battelle labels.
- The air samples were not field spiked but rather laboratory spiked at Battelle Duxbury.

The following deviations were noted during the Columbus Georgia survey:

- Pine Grove Landfill in Columbus has gravity fed leachate pond, which is accessible through a manhole. A single attempt to collect samples from this leachate source was unsuccessful. Due to noxious fumes and confined space entry, an alternate method was developed, with the help of the site supervisor, Mr. Ralph Jackson. Using jumper cables, sample bottles and pre-approved packing tape we were able to collect the sample successfully. A telescopic pole and bucket was purchased for future situations.

- Contrary to the QAPP the spiked filter and PUF for Columbus were shipped to the field on blue ice. The PUF, filter, and blue ice were each individually sealed in zip lock bags that did not leak and so blue ice did not come in contact with the filter or the PUF. In the future the filter and PUF will be sent on dry ice.

The following deviations occurred during the Port St. Lucie Florida survey

The QA Project Plan Section 7.3.5. states that “whole (bulk) water will be collected from three sites within a surface water source of drinking water, and at the water treatment plant influent and outflow... If the drinking water source is groundwater then the surface water samples will be collected from any selected lake, pond, or river...”. In Port St. Lucie, drinking water is pumped from groundwater and so the surface water collected does not relate to drinking water supplies. Sampling specifics follow:

- The project manager gave coordinates for surface water collection; these coordinates were not accessible due to private property and needed to be modified. Surface water from Port St. Lucie was collected from the Port St. Lucie River, which is brackish (partially mixed with seawater and slightly saline). Intake and outflow drinking water samples were collected from the municipal drinking water plant.
- Sludge from the Port St. Lucie POTW was pre-treated sludge. After sampling at the POTW, it was discovered that plant staff did not take sludge from the appropriate sludge chamber. The plant manager, Mr. Carl Norton was contacted to confirm the exact sampling location. He informed us that the sludge was collected from the Chlorine Contact Chamber.
- The accuracy of the GPS was not verified in Port St. Lucie. At this city a benchmark could not be found and the accuracy of the GPS was not verified. The manual for the GPS indicates however that if two cities are within 500 miles then a second verification is not needed.

Quiescent water was not sampled at the pre-designated site because it was far from the other sampling sites and time was short. The Battelle project manager, Marcia Nishioka approved changing the location for this reason.