Appendix B-3

Onondaga County Department of Water Environment Protection
Lake Audit Report

Audit Date: *Wednesday October 30, 2013*
Completed by: *Anthony R. Prestigiacomo, UFI*

Summary of Audit Activities

Pre-Departure

I arrived at the Henry Clay Bvd. facility at approximately 7 AM on Wednesday October 30, 2013. Upon my arrival, crew members were arriving and getting organized for the sampling day. I met with Mark H. and we discussed the new lake program. For example, in 2013 the UML and LWL were replaced with samples collected discretely at 3 and 15m, respectively. This allows for a more time efficient day as only the pump is used with no dunker needed. We also discussed the current state of the lake with respect to approaching turnover. The lake had not turned over as of midnight 10/30, it was still stratified at ~ 16.5m.

I was early enough to observe the daily safety meeting led by Dan Walpole. Also, I inspected the day's sampling containers for the equipment (wash) blanks. The labeling was clear, adequate with the proper date. All crew members were wearing nitrile gloves. All equipment was rinsed with DI and then used to fill the churns. All bottles were rinsed and filled properly and filtered and/or preserved if necessary. pH on the final preserved samples were verified with the litmus (pH) strips. The COCs were filled out properly and samples were relinquished to the lab before departure. Throughout the collection, there was good teamwork and open communication. The lab verified pH and the all samples were collected as required.

Two WEP field crew members then moved to the mercury clean room to collect the mercury equipment blanks from the dunker. I was able to see them through the double doors, but did not see the clean hands, dirty hands procedure. Mark H. discussed the difficulties of honoring the clean hands/dirty hands technique while handing the clean water, dunker, and double bagged sampling container. WEP is processing their own mercury samples now but still running sample splits with Test America to verify lab performance.

Jason was performing the sonde maintenance and calibration. I was able to observe the pH calibration. The calibration notebook looked in good order with good, clear handwriting. Jason noted a specific conductivity probe error and installed a new probe.

Before departure I observed the crews loading the trucks and readying the Whaler for use in mercury sampling. Janaki and I left for the marina at ~ 8:20 AM.

Boat Equipment and Organization

Upon arrival at the marina, the crew had begun loading the Captain Jack. The boat looked to be in good working order. Everything was neatly stowed with good housekeeping. The County's sampling vessel had all proper equipment, including: marine radio, depth finder, GPS, first aid kit, fire extinguisher and all appropriate field paperwork was present. All crew members had life vests and appropriate personal protective equipment. All equipment, sample bottles, and coolers were packed neatly and in a manner that allowed efficient sample and field data collection.

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South Deep Sample and Field Data Collection

A. Discrete Water Samples ~0845 – 09:50

The water collection is all done with the peristaltic pump and tubing. Initially the pump is set to 0m and pumped for approximately 5 minutes to purge and clean the tubing.

The crew began sampling 0m at ~ 08:50. The correct bottles were properly rinsed and filled with time of collection added to the bottle labels as the samples were collected. All crew members wore nitrile gloves. There was good communication as the collection was completed and the chain of custody was filled out as the collection progressed.

The crew performed the sample collection according to the QAPP. Specifically,

1. The correct equipment was used, peristaltic pump.
2. The pump was allowed to flush for 2-3 minutes prior to collection.
3. Sample bottles were rinsed with sample water before collection (1 rinse).
4. The samples were collected and all required samples were preserved using guidelines of preservation kit. The preservation was verified with pH strips on the 0m sample only; pH was not verified for all samples.
5. TDP and SRP samples were field filtered.
6. The duplicate sample was collected at 3m (standard duplicate depth).
7. UML parameters were collected at 3m and LWL parameters were collected at 15m.
8. See Cl_2 residual notes below.
9. The samples were put on ice after collection.
10. The field sheets and chain of custody were filled out properly.
11. The F. Coliform sample was collected at the surface
12. Pump/tubing was flushed with DI after use.

Notes on Cl_2 Residual Detections

At 0m a 0.07 mg/L Cl_2 residual was detected so the sample was properly administered 1 drop of sodium thiosulfate. Janaki and field team subsequently had a conversation about the importance of checking for Cl_2 residual as it causes interferences with lab analysis, particularly total ammonia. We also discussed that detecting Cl_2 residual in lake was uncommon but not extraordinarily rare.

At 3m the Cl_2 residual test revealed 0.14 mg/L of Cl_2 residual. This was determined to be a very high concentration and rare to get a detection at 3m. We all discussed the implications of so much Cl_2 residual in the lake.

Sample collection continued at 6m, 9m, 12, and 15m. Cl_2 residual was detected at all of these depths which compounded the rare occurrence we observed. After Cl_2 residual was detected at 15m, Mark H. had the mercury collection crew (who had finished) take two sample containers and collected grabs at Metro outfall and Onondaga Creek mouth to shed some light on the source of the Cl_2 residual. Metro outfall had 0.25 mg/L of Cl_2 residual and Onondaga Creek had 0.11 mg/L. This demonstrated professional diligence and flexibility by the field team to help investigate this anomaly.

Interestingly, there was no Cl_2 residual detected at 18m which was consistent with the boundary of thermal stratification.

Observations/Suggestions for Improvements: Discrete Water Collection

1. I observed that the sample end of the tubing from the pump was touching the floor of the boat at times. While probably not a major problem, it could lead to contamination. It would be best if the nozzle were somehow secured to keep it from contacting any surface that could result in contamination.

B. YSI profile Collection

YSI data (temperature, specific conductance, pH, and dissolved oxygen) was collected at 0.5 m intervals from surface to 18m (near bottom). The field technician stated that ~ 1 minute was the time used for DO equilibration in the epilimnion.

Observations/Suggestions for Improvements

1. The YSI field data is collected electronically, with no paper backup. If the data is lost due to instrument malfunction or during electronic transfer the potential exists to lose the entire day's field data. Perhaps considering keeping a hand written copy of the data as an emergency backup.

Make sure enough time is given for the DO to equilibrate. 1 minute should be adequate in the upper waters, but in areas of rapid DO change with depth, equilibration could take longer than 1 minute.

C. Tube Composite

Chlorophyll and phytoplankton samples were collected from the 0-3m tube composite. The phytoplankton sample was collected into a pre-preserved (Lugol's) bottle. In addition, a chlorophyll duplicate sample was collected from 0-3m.

Observations/Suggestions for Improvements

1. None.

D. Zooplankton Sample

The crew performed the zooplankton sample collection according the QAPP. Specifically,

1. A 15m tow was collected pre and post flow meter readings were recorded
2. The flow meter was calibrated in the spring of 2013.
3. The line was pre-marked for depth and the pre-post flow meter readings were recorded.
4. The samples were poured into Alka-seltzer and preserved with 190 proof (95%) ethanol.

Observations/Suggestions for Improvements

1. None.

E. Mercury Sample Collection

The mercury collection crew tied their Whaler to the primary vessel (Captain Jack) to perform their sampling.

For the sample collection, the crew wore nitrile gloves as required. I observed that the use of the Teflon dunker makes it difficult for a two person mercury field crew to collect mercury samples while maintaining the clean hands/dirty hands technique given the observed procedure. The two person mercury field crew performed the collection in the following manner:

1. Member A lowered the dunker to depth and collected the sample.
2. Because the dunker needed to be handled at all times by Member A, Member B operated as **both** dirty hands and clean hands for the rest of the collection.
    a. Member B opened the cooler, removed the double bagged sample container from the cooler by touching the outer bag.
    b. Member B then opened the outer bag.
    c. Member B then opened the inner bag.
    d. Member B then removed the sample container and opened the sample container
3. Member A opened the dunker and poured into the sample bottle being held by Member B
4. Member B placed the container in the inner bag and sealed.

5. Member B then placed the inner bag into the outer bag and sealed.
6. This was repeated for all mercury samples collected (that I observed).

This procedure violates the clean hands/dirty hands procedure for mercury sample collection. Again, it is difficult to complete with the dunker with just two people. I have listed a few alternatives to the current procedures to allow for mercury collection that does not violate the clean hands/dirty hands technique.

Observations/Suggestions for Improvements: Mercury Collection

1. Although performing the field blanks in the same manner should detect contamination, the clean hands/dirty hands technique is specifically required for mercury collection and given the importance (and expense) of mercury collection I think the procedures currently being used could be improved.
2. Follow recommended actions (addendum) for improvement to mercury collection.

Chemistry Sample Transfer

After this site, Janaki, Mark H., and I went back to the Henry Clay facility to observe sample transfer to the lab. Mark took the samples from the truck to the lab where the samples were received by the lab. All required samples were present and the COCs were filled out correctly and verified by the lab. The receiving lab tech stated that the temperature in the cooler was acceptable and all preserved samples were at the appropriate pH.

Conclusions

Overall, the lake monitoring is well organized and was executed very efficiently. All field crew members were knowledgeable and were able to answer all of my questions. All procedures were consistent with the program design in the 2013 QAPP and there are only a few minor suggestions I have listed (above). I have listed several alternative mercury collection procedures that should be considered. Chain of custody and field note documentation was adequate. The equipment looked to be in good working condition. Safety procedures, safety precautions and personal protective equipment were exemplary.

Anthony R. Prestigiacomo
Field Supervisor, Field Safety Officer
Upstate Freshwater Institute

December 19, 2013

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Audit Checklist

Quality Assurance Project Plan Requirement	Acceptable/ Unacceptable	Notes/Comments
Sonde calibrated according to the SOP and logged in bound notebook	A	Jason showed me the sonde calibration record for the event
Bottles pre-labeled and match planned field effort	A	
Chain of custody accurate and complete	A	verified COC completion for wash blanks prior to departure; verified COC for South Deep samples.
Wash blanks prepared on cleaned equipment and submitted to lab check-in prior to departure	A	
Field crews verified that all equipment is packed in vehicles prior to departure	A	
Schedule and sequence of sites are reviewed prior to departure	NA	nothing formal that I observed, but all crew members were present and communicating about the tasks at hand for the day; all crew members have extensive experience about the day's tasks and goals
Daily safety meeting prior to departure, potential hazards discussed	A	
Safety precautions observed	A	excellent attention to safety; verified first aid kit, fire extinguishers, and all crews wore appropriate personal protective equip. including life vests
Field crew verifies correct location prior to initiating sampling	A	only South Deep sampled
Field crews verify correct pre-labeled bottles filled at proper location	A	all bottles arranged and checked prior to filling
Samples collected according to QAPP	***A****	***Acceptable for all parameters except Hg, see notes on Hg collection***
Duplicate sample collected	A	duplicate sample collected at 3m
Submersible pump allowed to flush for sufficient time prior to collected the sample	A	~ 2 to 3 minutes per depth, I verified for several depths
Tube composites sampled properly	A	
Bottles rinsed with sample water prior to collection	A	1 rinse
Water mixed in churn at proper rate	NA	Churn composites no longer collected in 2013.
Zooplankton flow meter properly set prior to collecting sample	A	
Field filtration SRP, TDP samples	A	
Preservation according to QAPP	A	All required samples were preserved according to the QAPP; pH verified on 0m South Deep samples
Samples iced and kept out of direct sunlight	A	
Proper equipment used for each sampling location	A	exactly according to QAPP

Field crews observe ambient conditions and make notes as needed	A	observations were made and notations made on COC and field sheets
Field crews properly trained and understand assignments	***A****	***all crew members were knowledgeable about sites, samples collected, equipment and procedures*; all observed good safety protocols and displayed good teamwork and showed good communication***

*As stated previously the clean hands, dirty hands procedure was violated for mercury collection. The field staff acknowledged the shortcomings with using the dunker with two people but felt that they were doing the best they could with the equipment and staffing that they had. Please see the Addendum for UFI's recommendations where a revised 2 crew member procedure is proposed for discrete sampling with the dunker.

Addendum.

Alternatives to current mercury collection procedure.

1. Dunker Technique

Member A Dirty Hands, designated DH
Member B Clean Hands, designated CH

Recommended Procedure: Field Blank (through Dunker) Collection

1. Clean gloves donned by both DH and CH
2. DH removes double bagged sample container from cooler
3. DH opens outer bag
4. CH opens inner bag and removes sample bottle
5. CH places inner bag into outer bag
6. DH closes outer bag and places bags in cooler
7. CH places the sample bottle onto a prepared clean surface (i.e., cooler lid lined with paper towels). The lid on the sample remains closed to prevent contamination
8. DH handles the dunker
9. CH pours mercury free water into dunker
10. **CH changes gloves*** after the water is in the dunker and handles the bottle
11. CH removes lid off sample bottle
12. DH pours field blank sample into bottle
13. CH closes sample container when sample is complete
14. DH sets down the dunker
15. DH removes outer bag from cooler and opens outer bag
16. CH places sample bottle into inner bag and places inner bag into outer bag
17. DH seals outer bag and places into cooler

* CH could also wear 2 clean pairs of gloves and remove the outer pair after handing the DI

Recommended Procedure: Discrete Depth Collection

1. Clean gloves donned by both DH and CH
2. DH removes double bagged sample container from cooler
3. DH opens outer bag
4. CH opens inner bag and removes sample bottle
5. CH places inner bag into outer bag
6. DH closes outer bag and places bags in cooler
7. CH holds the sample bottle with lid closed to prevent contamination
8. DH lowers the dunker to appropriate sample depth
9. DH raises dunker
10. CH removes lid from bottle
11. DH pours sample to bottle
12. CH closes lid when sample is complete
13. DH sets down the dunker
14. DH removes outer bag from cooler and opens outer bag
15. CH places sample bottle into inner bag and places inner bag into outer bag
16. DH seals outer bag and places into cooler

These two revised procedures add a certain level of complexity to the process (rearranging sequence, glove changes mid-process, more work for DH, etc…) but would allow for the clean hands/dirty hands technique to be more closely followed.

2. Pump Technique

Member A Dirty Hands, designated DH
Member B Clean Hands, designated CH

Recommended Procedure: Field Blank (through Pump Tubing) Collection

1. Clean gloves donned by both DH and CH
2. DH removes double bagged sample container from cooler
3. DH opens outer bag
4. CH opens inner bag and removes sample bottle
5. CH places inner bag into outer bag
6. DH closes outer bag and places bags in cooler
7. CH holds the sample bottle with lid closed to prevent contamination
8. DH places pump in enough mercury free water to allow 3 times tubing volume flush
    a. assuming a 0.5 inch inner diameter tube and 20m length you would need ~ 18L to properly flush and collect ~ 1L sample
9. CH collects sample from end of tubing
10. CH closes lid when sample is complete
11. DH turns off pump
12. DH removes outer bag from cooler and opens outer bag
13. CH places sample bottle into inner bag and places inner bag into outer bag
14. DH seals outer bag and places into cooler

Recommended Procedure: Discrete Depth Collection

1. Clean gloves donned by both DH and CH
2. DH removes double bagged sample container from cooler
3. DH opens outer bag
4. CH opens inner bag and removes sample bottle
5. CH places inner bag into outer bag
6. DH closes outer bag and places bags in cooler
7. CH holds the sample bottle with lid closed to prevent contamination
8. CH removes lid from bottle and collects sample from tubing
9. CH closes lid when sample is complete
10. DH removes outer bag from cooler and opens outer bag
11. CH places sample bottle into inner bag and places inner bag into outer bag
12. DH seals outer bag and places into cooler

The pump option is definitely easier for the field team to collect a sample as there is less equipment handling, but it comes with its own complications such as finding tubing appropriate for sampling mercury (we had had good luck with MasterFlex), expense, having enough mercury free water to collect the field blank (through the tubing), finding a suitable pump weight, and others.

Response to October 30, 2013, AMP Onondaga Lake Sampling
UFI Audit Report (received January 14, 2014)
OCDWEP

Suggestion 1: The YSI field data is collected electronically, with no paper backup. If the data is lost due to logger malfunction or during electronic transfer the potential exists to lose the entire day's field data. Perhaps a hand written copy of the data as an emergency backup.
Response: To-date, there have been no issues relating to loss of data due to YSI datalogger malfunction in the field or during electronic transfer. Data is checked on the logger periodically throughout the sampling event, and the WW technician staff carry extra batteries in case of a loss of power. We will re-evaluate the need to hand write in-situ data if the need arises.

Suggestion 2: I observed that the sample end of the tubing from the pump was touching the floor of the boat at times. While probably not a major problem, it could lead to contamination. It would be best if the nozzle were somehow secured to keep it from contacting any surface that could result in contamination.
Response: The tubing will be secured during the sampling events and kept from contacting any surface that could potentially result in contamination. The tubing will be attached to the handle of the pump container (Tub) with zip ties or rope to achieve this. Reference to keeping the sample end of the tubing from contacting any surface has been added to the draft OCDWEP ETS SOP #0085 (Onondaga Lake Sampling Methodology), revision dated June 18, 2014.

Suggestion 3: Although performing the field blanks in the same manner should detect contamination, the clean hands/dirty hands technique is specifically required for mercury collection and given the importance of mercury collection i think the procedures currently being used could be improved.
Response: The ultra low-level mercury samples are collected by a two-person crew following the "*Clean Hands Dirty Hands Sampling Technique*" for grab samples in the procedures outlined in the OCDWEP ETS SOP # 00126 (Low-level Mercury Sample Collection). These procedures reference that the "Dirty Hands" sampling technician will be responsible for handling the Teflon Dunker and pouring the sample. ***The "Clean Hands" sampling technician shall only touch the sample container and cap and that if at any time the "Clean Hands" sampling technicians gloves touch an un-clean object, the gloves should be immediately replaced.***

The dunker collection technique recommended in the UFI lake audit report, provide step-by-step procedures for each member of the two-person sampling crew and have been incorporated into the draft SOP #0085 (Onondaga Lake Sampling Methodology), revision dated June 18, 2014, to be reviewed with the WW Technician staff. These procedures will be followed for collection of both the "Field Blank" (through dunker) and "Discrete Depth" samples.

We do not consider conducting an audit of the sample collection crew from a different boat ideal, and suggest that in 2014 the review of the mercury sample collection be conducted from the same boat to allow closer observations of the sampling procedures.