Tonawanda Coke Corporation (TCC) Soil Study
First year annual report
August 2016 through December, 2017

Introduction

This report covers the first full year of the TCC Soil Study, and includes efforts from the three study partners, staff and students from the Department of Chemistry at the University at Buffalo, SUNY, led by the overall Study Principal Investigator, Professor Joseph A. Gardella, Jr., students from Department of Chemistry at SUNY Fredonia, led by Professor Michael Milligan and efforts from community volunteers organized by Citizen Science Community Resources (CSCR), under the direction of Jackie James-Creedon. Attached are summaries of activities and budget reports from SUNY Fredonia Department of Chemistry and CSCR (appendices 1, 2 and 5).

The present report will focus on activities ***after what was reported in the June 1, 2017 report***, which included initial startup activities (hiring, organization, community outreach and education) and planning for the program of soil sampling in two phases. The focus for this report is the Phase 1 sampling conducted from June to December 2017. Also underway is the analysis of the testing data and reporting to residents who participated (participants), municipalities, school districts and corporate sites. The final step in Phase 1 is the development of maps of pollutants which are elevated above soil cleanup objectives (SCOs) and the identification of "hot spots" that can be investigated in Phase 2. Phase 2 sampling will take place in Summer and Fall 2018 with data analysis to present a comprehensive picture of the legacy of pollution in the Town and City of Tonawanda, parts of North Buffalo, Black Rock and Riverside neighborhoods in the City of Buffalo and portions of Grand Island.

Outreach and Community Education

The primary activities of outreach and community education involve tight collaborations between all three partners with ***facilitation led by CSCR***. Community meetings, an August 4th, 2017 Press Conference and monthly meetings of the TCC Soil Study Community Advisory Committee (CAC) have been the regular actions of Outreach and Community Education. A summary of meetings is given in appendix 2.

TCC Soil Study Sampling Plan

The sampling plan for the TCC Study is based on a two phase approach described in the proposal from the University at Buffalo approved by Judge Skretny.

Phase 1 has involved a standard grid based sampling plan (Figure 1) over an area encompassing the City and parts of the Town of Tonawanda, parts of the City of Buffalo and parts of the Town of Grand Island. Data collected from participants' residences, corporate sites, sites owned by the municipalities and school districts (including parks, right of ways and easements) are types of sites that local government has facilitated. Two school districts, the Kenmore-Tonawanda Union Free School District and the Grand Island Central Schools have participated. Municipal sites in the City and Town of Tonawanda were utilized for meeting sampling sites in the grid plan.

A standard operating procedure (SOP) for collecting samples was developed by Dr. Joshua Wallace and reviewed by Professors Gardella and Milligan. The SOP was then reviewed by Technical Advisors from NYS DEC Region 9 (Benjamin McPherson) and EPA Region 2 Emergency Cleanup (Dr. Jon Gabry, Edison, NJ). It is provided in Appendix 3.

As noted in the June 1 report, after a bid process to NY State Certified (Environmental) laboratories in the WNY Region, the contract for analytical testing using EPA approved procedures was awarded to ALS Environmental Rochester (NY) laboratory (http://www.alsglobal.com/us/locations/americas/north-america/usa/new-york/rochester-environmental). Also in Appendix 3 is the New York State Laboratory Certification for ALS Environmental Rochester laboratory.

Reports that were distributed to participants, who have given signed permission to collect samples, were created from the testing results and compiled by UB staff following a format from the June 1, 2017 report.

We compared the testing results to Soil Cleanup Objectives (SCOs) as a means to consider whether the testing results were elevated to a level of concern as a component of a "hot spot" for Phase 1 mapping. SCOs were developed considering all the values available from NY State and also values from Pennsylvania, Massachusetts and other states in the northeastern US. We developed a list of SCOs based on the most conservative values for resident's protection.

The report to participants includes the full testing report from ALS. As noted in the June 1 report, the UB team developed a standard report format for the analysis of the data and reported the results to the participants. The reporting approach gives a summary of all tests for chemicals in three categories:

1. Those tests that yielded no detectable results[1], below the limit of detection (LOD)
2. Those tests that yielded concentrations above the LOD but below the Soil Cleanup Objectives (SCO)
3. Those tests above SCOs

We also include a glossary of terms, a TCC Soil Study Fact Sheet and health impact information for those chemicals above SCOs from the US Center for Disease Control and Prevention's (CDC) Agency for Toxic Substance and Disease Registry (ATSDR) ToxFAQs™ (https://www.atsdr.cdc.gov/toxfaqs/index.asp). These documents are included in appendix 4.

[1] Testing results that are below the limit of detection (LOD) for the test are reported as such. This does not mean that the result is zero, it is not detectable. This is the response as defined by federal and NY state regulations for environmental testing results.

Phase 1 then moves into the geographic information analysis of the results from the Grid Sampling (presently underway). Map development is overseen and executed by Dr. Tammy Milillo with input of testing results into a database created with ArcGIS® ArcMAP version 10 (https://www.arcgis.com/features/index.html), a standard GIS software provided by ESRI, Inc. The data are stored in a secured server at UB, following transfer from ALS. The transfer of data is covered by a quality assurance and quality control methodology for reviewing data requiring at least two additional reviews of data by an independent member of the UB team.

Maps are being created for each ca. 140 chemicals that are tested. Figure 4 shows a map created using simulated data from previous studies. Elevated levels are shown by darker regions and areas of elevated levels are assigned as "hot spots". These maps will be released as public information and preparation for Phase 2 sampling.

In Phase 2 the sampling will focus on hot spots and will develop sampling plans with a high spatial density of sampling to determine the extent of a hot spot to six inches depth. A detailed sampling plan will be developed from the maps developed in Phase 1. From those testing results a geographic analysis of the extent of Tonawanda Coke's impact on soil contamination in the City and Town of Tonawanda and areas of Buffalo and Grand Island will be evaluated. Phase 2 also includes a detailed analysis of source apportionment[2], as described in the UB led proposal to Judge Skretny, using advanced testing methods at SUNY Fredonia (two-dimensional gas chromatography with time-of-flight mass spectrometry (GCxGC-TOF)) and UB (Time of Flight Secondary Ion Mass Spectrometry) along with Geospatial data analysis to determine the impact of TCC separated from other sources of the same chemicals in the geographic area.

Status of the execution of the Sampling Plan for Phase I

The finalized Phase 1 grid sampling plan was developed in consultation with the TCC Soil Study CAC (Figure 1) (below). The CAC recommended an option that identified 237 sample points in the grid. These are shown schematically below.

We initially executed a pilot study of thirty samples in the southeast corner of the grid (see Figure 1) to determine the eastern edge of the grid and answer questions about recruiting participants, gathering permission in two stages and developing materials for the reporting to participants. The sites for those thirty samples were identified by efforts with Katie Little, student support and CSCR efforts to recruit participants.

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[2] Hopke P.K. (1995) The Mixture Resolution Problem Applied to Airborne Particle Source Apportionment. In: Einax J. (eds) Chemometrics in Environmental Chemistry - Applications. The Handbook of Environmental Chemistry, vol 2 / 2H. Springer, Berlin, Heidelberg

P. Hopke, (2015) Chemometrics applied to environmental systems, Chemometrics and Intelligent Laboratory Systems 149 205–214 http://dx.doi.org/10.1016/j.chemolab.2015.07.015

J. S. Wallace Modernizing Environmental Analysis: Mass Spectrometry as a Tool for Investigating and Answering Salient Environmental Questions, Ph.D. Dissertation, May, 2016.

Following the collection of samples, acquisition of the testing results from ALS laboratories, processing of the data into participant reports and delivery of those reports, a meeting was held to explain results to the participants, followed by an open meeting where the full general results were discussed to any interested party. We utilized a standard EPA meeting format which starts with individual tables for meeting with individual participants to explain their results and answer questions. A second, collective meeting of all participants to ask general

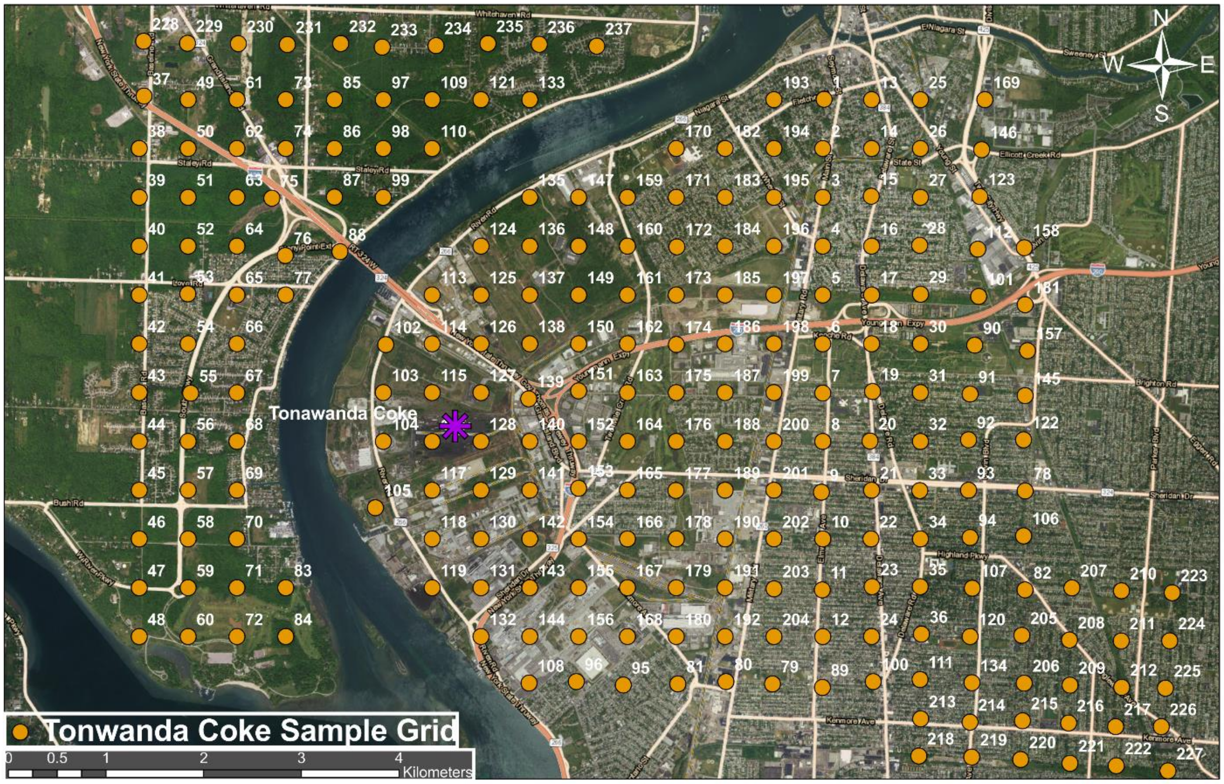


Figure 1 Phase 1 Sampling Grid Plan

questions was then held. Finally, we had a third portion open to the public to report general results from the initial testing.

We continued collecting permissions and continued sampling through the summer and ending December 20, 2017 as part of Phase 1 with the resulting samples collected and documented in Figure 2 (page 5 following). As shown, we note that many corporate sites near Tonawanda Coke refused to participate. There were additional large areas on the Northwest corner of the sampling plan where private ownership of open land declined participation. Professor Gardella and Dr. Josh Wallace met with Tonawanda Coke Corporation and staff on August 8th, 2017 to address the procedures of obtaining the three required samples (authentic Coke product, a composite soil sample from the corporate site and an air emissions sample) that were described in the proposal and required by Judge Skretny as part of the requirement to support the soil study plan. We received the samples of authentic Coke product following the meeting on August 8th. We will be sampling the corporate site once training for Professor Gardella and the sampling team is accomplished this spring. An air emissions sample will be arranged with help from Professor Milligan (see appendix 1).

To mediate the effects of the lack of participation by corporate sites, we obtained permissions from easements owned by the Town and City of Tonawanda. For the remaining unsampled areas, we are currently reviewing existing DEC data from required soil testing at many of these

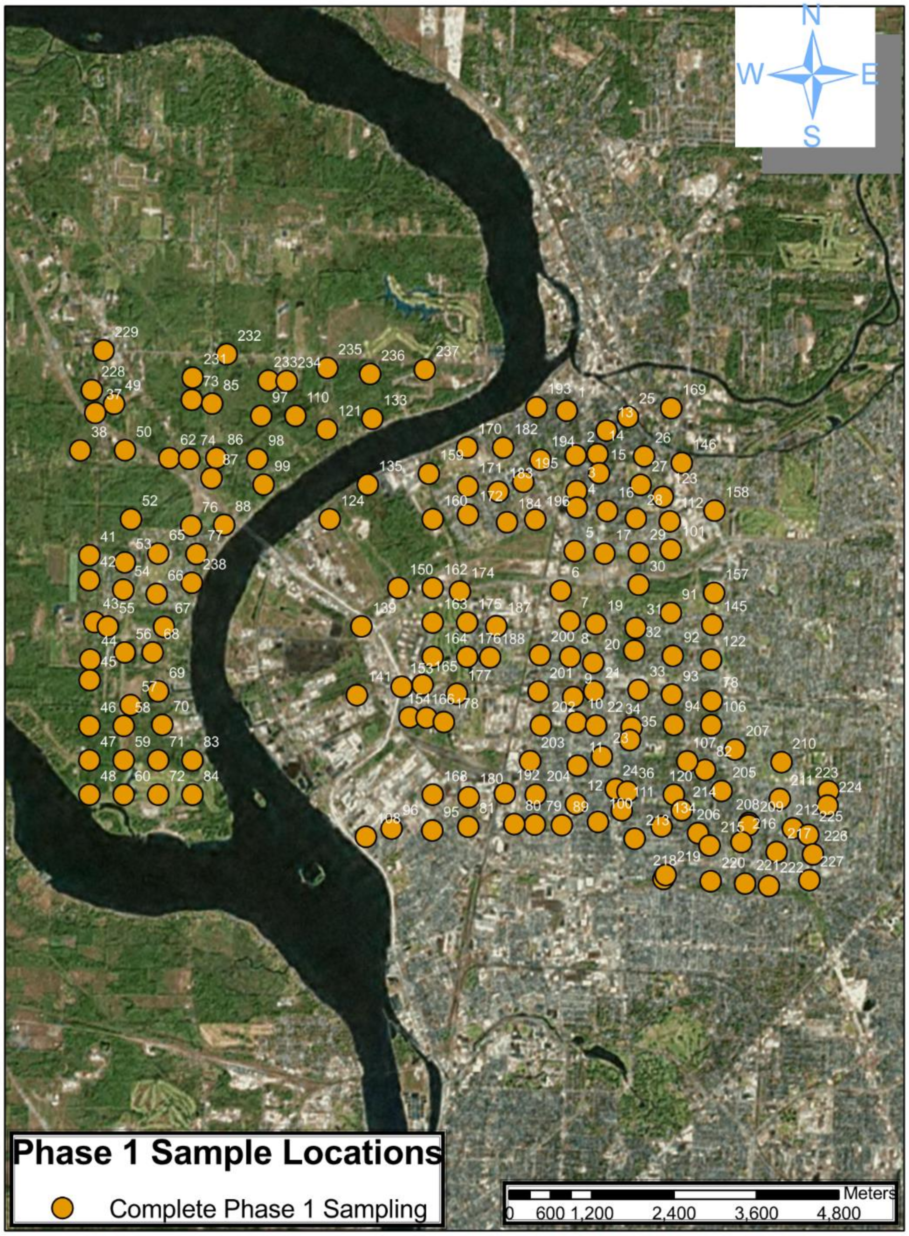


Figure 2 Actual Sample Points collected from June to December 2017

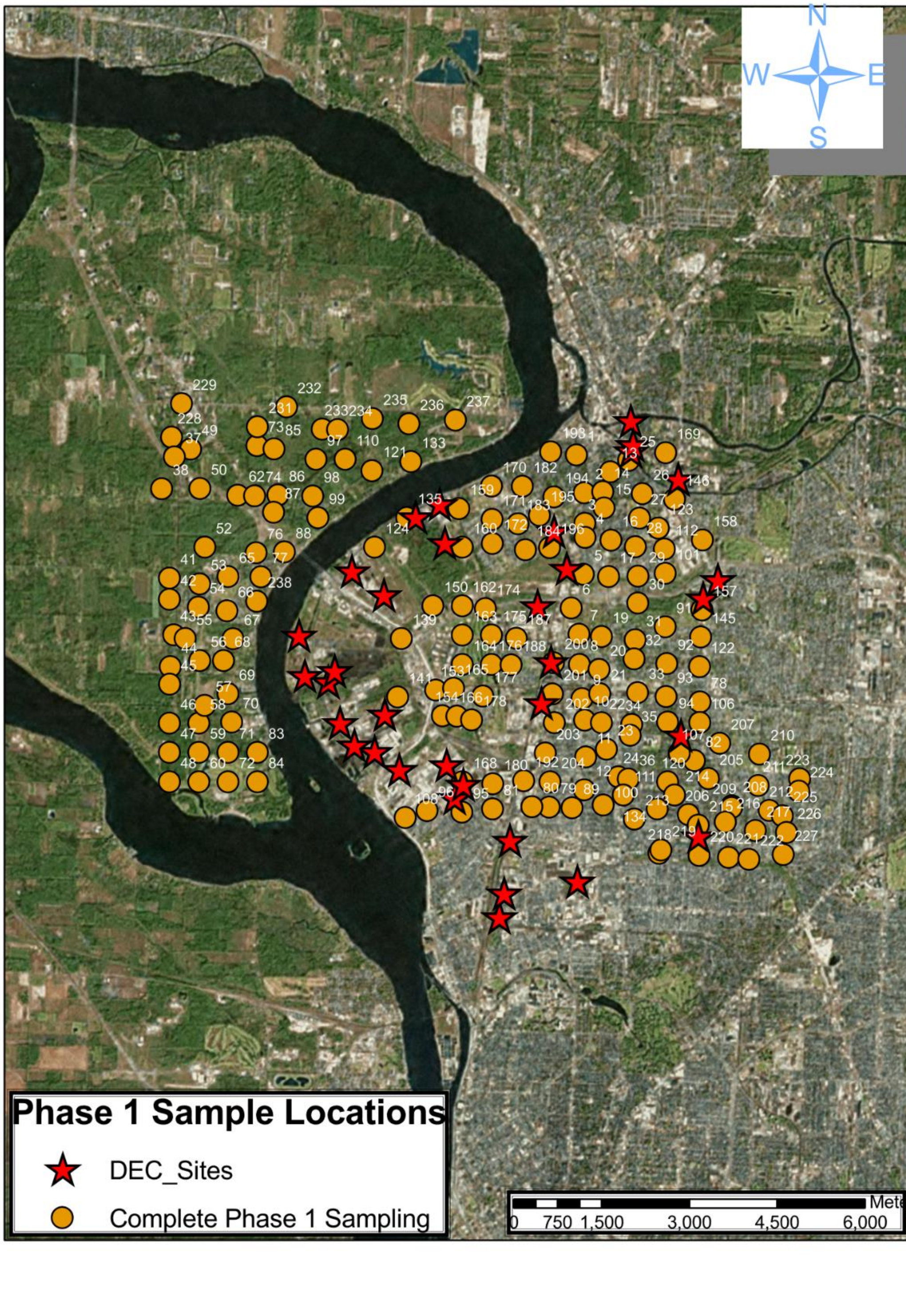


Figure 3 Combination of Phase 1 collected samples and planned use of DEC data from corporate sites

corporations to substitute for some of the testing that would have occurred. Figure 3 (page 6 above) shows the current map including those areas covered by ***known*** DEC sampling data. The advantage of using the DEC data is that many more samples were taken on many sites and can be composited into representative average values for the sites. The disadvantage is the dates of sampling may represent conditions that are different from the current data collected.

Figure 4 Simulated "Hot Spot" map developed from data from other sites. Data is for polycyclic aromatic hydrocarbons. Elevated regions are shown by darker shade of brown.

Professor Gardella has held four (closed to only participants) meetings for participants to discuss the interpretations of the sample results for their property. These have been sparsely attended but give each participant a good chance to have a private consultation. In addition, he has reported to school districts in closed meetings at their site. He has had phone conversations with individual participants and visits to participants' houses. All these availabilities are offered through the communications to the participants.

The following is an up to date (as of February 15, 2018) tally of all actions in Phase 1 sampling and reporting.

We sampled at 182 locations for the TCC soil study in 2017.
178 reports have been delivered.
We have 79 secondary permissions. Of the reports that have been delivered we still need 97 secondary permissions.
2 people have officially declined to provide secondary permission.

Of the 4 reports that have not been delivered:
3 were from the pilot study- 2 could not be reached to schedule delivery, 1 refused the report. One has not been delivered because the sample was taken at the wrong address- Katie Little is working to follow up with that household.

Next Steps

1. We will be following up with Tonawanda Coke to schedule the soil sampling in spring once the weather makes it possible to sample.
2. We will be collecting air samples collaboratively between UB and SUNY Fredonia.
3. We will continue to report to Phase 1 participants and collect secondary permissions.
4. We will be completing the maps to identify regions of elevated concentrations of pollutants ("hot spots").
5. We will hold a press conference and meetings to announce the Phase 1 results.
6. We will design Phase 2 sampling based on Phase 1 results.
7. We are beginning the collaborative effort for source apportionment analysis of contributions from Tonawanda Coke and separating these results from other polluters in the area.

List of Appendices

Appendix 1: SUNY Fredonia Report with SUNY Fredonia Budget Report
Appendix 2: CSCR Report
Appendix 3 Standard Operating Procedure for Sampling, Testing Certificate from ALS
Appendix 4. Glossary, TCC Soil Study Fact Sheet and Example of ToxFAQs™ used for Testing Report
Appendix 5 Budget Reports, UB and CSCR

Appendix 1

Report from SUNY Fredonia Department of Chemistry

Determining the Environmental Impact of Coke Oven Emissions Originating from Tonawanda Coke Corporation on Surrounding Residential Community

Progress Report for Subcontract awarded to SUNY Fredonia, Co-PI Michael S. Milligan

06-01-17 to 12-31-17

Progress

- Continued work on the development, improvement, and refinement of analytical methods using comprehensive two-dimensional gas chromatography with time-of-flight mass spectrometry (GCxGC-TOF) to be used for non-targeted analysis of soil sample extracts and air samples. Our hope is to identify unique chemical markers to the coking industrial process.
- Assisted in the analysis and interpretation of the analytical results generated from the Phase I soil sampling
- Attended meetings with the Community Advisory Committee to update them with the details of our progress.
- Attended meetings with community members, under the supervision of Dr. Joe Gardella, to discuss soil sample results with individual property owners who had agreed to have their soil sampled during the Phase I process.
- Supervised a paid undergraduate research assistant (Ethan Whitver) for the summer of 2017. Ethan worked on developing our laboratory procedures associated with Phase I of this project.

Plans

- We have ordered a new, digitally controlled high-volume air sampler (Tisch Environmental) that will be used to satisfy the air-sampling component of this project. We will spend the months of February and March familiarizing ourselves with the operation of this new sampler before deployment on the grounds of the Tonawanda Coke facility and in the surrounding community.

Budget details

- The total SUNY Fredonia subcontract for the two year period of this project was $87,659.
- As of 12-31-17, the following expenditures have been made:
    - $8,890 on Co-PI Milligan partial summer salary, and undergraduate research student salary
    - $1,245 in fringe benefits
    - $5,270 in indirect costs
- The remaining funds will be used for the following in 2018:
    - Purchase of a new air sampler with a calibration kit and filter media (about $7000)
    - Summer salaries for Co-PI Milligan and undergraduate research student
    - Analytical standards to be used in GCxGC-TOF analyses of soil and air samples
    - Costs of analysis for air samples to be collected at the Tonawanda Coke site and in the surrounding neighborhood

Appendix 2

Report from CSCR

Tonawanda Coke Soil Testing Project
Subcontractor: The Wellness Institute of Greater Buffalo/Citizen Science Community Resources
Date: Nov 18, 2017

To: Joe Gardella, University at Buffalo

Cc: PHil Haberstro, CSC Board President

From: Jackie James Creedon, Citizen Science Community Resources, Inc.

Re: Second 6 Month Update for Tonawanda Coke Soil Study Project : May- Oct. 2017

Task: 1
Increased Community Capacity, Recruitment and Education:
Community organizer, Katie Little, and (hired) students, CSCR canvassed 2600 houses on Grand Island, the Tonawanda's and Riverside (N Buffalo) to inform folks about soil study and a series of (5) community meetings that would be held (May-July). Additionally, CSCR:

- Prepared and organized 5 community meetings (with elected officials). At meetings, gave presentation on Tonawanda Coke story, answered questions, and signed folks up to have their yard tested.
- Tabled at various local community events
- Students presented (soil study background and project info) at area high schools
- Met with local elected officials Supervisor Emminger (Town of Tonawanda), Supervisor McMurray (Grand Island) and Mayor Davis (City of Tonawanda) to discuss recruitment strategy for securing company permissions to sample soil. (June 30,2017). Drafted letter with elected officials to mail out to company owners encouraging participation.

Results: 2600 homes canvassed, Held 5 community meetings, Increased database from 250 to 900 residents, 556 residents signed up to have their yard (soil) tested, 184 permissions to enter property. Educated approx. 700 residents and high school students about the soil study (and citizen science).

Task 2
Held 6 Community Advisory Committee Meetings (CAC): Held on third Wednesday of every month.
CSCR : drafted agendas, fielded questions for researchers, chaired meetings, documented minutes.
Results:

- CAC input and provided recommendations on :
  - soil study grid (boundary and # of points)
  - Resident (result) packets
  - Community (result) meetings
- Hired technical consultant, Dr Shaun Crawford.
- Drafted two documents
  - Technical Questions pertaining to the study
  - Concerns (internal document) about study veering off course.
- Reviewed study outline and discussed if project was meeting goals, purpose and objectives.

Tonawanda Coke Soil Testing Project
Subcontractor: The Wellness Institute of Greater Buffalo/Citizen Science Community Resources
Date: Nov 18, 2017

Task 3

Supervised Community Organizer (Katie Little) Activities

CSCR supervised Katie. She, in turn, supervised four University at Buffalo undergraduate students (May-August). Katie and her team of students: canvassed houses, contacted residents, secured sampling locations, generated result packets and delivered to residents, created and developed map - overlaying grid map (points) with residents that wanted soil tested and residents secured for sampling points. Katie and her team (with JJC) were also responsible for communicating with residents and elected officials via : email , social media , newsletters and phone calling , community meetings .

Results: Houses canvassed: 2600, Permissions to sample points: 184, properties sampled and tested: 173, Residents who want soil tested: 556. Doubled social media following (from 200 to over 400). Also, see Task 8.

Task 4

Educated and informed community members and elected officials re: project progress

CSCR, (with Katie) updated community (project progress) via: phone calling, Social media communications, mailings, meetings, local events, and other communications.

Results: see above

Task 5

Relationship Building with Media/ Organized and Held Press Conference (Study Kick Off)

Results: Press release and conference (Aug 4, 2017), Featured Story on Channel 4 News Wake Up (Aug 11,2017)

Task 6

Held Student Training: "Canvassing and Compassion"

With the assistance of Brian Smith, Director at Citizens Campaign for the Environment, and Jennifer Carlson, LMSW, Director of Clinical Operations at Sheridan Medical Group, CSCR held a "Canvassing and Compassion" workshop for students involved in soil study. **Results**: students gained a greater understanding of how to interact and communicate effectively with (impacted) residents while also learning "best practices" for successful canvassing.

Task 7

Developed Strategic Plan and Organization, Created Website.

CSCR Secured contractor, Nikki Hitchcock from City of Light, to assist with: strategic planning, website design, social media training, community engagement strategy, writing and editing documents. **Results:** created and developed website: csresources.org, doubled facebook following, Recruited over 500 residents: see attached "Communication Pathways Recruitment Strategy" document.

Task 8

Tonawanda Coke Soil Testing Project
Subcontractor: The Wellness Institute of Greater Buffalo/Citizen Science Community Resources
Date: Nov 18, 2017

Developed "Citizen Scientist" Program for Soil Study
CSCR recruited community members and students (see Task 1) to form 4 student/ community "teams" (sample properties). Additionally, Katie organized (2) trainings, scheduled and organized "teams" of "Citizen Scientists" (soil extraction dates and locations).
Results: (2) community trainings (July), 60 residents and students recruited and trained : "Standard Operating procedure for Soil Sampling", 173 properties tested (Aug-Sept).

Deliverables (as of 11/1/17):
5 community meetings
Permissions to sample points: 184
Properties sampled and tested: 173
Residents who want soil tested: 556
Houses canvassed: 2600 (see attached flyer)
Student training: Compassion and Canvassing
2 resident/student Citizen Science Trainings (60 volunteers recruited)
Press Release (attached) and Conference
Featured Story on Channel 4 Wake Up
6 Community Advisory Committee Meetings
Approximately 700 residents, students, elected officials and company owners educated and recruited for study
Question and Answers (internal) Document (see attached)
Google Map - overlaying grid map (points) with residents requesting soil testing and addresses secured for sampling points
Website: csresources.org

CITIZEN SCIENCE
COMMUNITY RESOURCES
Empowering People to Protect our Planet

FOR IMMEDIATE RELEASE

June 19, 2017

Contact: Jackie James-Creedon
Office: (716) 873-6191
Cell: (716) 998-8887
jackiejamescreedon@gmail.com
csresources.org

Community Group Offering Citizen Science Mentoring Program for Local High School Students

TONAWANDA, NY: A unique summer opportunity is being offered to local high school students in Citizen Science Community Resources (CSCR) 2017 "Students Become Citizen Scientists" program.

Students will gain community service hours, firsthand experience collaborating with research scientists, and the opportunity to participate in data collection.

The program begins this week and runs until the end of August. It's not too late to apply! Participants must be at least 15 and not older than 18 years of age.

Interested students are encouraged to sign up by calling CSCR office at 716-873-6191 or email at info@csresources.org.

This year's opportunity will focus on a Soil Study in neighborhoods potentially impacted by pollution coming from Tonawanda Coke Corp. located in Tonawanda, NY.   CSCR is collaborating with the University at Buffalo and SUNY Fredonia, on the project which was funded by the courts in the Tonawanda Coke Corp. *v* United States of America guilty verdict against the company. Students living in the Tonawanda's, Kenmore, Riverside, and Eastern Grand Island are especially encouraged to participate.

Director Jackie James Creedon explains, "This is a unique opportunity for high school students to learn about citizen science and community activism. We are introducing students to a real environmental issue in our community and engaging them in building solutions. We currently have five college students, three of them graduates from our first High School Citizen Science class (2013), to mentor the high school students."

Citizen science is the practice of public participation and collaboration in scientific research to increase scientific knowledge.

NEWS RELEASE

For Release: Aug. 4, 2017
Contact: Ellen Goldbaum, University at Buffalo
716-645-4605; goldbaum@buffalo.edu

Jackie James-Creedon, Citizen Science Community Resources
716-873-6191; jackie@csresources.org

Tonawanda Coke environmental impact study kicks off Friday with soil sampling

The event, which spotlights how citizens can help improve our understanding of air pollution, includes remarks from Rep. Brian Higgins, others

BUFFALO, N.Y. — The investigation into how air pollution emissions from the Tonawanda Coke plant may have affected nearby soil kicked into gear Friday with a gathering of elected officials, community organizers and scientists from the University at Buffalo and SUNY Fredonia.

The event — at the River Road Volunteer Fire Co. in Tonawanda — included students and citizen scientists taking the first of a planned 270 soil samples from sites in the town and city of Tonawanda, the village of Kenmore, Grand Island and the city of Buffalo that surround the plant.

"The situation surrounding Tonawanda Coke speaks to the importance of the Environmental Protection Agency and the critical difference residents can make in fighting for their community," said Rep. Brian Higgins. "The soil study, a collaboration between various levels of government, the community, local businesses and the University at Buffalo, will provide further clues about the lasting impact of the company's negligent actions and give us insight to make informed decisions moving forward."

"The University at Buffalo — along with collaborators from SUNY Fredonia and Citizen Science Community Resources — will implement citizen-science-based soil sampling in the communities of the city and town of Tonwawanda, parts of Riverside, Black Rock and North Buffalo and parts of Grand Island. The soil samples will be tested using a state Department of Health-certified laboratory and cutting-edge soil-analysis techniques at UB and SUNY Fredonia to determine the impact that emissions from Tonawanda Coke have had on the surrounding environment," said Joseph Gardella Jr., SUNY Distinguished Professor and John and Frances Larkin Professor of Chemistry at UB, who is leading the study.

Jackie James-Creedon, executive director of Citizen Science Community Resources, credited community activists for prompting local authorities to examine Tonawanda Coke.

"If it wasn't for a small group of people believing that they could make a difference, and actually getting off their couches, going outside and doing something about it, none of this would have happened," James-Creedon said.

The $711,000 study — "Determining the Environmental Impact of Coke Oven Emissions Originating from Tonawanda Coke Corp. on Surrounding Residential Community" — is a collaboration between members of UB's Department of Chemistry, SUNY Fredonia's Department of Chemistry and CSCR.

It is part of a larger $11.4 million effort — also led by UB researchers — ordered by a federal judge after Tonawanda Coke Corp. was found guilty of violating the Clean Air Act and Resource Conservation and Recovery Act.

Study participants are trying to determine how the violations may have affected the health of nearby residents and employees. Coke oven gas contains a number of toxic chemicals that are potentially hazardous to health, including benzene, a known carcinogen.

Statements regarding the Tonawanda Coke soil study

"As a native of the Town of Tonawanda, I am honored to be a part of this important, groundbreaking project, and I hope that we can help the residents get a clearer picture of what has been happening in their community," said Michael Milligan, professor in SUNY Fredonia's Department of Chemistry.

"The soil study being conducted is an important first step in assessing the potential longer-term impact of the Tonawanda Coke emissions on our community," said state Sen. Chris Jacobs. "The results of this testing will be critical to determining if any additional clean-up will be necessary to protect the health and safety of our community, and I am glad this essential work is moving forward."

"The Town of Tonawanda supports this soil sampling investigation and applauds the efforts of Citizen Science Community Resources and the residents of Tonawanda and Kenmore who will assist in this research. We are excited about the prospects for a cleaner environment in Tonawanda and a resident-led engagement with our partners at the University at Buffalo and SUNY Fredonia," said Tonawanda Supervisor Joseph H. Emminger.

"I have supported Jackie's efforts for the last 11 years. The City of Tonawanda stands with CSCR, UB and SUNY Fredonia and supports the soil testing as a means to figure out what, if any, contamination has occurred because of the negligence of Tonawanda Coke," said City of Tonawanda Mayor Rick Davis.

"I encourage the community to stay involved in the process of the soil study. Positive action happens when people care," said Grand Island Supervisor Nate McMurray.

"Citizen science — scientific research undertaken by members of the public — puts the tools of science into the hands of people who can use it to make a difference for the places they live in and care about. In some of the most powerful cases, such as here in Tonawanda, citizen science can be a tool for communities to create defensible knowledge and use it to combat injustice," said Jennifer Lynn Shirk, interim director of the Citizen Science Association.

About the University at Buffalo: The University at Buffalo is a premier research-intensive public university, the largest and most comprehensive campus in the State University of New York. UB's nearly 30,000 students pursue their academic interests through more than 300 undergraduate, graduate and professional degree programs. Founded in 1846, the University at Buffalo is a member of the Association of American Universities.

About Citizen Science Community Resources: Citizen Science Community Resources is a grassroots organization in Western New York dedicated to science-based activism for winning environmental health and justice campaigns. Teaching others through our example, we empower people to investigate their air, soil, or water and use the power of scientific data to create healthier communities and a more just society. Citizen science is the practice of public participation and collaboration in scientific research to increase scientific knowledge. We seek to educate, empower, and advocate.

About SUNY Fredonia: Founded in 1826, Fredonia is among the most storied in the State University of New York system. It is home to a world-renowned School of Music and over 100 degree programs in the liberal arts, natural and social sciences, education, mathematics and business. Fredonia also features cutting-edge programs in the emerging fields of technology, service and communication. Fredonia is known for its strong academic programs, attractive architecture and grounds, rich campus life and commitment to student engagement and success. Fredonia is focused on ensuring that all Fredonia students, utilizing knowledge developed through a broad range of intellectual experiences, will be: Skilled, Connected, Creative and Responsible global citizens and professionals.

Community Advisory Committee (Tonawanda Coke Soil Study) Questions and Answers (Dr. Joe Gardella, UB):

Determining sampling/testing depth and design:

- **How was it determined that 6 inches was the appropriate sampling depth?**
  - **Pilot study? The pilot study was taken a few miles away from TCC where little/no contamination was found from TCC, Why wasn't a neighborhood where we are fairly certain TCC contamination exists (Kaufman Ave area) used to determine sampling/testing depth?**

- In the pilot study we tested the idea of whether 2 in or 6 in samples were better to identify hot spots. We were concerned that 2 in samples would be complicated by residences that had taken very good care of their yards with regular new topsoil added. And we did not want to miss data for a hot spot in those cases by only sampling 2 inches- the research team heard the concerns from Jackie James-Creedon and the community that we would miss hotspots and areas with contamination. Thus we decided to take samples at both 2 and 6 inches in the pilot study and compare. At nearly every site contamination was higher in samples taken at 6 inches. This confirmed our hypothesis based on prior experience that regular lawn care (addition of topsoil) will negatively affect our ability to see historic buildup of contaminants. Vacant lots/abandoned homes would allow us to see historic deposition at 2 inches, but those areas are not often found in our study area.
- With 2 inch samples we will not detect historic deposition, which will mean we will find fewer hotspots and fewer areas to clean up.
- Sampling only at 2 inches would mean we could potentially miss contamination. (false negative).
- We will be taking some 2 inch samples in Phase 1 in addition to the 6 inch samples. If we see that there is a connection, that there is contamination at 2 and 6 inches (that connection was not there in the pilot study), we will increase the number of 2 inch samples taken in the hotspot study.
- It is important to keep an open mind and have no preconceived notions about where contamination exists. That is why we are doing a broad study with a large area- to determine how our community has been affected on a large scale.
- The area of the soil study was influenced by the Air Study done by the DEC. That study concluded that the affected area of pollution was relatively small and limited to census tracts in the Town of Tonawanda. We laid down a grid that was larger than the results from DEC Air Study, generally centered around Tonawanda Coke, and that evenly distributed the points for Phase 1 of the study. After putting the points on the map we used the Pilot Study to test the edge of the grid to make sure that we had gone far enough from TCC. We wanted to make sure that we found the edge of any existing contamination. If we had found significant contamination in the Pilot Study we would have made the grid wider to include any contamination.
- Testing in the Kaufman Ave area would not have made us confident that we had found the edge of contamination. One of the main objectives of the Pilot Study was to confirm the edge of the grid. It is important when we use GIS that we find the edges of contamination- GIS can only model from areas where we have collected data (interpolate) we cannot accurately estimate levels of contamination outside of our study area.

- **Does 6 inch sampling support the nature of PAH and heavy metal migration? References used?**

- We are not concerned about migration of Semi volatile organic compounds (SVOCs including PAHs) and metals in soil. The amount of migration for most of these is minimal, but build up occurs as deposition over time giving pollution at deeper depths. Keep in mind that we are not just sampling for PAHs and heavy metals. We don't know exactly what TCC is burning/has burned, so we are doing broad suite of tests to make sure we find any contamination that may be present.

- Based on the Pilot Study we observed that in most cases chemical concentration was negligible at 2 inches and higher at 6 inches. We would like to find any contamination in the community and have it cleaned up. In order to find contamination, we need to look in the areas where it has been shown to be present- in the Pilot Study concentration of contaminants was higher at 6 inches.
- We will be taking some 2 inch samples in Phase 1 of the study. If there seem to be higher levels of contamination at 2 inches in Phase 1, we will take additional 2 inch samples in the hotspot study.

● **Why soil samples six inches deep instead of 3 inches maximum depth (as per USEPA for risk assessment purposes)?**
- This study is not a risk assessment; it is a soil study. Standard/typical sampling depths used by DEC and EPA for near surface contamination are 2 inches and 6 inches, as confirmed by Ben McPherson, DEC representative.
- Due to the nature of soil formation (grass dies and soil builds on itself, getting higher over time) we would expect to see historic contamination, when TCC was heavily polluting, deeper in the soil.

● **How do PAH's and heavy metals migrate thru soil over time?**
  ○ **And what is the half-life of the most dangerous PAH's?**
- Soil builds up over time, so what was once at 2 inches is now deeper in the soil (in addition to the amendments people make to their lawns). 6 inch samples help to quantify gardening and plant exposure.
- Half-lives can be examined under laboratory circumstances and are published in the literatures, but PAHs as a class are constantly being emitted and deposited.

● **Why are we measuring some anaytes that are not part of the coking process?**
  o **eg. pesticides?**
- The chemicals we are testing for are a standard suite of tests used by the EPA to determine clean-ups. We are testing for a whole suite of compounds that are related to chemicals that may have come from TCC. It is rare to have residential areas included in Superfund sites based on historical contamination. We are looking for anything that will help to justify a cleanup. For instance, in Hickory Woods the cleanup was driven by the discovery of Arsenic in the soil, which is not something they expected to find. Suing a company for remediation delays cleanup for many years. Our best chance for securing funding for remediation may be through an emergency cleanup. We should look for anything that would help to justify a cleanup to ensure that we do the most we can for the community.

<u>Determining Grid Map (boundary)- Neighborhoods to Test</u>

● **What research (reference documentation) was used in determining how particulate organic material moves in the environment (air)?**
  ○ **Does this (research) documentation support the current sampling boundary?**
- The DEC Air Study was used as a reference. We wanted a study area that was larger than the census tracts from that study and that covers the areas of suspected heavy contamination.

● **How was the grid layout designed regarding distance and direction to sample from TC?**
- Using GIS we can only interpolate, meaning that we have to test farther than what you think is contaminated so that you can accurately model the entirety of the contamination.

● **What references were used to determine the perimeter of the grid?**
  o **How far the pollution migrated off site?**

- We wanted a study area that was larger than the DEC Air Study. We don't want to miss any area of the community that may have been affected. **We did not make any assumption about migration of pollutants. We established a large area grid and tested the edge in the pilot study.**
- The worst kind of particulates, in terms of affecting human health, are ultrafine and will travel very far from the site.

- **Were soil types and weather (rainfall, temperature) considered for the fate and transport of chemicals in the ground, and was any effort made to predict where the contaminants of concern might be distributed by distance and depth?**
- Modeling is done regularly for air pollution, and for groundwater pollution, but not for soil pollution. This study is taking an agnostic look at where contaminants may be distributed in the community. Guessing or using modeling to predict where the chemicals may be first adds a bias that is detrimental to the integrity of the study. It is important that we use an evenly distributed sampling grid so that we do not introduce bias into the study.

- **How does the study design control for false negatives and false positives?**
  - **i.e. actual contaminated sites might be classified as clean.**
- A false positive (showing contamination where there was none) would mean that there is a flaw in our testing procedure. A false negative (not detecting contamination that was present) would mean that we may not have sampled in exactly the right spot.
- We are minimizing false positives by using a certified testing laboratory to ensure careful handling of samples. We have validation from ALS that the samples were handled correctly based on their certified procedures. The hotspot study will also show/clarify any false positives that did occur.
- We are minimizing false negatives by using the GIS analysis. If we detect contamination in areas surrounding a sample that did not have contamination, we will sample more in the contaminated area.
- Using GIS and sophisticated geographic information analysis the maps will be based on all of the samples taken, not just each sample independently. A false negative would be somewhat corrected for based on the surrounding samples and the additional samples taken in the hotspot study.

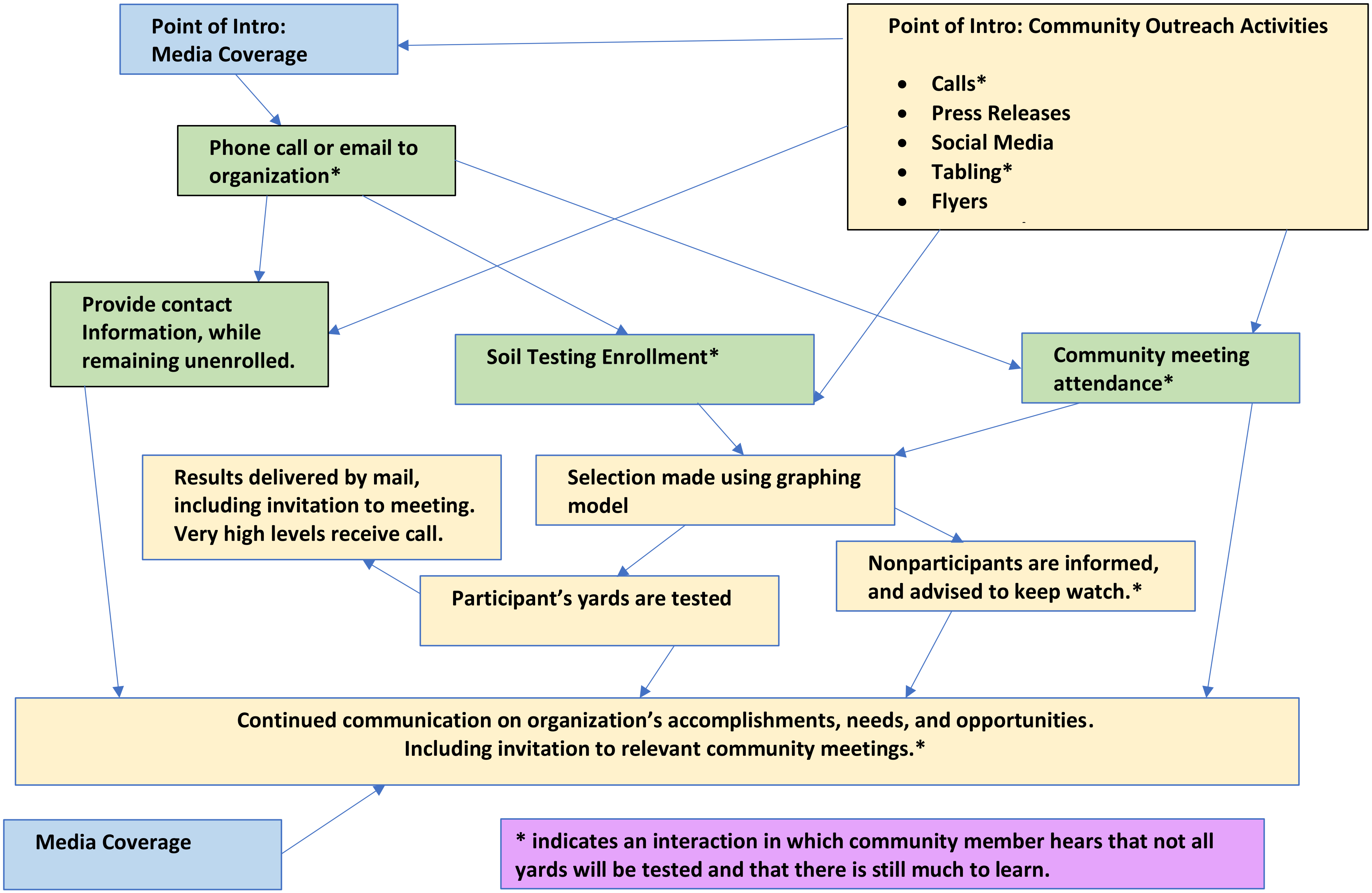
- **Why were discrete samples chosen over composite sampling at each sample site?**
- There are risks in taking composite samples and in taking discrete samples. Composite: If you take 1 high sample and 9 low samples the high sample may be washed out. Discrete: If you take 1 low sample you may miss contamination.
- Composite samples are significantly more expensive and labor intensive than discrete samples. A higher cost means that fewer samples could be taken overall, reducing the total amount of areas we could test in the community.
- Using GIS and an equally spaced sampling grid we reduce the risk of missing contamination from discrete samples. Even if one sample is low the surrounding samples will show higher levels of contamination. Using the grid spacing from Tammy's map (500 meters between each sample) we will not miss a significant hotspot that would trigger a cleanup.

<u>Determining health impact or risk:</u>
- **What is the route of exposure at 6 inches?**
  - **Why aren't we testing the top (0-2 inches) surface soil where human exposure is most likely?**
- We are testing at 6 inches where contamination has been shown to be present and historic exposure was likely. The soil study will not be determining health impact or risk. The soil study will turn over the data to the health study. The health study is responsible for determining health impact and risk.

- **How will contaminated areas will be distinguished from non-contaminated areas? How will the perimeters of contamination be drawn?**

- We are defining contaminated areas based on Soil Cleanup Objectives (SCOs). The soil study is using the most conservative and stringent SCOs from NY, PA, and MA to ensure that decisions about the soil study are made with the highest standards of safety in mind.
- The perimeters of contamination will be drawn based on GIS modeling. The modeling process uses sophisticated mathematics to collectively look at all of the data within the sampling grid to interpolate chemical concentrations between sampling locations. These concentrations will then be mapped using a color gradient. Individual concentrations at each sampling site will not be identified or shown on the map.

CSCR Recruited Soil Sites Strategy Communication, Communication Pathways



Can't make the meeting?
Here's our list of upcoming events:

Community Meeting
Wednesday, June 28th, 2017 6-7:30 pm
Tonawanda City Hall
200 Niagara Street, Tonawanda, NY 14150

Community Meeting
Thursday, July 13th, 2017 6-7:30pm
CSCR Office – Phillip Sheridan Building
3200 Elmwood Avenue Room 210, Kenmore, NY 14217

Support from our Elected Officials:

"Some people may say why would you want to do [a soil study]? It might hurt property values or might cause trouble. Well, the more we know, the more we're armed with knowledge, the better actions we can take to fix the problem, and stop future problems,"
Nathan McMurray - Town Supervisor of Grand Island.

"We need the data [from the soil study] to back up whether or not people like myself can rest easy or we need to change our outlook on things"
Rick Davis – Mayor of the City of Tonawanda

"The fines could never be steep enough for the cost to this community and its residents, but we are pleased that Tonawanda Coke will be made to pay for their negligence and more than $12M in fines will be kept here where the psychological, physical and property damage occurred."
Congressman Brian Higgins.

"It is not acceptable to allow the status quo to continue, with ever increasing health problems for Tonawanda residents. I urge you to act swiftly to put in place the measures that will bring the benzene emissions from Tonawanda Coke into compliance."
Charles Schumer – NY State Senator

Dear Neighbor,

You may have heard about the successful lawsuit against Tonawanda Coke. They were found guilty of releasing harmful coke oven gas, fined, and ordered to fund a soil and health study. The University at Buffalo, SUNY Fredonia, and Citizen Science Community Resources will be working together on this project.

We believe that the emissions may have migrated into our yards. We are reaching out to let you know that we are looking for residents in the neighborhood to participate in the soil study and have their lawns tested. This information will be used to investigate how our community has been affected.

Come to our next meeting!

Thursday June 15th, 2017 6-7:30pm
Grand Island Town Hall
2255 Baseline Rd, Grand Island, NY 14072
Refreshments will be provided

We'll discuss how you can get involved in the soil study and there will be an opportunity to share personal stories about how industry in Tonawanda has impacted our lives and our health. Please let me know if you have any questions. Feel free to call or email me; you can find my contact information below.

Thank you for your interest in our community and our research.

In solidarity,

Katie Little

Katie Little
Community Organizer
klittle234@gmail.com
716-873-6191
3200 Elmwood Ave. Room 210

Jackie James-Creedon
Director
Citizen Science Community Resources

csresources.org Find us on Facebook!

University at Buffalo
The State University of New York
CITIZEN SCIENCE
COMMUNITY RESOURCES
FREDONIA
STATE UNIVERSITY OF NEW YORK

CITIZEN SCIENCE
COMMUNITY RESOURCES

"Empowering People to Protect our Planet"

3200 Elmwood Ave. Room 212. Kenmore, N.Y.14217
csresources.org

October 4, 2017
Melissa Colley
United States Probation and Pretrial Services Western District of New York
2 Niagara Square Buffalo. NY 14202-3350
Subject: Tonawanda Coke Soil Sample Proposal
Reference: Case Number 1: 10CR00219-OO1

Dear Ms. Colley:

I am writing in reference to the above subject and case number on behalf of the Tonawanda community group, Citizen Science Community Resources, Inc. (CSCR). As co-director on the study, it has come to our attention that there is a degree of misalignment between the project proposal and the actual work that is being performed. In our view, the scope of work (description) and goals are veering away from the main intent and purpose of the study. Additionally, some of the roles and responsibilities are shifting from our organization (without consent) to the University at Buffalo (UB).

A meeting was held on September 29, 2017 between UB, SUNY Fredonia and CSCR to discuss these concerns and facts. Unfortunately, we are at an impasse and we are writing for your intervention into this matter. This letter is serving as a basis for the work that, we believe, has veered off course, and corresponding proposed corrective measures to address these misalignments.

1. **Scope of Work #1.**

a. Project Proposal: A comprehensive environmental soil investigation to examine the impact of Tonawanda Coke's (TCC) foundry coke emissions, specifically particulate organic material (POM) in the immediate surrounding environment.

b. Actual work: Dr. Joe Gardella (University at Buffalo) states: "We are testing for a whole suite of compounds that are related to chemicals that may have come from TCC. It is rare to have residential areas included in Superfund sites based on historical contamination. **We are looking for anything that will help to justify a cleanup.**"

c. FACT: 1/3 of the soil testing budget for the first round - **nearly $30, 000 is being spent on testing for cyanide, PCB's, and pesticides.** These are chemicals not associated with TCC production, and were not outlined in the project proposal as contaminants to be tested. This funding should be used to implement the project, as proposed.

Cc: Dr. Joseph Gardella, Prof. of Chemistry, University at Buffalo
Aaron Mango, Assistant US Attorney, Department of Justice Western N.Y. Division

d. Proposed Resolution: The three co-directors shall meet to collaboratively revamp the budget and sampling strategy to reflect a project that adequately investigates for chemicals associated with TCC production

2. **Scope of Work #2:**

a. Project Proposal: A scientific investigation and collaboration between University at Buffalo, SUNY Department of Chemistry; State University of New York at Fredonia Department of Chemistry; and the local community group, Citizen Science Community Resources. This three way partnership is also reiterated in UB's letter to you (first paragraph).

b. Actual work: In meeting on September 29, 2017 with UB, when CSCR asked about the need for collaboration, University at Buffalo Moises Sudit, Associate Vice President for Sponsored Programs and Commercialization, responded "This (project) is not a collaboration, this is a dictatorship"

c. Concern: There have been no discussions, communications, or agreements between the three "directors" , Dr. Joe Gardella (UB), Dr. Mike Milligan (SUNY Fredonia), and Jackie James-Creedon (CSCR) of the study on how to collaborate effectively.

d. Proposed Resolution: The three co-directors along with the entity's they represent (UB, SUNY Fredonia, and CSCR) **shall work together as a true partnership.** A document will be drafted and co-signed, agreeing on what this will be. Co directors meet periodically with community advisory committee to discuss strategy, making sure project meets requirements (scope of work, and goals).

3. Goal #1:

a. Project proposal: To characterize and measure the POM originating from Tonawanda Coke Corp. via air sampling and chemical analysis and determine what chemicals are specific to TCC. Deliverable: Research report determining TCC POM characterization and environmental impact via soil and air analysis.

b. Actual Work: Dr Gardella states "Keep in mind that we are not just sampling for PAHs and heavy metals. We don't know exactly what TCC is burning/has burned, so we are doing broad suite of tests to make sure we find any contamination that may be present."

c. FACT: Tonawanda Coke air permit only allows the gasification (burning) of coal and coal tar sludge.

d. Proposed Resolution: Co-directors shall meet with community advisory committee to discuss testing strategy going forward with a focus on testing for chemicals associated with TCC production.

4. **Goal #2**

a. Project Proposal: To determine what chemicals are present in the surrounding residential community (Tonawanda, NY) via soil analysis, identify through source apportionment the potential source(s), and if levels pose a potential health risk and warrant remediation. □

b. Actual work: Dr Gardella states "The soil study will not be determining health impact or risk. The soil study will turn over the data to the health study. The health study is responsible for determining health impact and risk."

c. FACT: There has been no resolution, that we are aware of, between the health and soil study teams as to who will be responsible for communicating health risk to residents.

d. Proposed resolution: health and soil research team members communicate and decide which info and who will be responsible for communicating health risk to residents.

5. **<u>Goal # 3:</u>**

a. Project proposal: To determine if further facility reductions are warranted and if TCC facility needs additional controls. □There has been no community monitoring verifying potential reductions. This proposed study would monitor and measure such emissions.

b. Actual Work: 6 inch samples are the focus of the study. Dr Gardella states, "With 2 inch samples we will not detect historic deposition, which will mean we will find fewer hotspots and fewer areas to clean up. "

c. FACT: The idea that the soil study is about historic deposition (6 inch sampling) is not in line with this project goal. 2 inch samples are indicative of recent air and soil exposure and we believe will provide a more accurate snapshot of recent air deposition (effectiveness of recently installed air pollution controls at TCC).

d. Proposed resolution: Co-directors meet with community advisory group to decide how to fulfill this requirement. Additional air testing or a community project involving wipe and/or tape sampling are some suggestions.

6. **Sharing of important information (soil testing data) and Shifting roles and responsibilities from CSCR (community group) to University at Buffalo.**

The following are outlined in the project proposal as some of CSCR responsibilities :

a. Collect and file sample test results. Secure under lock and key.

b. Produce community soil and air testing reports.

c. Collaborate with UB, Fredonia, EPA/NYS DEC and other industry experts regarding data result interpretations.

d. Explain and interpret sample results for owners of properties tested; obtain permissions to use data.

We understand that as projects evolve, some roles and responsibilities may shift. However, the fact that CSCR is co-director on the study and we do not have access, let alone co-ownership, to the raw data limits CSCR's effectiveness in providing the support needed and required for our members (residents). CSCR is the trusted community face of this study, and, as such, needs access to the data in order to offer sensitive information in a discreet and respectful way to homeowners. Proposed resolution: UB files an amendment to IRB to allow CSCR access to raw data.

We are eager to move forward with a resolution as soon as possible and look forward to hearing from you soon. Thank you for your consideration into this important matter.

Sincerely,

Jackie James Creedon
Director

Phillip Haberstro
Board President

<u>Community Advisory Committee (Tonawanda Coke Soil Study) Questions and Answers (Dr. Joe Gardella, UB):</u>

<u>Determining sampling/testing depth and design:</u>

- **How was it determined that 6 inches was the appropriate sampling depth?**
    - **Pilot study? The pilot study was taken a few miles away from TCC where little/no contamination was found from TCC, Why wasn't a neighborhood where we are fairly certain TCC contamination exists (Kaufman Ave area) used to determine sampling/testing depth?**

- In the pilot study we tested the idea of whether 2 in or 6 in samples were better to identify hot spots. We were concerned that 2 in samples would be complicated by residences that had taken very good care of their yards with regular new topsoil added. And we did not want to miss data for a hot spot in those cases by only sampling 2 inches- the research team heard the concerns from Jackie James-Creedon and the community that we would miss hotspots and areas with contamination. Thus we decided to take samples at both 2 and 6 inches in the pilot study and compare. At nearly every site contamination was higher in samples taken at 6 inches. This confirmed our hypothesis based on prior experience that regular lawn care (addition of topsoil) will negatively affect our ability to see historic buildup of contaminants. Vacant lots/abandoned homes would allow us to see historic deposition at 2 inches, but those areas are not often found in our study area.
- With 2 inch samples we will not detect historic deposition, which will mean we will find fewer hotspots and fewer areas to clean up.
- Sampling only at 2 inches would mean we could potentially miss contamination. (false negative).
- We will be taking some 2 inch samples in Phase 1 in addition to the 6 inch samples. If we see that there is a connection, that there is contamination at 2 and 6 inches (that connection was not there in the pilot study), we will increase the number of 2 inch samples taken in the hotspot study.
- It is important to keep an open mind and have no preconceived notions about where contamination exists. That is why we are doing a broad study with a large area- to determine how our community has been affected on a large scale.
- The area of the soil study was influenced by the Air Study done by the DEC. That study concluded that the affected area of pollution was relatively small and limited to census tracts in the Town of Tonawanda. We laid down a grid that was larger than the results from DEC Air Study, generally centered around Tonawanda Coke, and that evenly distributed the points for Phase 1 of the study. After putting the points on the map we used the Pilot Study to test the edge of the grid to make sure that we had gone far enough from TCC. We wanted to make sure that we found the edge of any existing contamination. If we had found significant contamination in the Pilot Study we would have made the grid wider to include any contamination.
- Testing in the Kaufman Ave area would not have made us confident that we had found the edge of contamination. One of the main objectives of the Pilot Study was to confirm the edge of the grid. It is important when we use GIS that we find the edges of contamination- GIS can only model from areas where we have collected data (interpolate) we cannot accurately estimate levels of contamination outside of our study area.

- **Does 6 inch sampling support the nature of PAH and heavy metal migration? References used?**

- We are not concerned about migration of Semi volatile organic compounds (SVOCs including PAHs) and metals in soil. The amount of migration for most of these is minimal, but build up occurs as deposition over time giving pollution at deeper depths. Keep in mind that we are not just sampling for PAHs and heavy metals. We don't know exactly what TCC is burning/has burned, so we are doing broad suite of tests to make sure we find any contamination that may be present.

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11/11/2016

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ALS Environmental

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1565 Jefferson Rd, Building 300
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Rochester, NY 14623
Ph. 585-288-5380
Fax 585-288-8475

SOIL SAMPLES
Rob McNair
814.502.4148
rob.mcnair@alsglobal.com

Project Notes:

PARAMETER	METHOD	MATRIX	QTY	TAT	UNIT PRICE	TAT SURCHARGE	ADJUSTED UNIT PRICE	EXTENDED PRICE	TEST COMMENTS
BOUNDRY CONDITION SAMPLING :									
Target Compound List (TCL) VOCs	EPA 8260C	S	30	10 Standard BD	$ 49.00	0	$ -	$ 1,470.00	
3 Pre-weighed VO Soil Vials (Terra Core)	EPA 5035	S	30	10 Standard BD	$ 9.00	0	$ -	$ 270.00	Required in NY State
TCL SVOCs (BN&A)	EPA 8270D	S	30	10 Standard BD	$ 105.00	0	$ -	$ 3,150.00	
TCL Pesticides	EPA 8082	S	30	10 Standard BD	$ 59.00	0	$ -	$ 1,770.00	
PCBs	EPA 8081	S	30	10 Standard BD	$ 49.00	0	$ -	$ 1,470.00	
23 Target Analyte List (TAL) Metals	EPA 6010/7471	S	30	10 Standard BD	$ 89.00	0	$ -	$ 2,670.00	
Total Cyanide	EPA 9012	S	30	10 Standard BD	$ 20.00	0	$ -	$ 600.00	
					$ 380.00			$ 11,400.00	Total for Boundry Condition Sampling
PROPOSED FOLLOW-UP SAMPLING :									
TCL SVOCs (BN&A)	EPA 8270D	S	270	10 Standard BD	$ 105.00	0	$ -	$ 28,350.00	
TCL Pesticides	EPA 8082	S	270	10 Standard BD	$ 59.00	0	$ -	$ 15,930.00	
PCBs	EPA 8081	S	270	10 Standard BD	$ 49.00	0	$ -	$ 13,230.00	
23 Target Analyte List (TAL) Metals	EPA 6010/7471	S	270	10 Standard BD	$ 89.00	0	$ -	$ 24,030.00	
Total Cyanide	EPA 9012	S	270	10 Standard BD	$ 20.00	0	$ -	$ 5,400.00	
					$ 322.00			$ 86,940.00	Total for followup sampling
ALS Rochester Sample Courier Service					No Charge				

GRAND TOTAL $ 98,340.00

} look in mostly richest cone spot

Appendix 3

Standard Operating Procedure for Sampling Preparation and Collection (Dr. J. W. Wallace) (Reviewed by Dr.Jon Gabry, EPA and Benjamin McPherson, DEC Region 9 staff, August 3, 2017.

ALS Laboratory Certification from NY State

Updated:7/31/2017 - JW

Sampling Protocol – Subsurface Soil

****Note****Procedure requires use of *dilute nitric acid* (HNO_3 aq). Nitric acid is a corrosive acid that may cause burns to the skin or mucus membranes if handled improperly. Personal protective equipment (PPE) must be utilized at all times.

Glassware Preparation:

-All glassware used in sample collection must be treated in 10% nitric acid bath (located in NSC 465) for a minimum of eight (8) hours and baked overnight to ensure removal of residual or adsorbed organic materials.

Procedure: (all stored glassware should be re-washed prior to use to ensure maximal recovery, unless previously treated with nitric acid bath, baked and stored with foil cap.

1. Wash all glassware with alconox soap and scrub brush until visibly clean.
2. Rinse 3x with tap water, or until all soap residue has been removed
3. Rinse 3x with DI/distilled water to minimize the presence of metal cations in the tap water.
4. Allow to mostly dry
5. **Carefully** Place cleaned glassware into 10% nitric acid bath, ensuring NO AIR BUBBLES are present where sample will contact the glass surface.
6. Allow to soak for at least 8 hours.
7. **Carefully** remove from acid bath and rinse with DI/Distilled water 3x.
   NEVER dump nitric acid down the drain. Please return all nitric acid to wash bath.
8. Place in oven while oven is cool (<40°C) and Bake at 250°C overnight.
9. Allow baked glassware to cool, cover with aluminum foil, LABEL AS ACID WASHED, and place in dry cupboard for short-term storage.

Plasticware Preparation (including caps):

-All plasticware used in sample collection must be treated in 2% nitric acid bath (located in NSC 465) for a minimum of eight (8) hours and air-dried to minimize carryover and contamination.

1. Wash all plasticware with alconox soap and scrub brush until visibly clean.
2. Rinse 3x with tap water, or until all soap residue has been removed
3. Rinse 3x with DI/distilled water to minimize the presence of metal cations in the tap water.
4. Allow to mostly dry to avoid diluting acid baths
5. **Carefully** Place cleaned plasticware into 2% nitric acid bath, ensuring NO AIR BUBBLES are present where sample will contact the plastic surface.
6. Allow to soak for at least 8 hours.
7. **Carefully** remove from acid bath and rinse with DI/Distilled water 3x.
   NEVER dump nitric acid down the drain. Please return all nitric acid to wash bath.
8. Allow to dry upside down on clean lab diaper.

NOTE: Metal-free sampling tubes (such as metal-free centrifuge tubes) do not need to be washed prior to use if sealed by the factory.

Generating 10% nitric acid (HNO_3) for rinsing:

****CAUTION: nitric acid is corrosive and can cause serious chemical burns to skin and mucus membranes. ALWAYS use proper PPE when handling nitric acid. Dilute nitric acid should be treated with the same respect as concentrated nitric acid.****

****When diluting acids, always add acid to water. DO NOT ADD WATER TO ACID – this may cause boiling and is extremely dangerous.**

For the purposes of this study, Huey Nitric acid (65%) stock will be utilized to make all baths and rinses.

To make a 10% nitric acid solution from 65% Huey stock:

1) Calculate the volume of nitric acid required for the intended final volume using the following equation:

$$\frac{V_f \cdot C_f}{C_i} = V_{stock} \tag{1}$$

where V_f is the final intended volume, C_f is the final, intended concentration, C_i is the concentration of the initial stock solution, and V_{stock} is the volume of the stock needed to make the appropriate solution.

An example for 1L of 10% (0.1)

$$\frac{1.000L \cdot 0.100}{0.650}$$ = **0.154 L** or **154 mL** of stock (65%) nitric acid.

2) Second, calculate the volume of water required to achieve the desired concentration using the following concentration:

$$V_f - V_{stock} = V_{water} \tag{2}$$

where V_f is the final intended volume, V_{stock} is the volume of the nitric acid calculated by equation 1, and V_{water} is the volume of water to be used.

From the example above:

1.000 L – 0.154 L = **0.846 L** or **846 mL**.

Updated:7/31/2017 - JW

Materials

1) Label(s) and Marker
2) Glass bottle(s) and terra core kits
3) Nitrile Gloves
4) Paper Towels
5) Bag for waste (bring waste back for disposal)
6) Trowel
7) 10% Nitric acid Squirt bottle (250 mL)
8) Distilled water squirt bottle (500 mL)
9) Waste containers (rinse disposal)
10) Smart phone with GIS App
11) Chain-of-custody forms
12) Site documentation
13) First Aid Kit
14) GPS Unit

Cleaning Sampling Tools:

1. Lightly wet tool with distilled water and remove any visible debris with a paper towel.
2. Rinse the tool with distilled water well and shake dry.
3. Rinse tool with the 10% nitric acid, ensure the waste goes in the white-tape container. Use caution with nitric acid as it is corrosive and may damage clothes or cause skin irritations.
4. Rinse the tool thoroughly with distilled water, placing waste in the same container as the nitric acid.
5. Rinse the tool with methanol (MeOH), being sure to place waste in the GREEN waste container.
6. Repeat steps 1-5 if soil remains after the First Round of Cleaning.
7. Allow to dry in air before next use.

Updated: 2/18/2018 - JW

Sampling Procedure:

** Ensure all collection units (Bottles) are covered with foil or appropriate cap prior to entering field. **

<u>Protocol</u>

1. Locate a clean, unobscured area of property from which to take soil. Consult with property owner to identify their preference. Location should be free from standing water, brush, overhang, etc.
2. On a ***new page*** of the notebook, title the page with the address and point number, and begin recording information concerning nature of the site, moisture content, presence of roots or stones, etc.
3. Collect GPS coordinates of selected location using GPS in the kit.
4. Take photos of area to be collected from an identifiable point, on the property (preferably from the street). Take at least three (3) photos to document location ***<u>before</u>*** removing the sod. A trowel may be placed in the ground to mark the point of collection.
5. Put on all personal protective equipment including gloves, safety glasses, etc.
6. Gently remove the sod in a roughly 12-inch circle using the trowel. The area to be removed may be "cut out" with the trowel and peeled back.
7. Using trowel, remove soil to the appropriate depth (as indicated by team leader), using ruler to confirm depth.
8. Using the stainless steel scoop, gently remove any soil possibly contaminated by the trowel (approximately 0.5 inches deep). Potentially contaminated soil may be scraped to one side of the circle cut in step 3.
9. Clean the trowel and scoop, or alternatively, place in sealable ziplock bag for later cleaning in chemistry lab.
10. **IF VOC Analysis is required:** Collect samples for volatiles analysis with TerraCore Kit from center of circle.

<u>Terra Core Kit Instructions</u>:
Step 1: With the plunger seated in the handle, push the Terra Core™ sampler into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 grams of soil.
Step 2: Wipe all soil or debris from the outside of the Terra Core™ sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.
Step 3: Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40 mL VOA vials listed in these instructions and extrude the sample by pushing the plunger down. Quickly place the lid back on the 40 mL VOA vial.

Note: When capping the 40 mL VOA vial, be sure to remove any soil or debris from the top and/or threads of the vial.

Step 4: Collect sample for the 60-gram jar using the bulk soil collection technique - (stainless steel spoon).
Step 5: Place kit in cooler with ice, ensuring all information is properly documented in notebook.

11. Using a stainless steel sppon, collect samples to fill the two small jars, and the larger 16 oz. jar.

Note: it is not necessary to clean the spoon in between jars <u>at the same location</u>. However, the tools must be cleaned before leaving the site, or placed into a sealable plastic bag to avoid contamination.

12. Before replacing the top of any jar, ensure the threads, top and cap are free of soil, which would not allow the sample to seal.
13. Place all samples in the appropriate jar, label, document, and photograph.
14. Place all jars in the appropriate cooler.
15. Replace sod to return area to previous state.
16. Clean tools and allow to dry (See back of clip board for protocol).

    Alternatively: Place all dirty equipment in sealable ziplock bag for later cleaning. DO NOT REUSE UNTIL CLEAN.
17. Ensure all information is properly documented in notebook.
18. Pack kit, placing all garbage in the provided bag.

<u>Before moving to the next site</u>, ensure all squirt bottles have parafilm placed over the spout to prevent leaking

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Issued in accordance with and pursuant to section 502 Public Health Law of New York State

NY Lab Id No: 10145

MR. CARLTON BEECHLER
ALS ENVIRONMENTAL - ROCHESTER
1565 JEFFERSON ROAD BUILDING 300, SUITE 360
ROCHESTER, NY 14623

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Bacteriology

Coliform, Total / E. coli (Qualitative)	SM 18-22 9223B (-97) (Colilert)

Fuel Additives

Methyl tert-butyl ether	EPA 524.2
Naphthalene	EPA 524.2

Metals I

Arsenic, Total	EPA 200.8 Rev. 5.4
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Metals II

Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Molybdenum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Thallium, Total	EPA 200.8 Rev. 5.4
Vanadium, Total	EPA 200.7 Rev. 4.4

Metals III

Boron, Total	EPA 200.7 Rev. 4.4
Calcium, Total	EPA 200.7 Rev. 4.4
Magnesium, Total	EPA 200.7 Rev. 4.4
Potassium, Total	EPA 200.7 Rev. 4.4
Sodium, Total	EPA 200.7 Rev. 4.4

Miscellaneous

1,4-Dioxane	EPA 522
Organic Carbon, Total	SM 21-22 5310B (-00)
	SM 21-22 5310C (-00)
Turbidity	EPA 180.1 Rev. 2.0
UV 254	SM 19-22 5910B (-00)

Non-Metals

Alkalinity	SM 18-22 2320B (-97)
Calcium Hardness	SM 18-22 2340B (-97)

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Non-Metals

Chloride	EPA 300.0 Rev. 2.1
Color	SM 18-22 2120B (-01)
Corrosivity	SM 18-22 2330
Cyanide	EPA 335.4 Rev. 1.0
Fluoride, Total	EPA 300.0 Rev. 2.1
Nitrate (as N)	EPA 353.2 Rev. 2.0
Nitrite (as N)	EPA 353.2 Rev. 2.0
Orthophosphate (as P)	EPA 365.1 Rev. 2.0
Silica, Dissolved	USGS I-2700-85
Solids, Total Dissolved	SM 18-22 2540C (-97)
Specific Conductance	EPA 120.1 Rev. 1982
Sulfate (as SO4)	EPA 300.0 Rev. 2.1

Trihalomethanes

Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2

Volatile Aromatics

1,2,3-Trichlorobenzene	EPA 524.2
1,2,4-Trichlorobenzene	EPA 524.2
1,2,4-Trimethylbenzene	EPA 524.2
1,2-Dichlorobenzene	EPA 524.2
1,3,5-Trimethylbenzene	EPA 524.2
1,3-Dichlorobenzene	EPA 524.2
1,4-Dichlorobenzene	EPA 524.2

Volatile Aromatics

2-Chlorotoluene	EPA 524.2
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2
n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2
sec-Butylbenzene	EPA 524.2
Styrene	EPA 524.2
tert-Butylbenzene	EPA 524.2
Toluene	EPA 524.2
Total Xylenes	EPA 524.2

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 524.2
1,1,1-Trichloroethane	EPA 524.2
1,1,2,2-Tetrachloroethane	EPA 524.2
1,1,2-Trichloroethane	EPA 524.2
1,1-Dichloroethane	EPA 524.2
1,1-Dichloroethene	EPA 524.2
1,1-Dichloropropene	EPA 524.2
1,2,3-Trichloropropane	EPA 524.2

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Volatile Halocarbons

1,2-Dichloroethane	EPA 524.2
1,2-Dichloropropane	EPA 524.2
1,3-Dichloropropane	EPA 524.2
2,2-Dichloropropane	EPA 524.2
Bromochloromethane	EPA 524.2
Bromomethane	EPA 524.2
Carbon tetrachloride	EPA 524.2
Chloroethane	EPA 524.2
Chloromethane	EPA 524.2
cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2
Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,2-Dichloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

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Acrylates

Acrolein (Propenal)	EPA 8260C
	EPA 624
Acrylonitrile	EPA 8260C
	EPA 624
Ethyl methacrylate	EPA 8260C
Methyl acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C

Amines

1,2-Diphenylhydrazine	EPA 8270D
1,4-Phenylenediamine	EPA 8270D
1-Naphthylamine	EPA 8270D
2-Naphthylamine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
5-Nitro-o-toluidine	EPA 8270D
Aniline	EPA 625
	EPA 8270D
Carbazole	EPA 625
	EPA 8270D
Diphenylamine	EPA 8270D
Methapyrilene	EPA 8270D
Pronamide	EPA 8270D
Propionitrile	EPA 8260C

Amines

Pyridine	EPA 625
	EPA 8270D

Benzidines

3,3'-Dichlorobenzidine	EPA 625
	EPA 8270D
3,3'-Dimethylbenzidine	EPA 8270D
Benzidine	EPA 625
	EPA 8270D

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
	EPA 608
4,4'-DDE	EPA 8081B
	EPA 608
4,4'-DDT	EPA 8081B
	EPA 608
Aldrin	EPA 8081B
	EPA 608
alpha-BHC	EPA 8081B
	EPA 608
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
	EPA 608
Chlordane Total	EPA 8081B
	EPA 608
Chlorobenzilate	EPA 8270D

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Chlorinated Hydrocarbon Pesticides

delta-BHC	EPA 8081B
	EPA 608
Diallate	EPA 8270D
Dieldrin	EPA 8081B
	EPA 608
Endosulfan I	EPA 8081B
	EPA 608
Endosulfan II	EPA 8081B
	EPA 608
Endosulfan sulfate	EPA 8081B
	EPA 608
Endrin	EPA 8081B
	EPA 608
Endrin aldehyde	EPA 8081B
	EPA 608
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
	EPA 608
Heptachlor epoxide	EPA 8081B
	EPA 608
Isodrin	EPA 8270D
Kepone	EPA 8081B
Lindane	EPA 8081B
	EPA 608
Methoxychlor	EPA 8081B

Chlorinated Hydrocarbon Pesticides

Methoxychlor	EPA 608
Mirex	EPA 8081B
PCNB	EPA 8270D
Toxaphene	EPA 8081B
	EPA 608

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 625
	EPA 8270D
2-Chloronaphthalene	EPA 625
	EPA 8270D
Hexachlorobenzene	EPA 8081B
	EPA 625
	EPA 8270D
Hexachlorobutadiene	EPA 625
	EPA 8270D
Hexachlorocyclopentadiene	EPA 625
	EPA 8270D
Hexachloroethane	EPA 625
	EPA 8270D
Hexachloropropene	EPA 8270D
Pentachlorobenzene	EPA 8270D

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A

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Chlorophenoxy Acid Pesticides

2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
Dicamba	EPA 8151A
Dinoseb	EPA 8151A
	EPA 8270D
Pentachlorophenol	EPA 8151A

Demand

Biochemical Oxygen Demand	SM 5210B-01,-11
Carbonaceous BOD	SM 5210B-01,-11
Chemical Oxygen Demand	EPA 410.4 Rev. 2.0

Dissolved Gases

Acetylene	RSK-175
Ethane	RSK-175
Ethene (Ethylene)	RSK-175
Methane	RSK-175
Propane	RSK-175

Fuel Oxygenates

Di-isopropyl ether	EPA 8260C
	EPA 8015C
Ethanol	EPA 8015C
Methyl tert-butyl ether	EPA 8260C
	EPA 624
tert-amyl methyl ether (TAME)	EPA 8260C
tert-butyl alcohol	EPA 8260C

Fuel Oxygenates

tert-butyl ethyl ether (ETBE)	EPA 8260C

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 625
	EPA 8270D
4-Bromophenylphenyl ether	EPA 625
	EPA 8270D
4-Chlorophenylphenyl ether	EPA 625
	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 625
	EPA 8270D
Bis(2-chloroethyl)ether	EPA 625
	EPA 8270D

Low Level Polynuclear Aromatics

Acenaphthene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Acenaphthylene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Anthracene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Benzo(a)anthracene Low Level	EPA 8310
	EPA 610
	EPA 8270D

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Low Level Polynuclear Aromatics

Benzo(a)pyrene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Benzo(b)fluoranthene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Benzo(g,h,i)perylene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Benzo(k)fluoranthene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Chrysene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Dibenzo(a,h)anthracene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Fluoranthene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Fluorene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Indeno(1,2,3-cd)pyrene Low Level	EPA 8310
	EPA 610

Low Level Polynuclear Aromatics

Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D
Naphthalene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Phenanthrene Low Level	EPA 8310
	EPA 610
	EPA 8270D
Pyrene Low Level	EPA 8310
	EPA 610
	EPA 8270D

Metals I

Barium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Calcium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4

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Metals I

Copper, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Lead, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Magnesium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Potassium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4

Metals I

Sodium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Strontium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C

Metals II

Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 200.8 Rev. 5.4
Antimony, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Arsenic, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Chromium VI	EPA 218.6 Rev. 3.3
	EPA 7196A
	EPA 7199
	SM 3500-Cr B-09,-11
Mercury, Low Level	EPA 1631E

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ALS ENVIRONMENTAL - ROCHESTER
1565 JEFFERSON ROAD BUILDING 300, SUITE 360
ROCHESTER, NY 14623

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Metals II	
Mercury, Total	EPA 245.1 Rev. 3.0
	EPA 7470A
Selenium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Metals III	
Cobalt, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Gold, Total	EPA 200.7 Rev. 4.4
Molybdenum, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Palladium, Total	EPA 200.7 Rev. 4.4

Metals III	
Platinum, Total	EPA 200.7 Rev. 4.4
Thallium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
	EPA 6020A
	EPA 200.8 Rev. 5.4
Tin, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Titanium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Uranium (Mass)	EPA 6020A
Mineral	
Alkalinity	SM 2320B-97,-11
Calcium Hardness	SM 2340B-97,-11
Chloride	EPA 300.0 Rev. 2.1
	EPA 9056A
Fluoride, Total	EPA 300.0 Rev. 2.1
	EPA 9056A
Hardness, Total	SM 2340C-97,-11
	SM 2340B-97,-11
Sulfate (as SO4)	EPA 300.0 Rev. 2.1
	EPA 9056A
Miscellaneous	
Boron, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Bromide	EPA 300.0 Rev. 2.1

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Miscellaneous	
Bromide	EPA 9056A
Color	SM 2120B-01,-11
Corrosivity	SM 2330
Cyanide, Total	SM 4500-CN E-99,-11
	EPA 335.4 Rev. 1.0
	EPA 9012B
Formaldehyde	EPA 8315A
Oil and Grease Total Recoverable (HEM)	EPA 1664A
Organic Carbon, Total	SM 5310B-00,-11
	SM 5310C-00,-11
	EPA 9060A
Perchlorate	EPA 6850
Phenols	EPA 420.4 Rev. 1.0
	EPA 9066
Silica, Dissolved	USGS I-2700-85
Specific Conductance	EPA 120.1 Rev. 1982
Sulfide (as S)	SM 4500-S2- F-00,-11
	EPA 9034
Surfactant (MBAS)	SM 5540C-00,-11
Total Petroleum Hydrocarbons	EPA 1664A
Turbidity	EPA 180.1 Rev. 2.0
Nitroaromatics and Isophorone	
1,3,5-Trinitrobenzene	EPA 8270D
1,3-Dinitrobenzene	EPA 8270D
1,4-Naphthoquinone	EPA 8270D

Nitroaromatics and Isophorone	
2,4-Dinitrotoluene	EPA 625
	EPA 8270D
2,6-Dinitrotoluene	EPA 625
	EPA 8270D
4-Nitroquinoline-1-oxide	EPA 8270D
Isophorone	EPA 625
	EPA 8270D
Nitrobenzene	EPA 625
	EPA 8270D
Nitrosoamines	
N-Nitrosodiethylamine	EPA 8270D
N-Nitrosodimethylamine	EPA 625
	EPA 8270D
N-Nitrosodi-n-butylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 625
	EPA 8270D
N-Nitrosodiphenylamine	EPA 625
	EPA 8270D
N-nitrosomethylethylamine	EPA 8270D
N-nitrosomorpholine	EPA 8270D
N-nitrosopiperidine	EPA 8270D
N-Nitrosopyrrolidine	EPA 8270D
Nutrient	
Ammonia (as N)	EPA 350.1 Rev. 2.0
	ASTM D6919-09

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Nutrient

Kjeldahl Nitrogen, Total	EPA 351.2 Rev. 2.0
Nitrate (as N)	EPA 353.2 Rev. 2.0
	EPA 300.0 Rev. 2.1
	EPA 9056A
Nitrate-Nitrite (as N)	EPA 353.2 Rev. 2.0
Nitrite (as N)	EPA 353.2 Rev. 2.0
	EPA 300.0 Rev. 2.1
	EPA 9056A
Orthophosphate (as P)	EPA 365.1 Rev. 2.0
Phosphorus, Total	EPA 365.1 Rev. 2.0

Organophosphate Pesticides

Atrazine	EPA 8270D
Dimethoate	EPA 8270D
Disulfoton	EPA 8270D
Parathion ethyl	EPA 8270D
Parathion methyl	EPA 8270D
Phorate	EPA 8270D
Sulfotepp	EPA 8270D
Thionazin	EPA 8270D

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015C

Phthalate Esters

Benzyl butyl phthalate	EPA 625
	EPA 8270D

Phthalate Esters

Bis(2-ethylhexyl) phthalate	EPA 625
	EPA 8270D
Diethyl phthalate	EPA 625
	EPA 8270D
Dimethyl phthalate	EPA 625
	EPA 8270D
Di-n-butyl phthalate	EPA 625
	EPA 8270D
Di-n-octyl phthalate	EPA 625
	EPA 8270D

Polychlorinated Biphenyls

PCB-1016	EPA 8082A
	EPA 608
PCB-1221	EPA 8082A
	EPA 608
PCB-1232	EPA 8082A
	EPA 608
PCB-1242	EPA 8082A
	EPA 608
PCB-1248	EPA 8082A
	EPA 608
PCB-1254	EPA 8082A
	EPA 608
PCB-1260	EPA 8082A
	EPA 608

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Polychlorinated Biphenyls

PCB-1262	EPA 8082A
PCB-1268	EPA 8082A

Polynuclear Aromatics

2-Acetylaminofluorene	EPA 8270D
3-Methylcholanthrene	EPA 8270D
7,12-Dimethylbenzyl (a) anthracene	EPA 8270D
Acenaphthene	EPA 625
	EPA 8270D
Acenaphthylene	EPA 625
	EPA 8270D
Anthracene	EPA 625
	EPA 8270D
Benzo(a)anthracene	EPA 625
	EPA 8270D
Benzo(a)pyrene	EPA 625
	EPA 8270D
Benzo(b)fluoranthene	EPA 625
	EPA 8270D
Benzo(ghi)perylene	EPA 625
	EPA 8270D
Benzo(k)fluoranthene	EPA 625
	EPA 8270D
Chrysene	EPA 625
	EPA 8270D
Dibenzo(a,h)anthracene	EPA 625

Polynuclear Aromatics

Dibenzo(a,h)anthracene	EPA 8270D
Fluoranthene	EPA 625
	EPA 8270D
Fluorene	EPA 625
	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 625
	EPA 8270D
Naphthalene	EPA 625
	EPA 8270D
Phenanthrene	EPA 625
	EPA 8270D
Pyrene	EPA 625
	EPA 8270D

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 625
	EPA 8270D
2,4,6-Trichlorophenol	EPA 625
	EPA 8270D
2,4-Dichlorophenol	EPA 625
	EPA 8270D
2,4-Dimethylphenol	EPA 625
	EPA 8270D
2,4-Dinitrophenol	EPA 625
	EPA 8270D

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Priority Pollutant Phenols	
2,6-Dichlorophenol	EPA 8270D
2-Chlorophenol	EPA 625
	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 625
	EPA 8270D
2-Methylphenol	EPA 625
	EPA 8270D
2-Nitrophenol	EPA 625
	EPA 8270D
3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 625
	EPA 8270D
4-Methylphenol	EPA 625
	EPA 8270D
4-Nitrophenol	EPA 625
	EPA 8270D
Cresols, Total	EPA 8270D
Pentachlorophenol	EPA 625
	EPA 8270D
Phenol	EPA 625
	EPA 8270D
Residue	
Settleable Solids	SM 2540 F-97,-11
Solids, Total	SM 2540 B-97,-11
Solids, Total Dissolved	SM 2540 C-97,-11

Residue	
Solids, Total Suspended	SM 2540 D-97,-11
Solids, Volatile	SM 2540 E-97,-11
Semi-Volatile Organics	
1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
2-Picoline	EPA 8270D
4-Amino biphenyl	EPA 8270D
Acetophenone	EPA 625
	EPA 8270D
alpha-Terpineol	EPA 625
Aramite	EPA 8270D
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D
Ethyl methanesulfonate	EPA 8270D
Isosafrole	EPA 8270D
Methyl methanesulfonate	EPA 8270D
O,O,O-Triethyl phosphorothioate	EPA 8270D
p-Dimethylaminoazobenzene	EPA 8270D
Phenacetin	EPA 8270D

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Semi-Volatile Organics

Safrole	EPA 8270D

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
	EPA 624
	EPA 524.2
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
	EPA 624
1,4-Dichlorobenzene	EPA 8260C
	EPA 624
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
	EPA 624
	EPA 524.2
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
	EPA 624
	EPA 524.2
Ethyl benzene	EPA 8260C
	EPA 624
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C

Volatile Aromatics

m/p-Xylenes	EPA 624
Naphthalene, Volatile	EPA 8260C
	EPA 624
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
	EPA 624
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
	EPA 624
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
	EPA 624
	EPA 524.2
Total Xylenes	EPA 8260C
	EPA 624

Volatile Chlorinated Organics

Benzyl chloride	EPA 8260C

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
	EPA 624
1,1,2,2-Tetrachloroethane	EPA 8260C
	EPA 624

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Volatile Halocarbons	
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
	EPA 624
1,1-Dichloroethane	EPA 8260C
	EPA 624
1,1-Dichloroethene	EPA 8260C
	EPA 624
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloro-1,1,2-Trifluoroethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
	EPA 624
	EPA 524.2
1,2-Dichloropropane	EPA 8260C
	EPA 624
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
	EPA 624
3-Chloropropene (Allyl chloride)	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
	EPA 624

Volatile Halocarbons	
Bromoform	EPA 8260C
	EPA 624
Bromomethane	EPA 8260C
	EPA 624
Carbon tetrachloride	EPA 8260C
	EPA 624
Chloroethane	EPA 8260C
	EPA 624
Chloroform	EPA 8260C
	EPA 624
	EPA 524.2
Chloromethane	EPA 8260C
	EPA 624
cis-1,2-Dichloroethene	EPA 8260C
	EPA 624
cis-1,3-Dichloropropene	EPA 8260C
	EPA 624
Dibromochloromethane	EPA 8260C
	EPA 624
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
	EPA 624
Hexachlorobutadiene, Volatile	EPA 8260C
Methyl iodide	EPA 8260C
Methylene chloride	EPA 8260C
	EPA 624

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Volatile Halocarbons

Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 8260C
	EPA 624
trans-1,2-Dichloroethene	EPA 8260C
	EPA 624
trans-1,3-Dichloropropene	EPA 8260C
	EPA 624
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
	EPA 624
Trichlorofluoromethane	EPA 8260C
	EPA 624
Vinyl chloride	EPA 8260C
	EPA 624

Volatiles Organics

1,4-Dioxane	EPA 8260C
	EPA 8270D
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
2-Nitropropane	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
	EPA 524.2
Acetone	EPA 8260C
	EPA 624
	EPA 524.2

Volatiles Organics

Acetonitrile	EPA 8260C
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Di-ethyl ether	EPA 8260C
Ethyl Acetate	EPA 8260C
	EPA 8015C
Ethylene Glycol	EPA 8015C
Isobutyl alcohol	EPA 8260C
	EPA 8015C
Isopropanol	EPA 8260C
Methanol	EPA 8015C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
n-Butanol	EPA 8260C
o-Toluidine	EPA 8260C
	EPA 8270D
Tetrahydrofuran	EPA 524.2
Vinyl acetate	EPA 8260C

Sample Preparation Methods

	EPA 5030C
	EPA 200.2
	EPA 9030B
	EPA 3010A
	EPA 3005A
	EPA 3510C

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Sample Preparation Methods

EPA 3535A

SM 4500-CN G-99,-11

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Acrylates

Acrolein (Propenal)	EPA 8260C
Acrylonitrile	EPA 8260C
Ethyl methacrylate	EPA 8260C
Methyl acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C

Amines

1,2-Diphenylhydrazine	EPA 8270D
1,4-Phenylenediamine	EPA 8270D
1-Naphthylamine	EPA 8270D
2-Naphthylamine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
5-Nitro-o-toluidine	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D
Diphenylamine	EPA 8270D
Methapyrilene	EPA 8270D
Pronamide	EPA 8270D

Benzidines

3,3'-Dichlorobenzidine	EPA 8270D
3,3'-Dimethylbenzidine	EPA 8270D
Benzidine	EPA 8270D

Characteristic Testing

Corrosivity	EPA 9045D
Free Liquids	EPA 9095B
Ignitability	EPA 1010A
Synthetic Precipitation Leaching Proc.	EPA 1312
TCLP	EPA 1311

Chlorinated Hydrocarbon Pesticides

2,4'-DDD (Mitotane)	EPA 8081B
4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
Atrazine	EPA 8270D
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
Chlorobenzilate	EPA 8270D
delta-BHC	EPA 8081B
Diallate	EPA 8270D
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B

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All approved analytes are listed below:

Chlorinated Hydrocarbon Pesticides

Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Isodrin	EPA 8270D
Kepone	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Pentachloronitrobenzene	EPA 8270D
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D
1-Chloronaphthalene	EPA 8270D
2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 8270D
Hexachlorobutadiene	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 8270D
Hexachlorophene	EPA 8270D
Hexachloropropene	EPA 8270D
Pentachlorobenzene	EPA 8270D

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A

Chlorophenoxy Acid Pesticides

2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
Dicamba	EPA 8151A
Dinoseb	EPA 8270D
Pentachlorophenol	EPA 8151A

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270D
4-Bromophenylphenyl ether	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270D

Low Level Polynuclear Aromatic Hydrocarbons

Acenaphthene Low Level	EPA 8270D
Acenaphthylene Low Level	EPA 8270D
Anthracene Low Level	EPA 8270D
Benzo(a)anthracene Low Level	EPA 8270D
Benzo(a)pyrene Low Level	EPA 8270D
Benzo(b)fluoranthene Low Level	EPA 8270D
Benzo(g,h,i)perylene Low Level	EPA 8270D
Benzo(k)fluoranthene Low Level	EPA 8270D
Chrysene Low Level	EPA 8270D
Dibenzo(a,h)anthracene Low Level	EPA 8270D
Fluoranthene Low Level	EPA 8270D
Fluorene Low Level	EPA 8270D
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D

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Low Level Polynuclear Aromatic Hydrocarbons

Naphthalene Low Level	EPA 8270D
Phenanthrene Low Level	EPA 8270D
Pyrene Low Level	EPA 8270D

Metals I

Barium, Total	EPA 6010C
	EPA 6020A
Cadmium, Total	EPA 6010C
	EPA 6020A
Calcium, Total	EPA 6010C
Chromium, Total	EPA 6010C
	EPA 6020A
Copper, Total	EPA 6010C
	EPA 6020A
Iron, Total	EPA 6010C
Lead, Total	EPA 6010C
	EPA 6020A
Magnesium, Total	EPA 6010C
Manganese, Total	EPA 6010C
	EPA 6020A
Nickel, Total	EPA 6010C
	EPA 6020A
Potassium, Total	EPA 6010C
Silver, Total	EPA 6010C
	EPA 6020A
Sodium, Total	EPA 6010C

Metals I

Strontium, Total	EPA 6010C

Metals II

Aluminum, Total	EPA 6010C
Antimony, Total	EPA 6010C
	EPA 6020A
Arsenic, Total	EPA 6010C
	EPA 6020A
Beryllium, Total	EPA 6010C
	EPA 6020A
Chromium VI	EPA 7196A
	EPA 7199
Lithium, Total	EPA 6010C
Mercury, Total	EPA 7471B
Selenium, Total	EPA 6010C
	EPA 6020A
Vanadium, Total	EPA 6010C
	EPA 6020A
Zinc, Total	EPA 6010C
	EPA 6020A

Metals III

Cobalt, Total	EPA 6010C
	EPA 6020A
Molybdenum, Total	EPA 6010C
	EPA 6020A
Silica, Dissolved	EPA 6010C

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Metals III

Thallium, Total	EPA 6010C
	EPA 6020A
Tin, Total	EPA 6010C
Titanium, Total	EPA 6010C

Minerals

Bromide	EPA 9056A
Chloride	EPA 9056A
Fluoride, Total	EPA 9056A
Sulfate (as SO4)	EPA 9056A

Miscellaneous

Boron, Total	EPA 6010C
Cyanide, Total	EPA 9012B
Organic Carbon, Total	Lloyd Kahn Method
Perchlorate	EPA 6850
Phenols	EPA 9066
Sulfide (as S)	EPA 9034

Nitroaromatics and Isophorone

1,3,5-Trinitrobenzene	EPA 8270D
1,3-Dinitrobenzene	EPA 8270D
1,4-Naphthoquinone	EPA 8270D
2,4-Dinitrotoluene	EPA 8270D
2,6-Dinitrotoluene	EPA 8270D
4-Dimethylaminoazobenzene	EPA 8270D
4-Nitroquinoline-1-oxide	EPA 8270D

Nitroaromatics and Isophorone

Isophorone	EPA 8270D
Nitrobenzene	EPA 8270D
Pyridine	EPA 8270D

Nitrosoamines

N-Nitrosodiethylamine	EPA 8270D
N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-butylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D
N-nitrosomethylethylamine	EPA 8270D
N-nitrosomorpholine	EPA 8270D
N-nitrosopiperidine	EPA 8270D
N-Nitrosopyrrolidine	EPA 8270D

Nutrients

Nitrate (as N)	EPA 9056A
Nitrite (as N)	EPA 9056A

Organophosphate Pesticides

Dimethoate	EPA 8270D
Disulfoton	EPA 8270D
Parathion ethyl	EPA 8270D
Parathion methyl	EPA 8270D
Phorate	EPA 8270D
Sulfotepp	EPA 8270D
Thionazin	EPA 8270D

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Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015C

Phthalate Esters

Benzyl butyl phthalate	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270D
Diethyl phthalate	EPA 8270D
Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 8270D
Di-n-octyl phthalate	EPA 8270D

Polychlorinated Biphenyls

PCB-1016	EPA 8082A
PCB-1221	EPA 8082A
PCB-1232	EPA 8082A
PCB-1242	EPA 8082A
PCB-1248	EPA 8082A
PCB-1254	EPA 8082A
PCB-1260	EPA 8082A
PCB-1262	EPA 8082A
PCB-1268	EPA 8082A
PCBs in Oil	EPA 8082A

Polynuclear Aromatic Hydrocarbons

2-Acetylaminofluorene	EPA 8270D
3-Methylcholanthrene	EPA 8270D
7,12-Dimethylbenzyl (a) anthracene	EPA 8270D
Acenaphthene	EPA 8270D

Polynuclear Aromatic Hydrocarbons

Acenaphthylene	EPA 8270D
Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(ghi)perylene	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D
Chrysene	EPA 8270D
Dibenzo(a,h)anthracene	EPA 8270D
Fluoranthene	EPA 8270D
Fluorene	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 8270D
Phenanthrene	EPA 8270D
Pyrene	EPA 8270D

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D
2,4-Dichlorophenol	EPA 8270D
2,4-Dimethylphenol	EPA 8270D
2,4-Dinitrophenol	EPA 8270D
2,6-Dichlorophenol	EPA 8270D
2-Chlorophenol	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D

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Priority Pollutant Phenols

2-Methylphenol	EPA 8270D
2-Nitrophenol	EPA 8270D
3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 8270D
Pentachlorophenol	EPA 8270D
Phenol	EPA 8270D

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
2-Picoline	EPA 8270D
4-Amino biphenyl	EPA 8270D
Acetophenone	EPA 8270D
Aramite	EPA 8270D
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D
Ethyl methanesulfonate	EPA 8270D
Isosafrole	EPA 8270D

Semi-Volatile Organics

Methyl methanesulfonate	EPA 8270D
O,O,O-Triethyl phosphorothioate	EPA 8270D
Phenacetin	EPA 8270D
Safrole	EPA 8270D

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C

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Volatile Aromatics

Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
Total Xylenes	EPA 8260C

Volatile Chlorinated Organics

Benzyl chloride	EPA 8260C

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
1,1-Dichloroethane	EPA 8260C
1,1-Dichloroethene	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloro-1,3-butadiene (Chloroprene)	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
3-Chloropropene (Allyl chloride)	EPA 8260C

Volatile Halocarbons

Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
Bromoform	EPA 8260C
Bromomethane	EPA 8260C
Carbon tetrachloride	EPA 8260C
Chloroethane	EPA 8260C
Chloroform	EPA 8260C
Chloromethane	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C
Dibromochloromethane	EPA 8260C
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methyl iodide	EPA 8260C
Methylene chloride	EPA 8260C
Tetrachloroethene	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C

Volatile Organics

1,4-Dioxane	EPA 8260C

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Volatile Organics

2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
2-Nitropropane	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Acetonitrile	EPA 8260C
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Di-ethyl ether	EPA 8260C
Ethyl Acetate	EPA 8260C
Ethylene Glycol	EPA 8015C
Isobutyl alcohol	EPA 8260C
Isopropanol	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
n-Butanol	EPA 8260C
o-Toluidine	EPA 8260C
	EPA 8270D
Propionitrile	EPA 8260C
tert-butyl alcohol	EPA 8260C
Vinyl acetate	EPA 8260C

Sample Preparation Methods

EPA 5035A-L
EPA 5035A-H

Sample Preparation Methods

EPA 3580A
EPA 9030B
EPA 3050B
EPA 3060A
EPA 3541

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ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:

Miscellaneous

Lead in Dust Wipes	EPA 6010C

Sample Preparation Methods

	EPA 3050B

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All approved analytes are listed below:

Miscellaneous

Sulfur Dioxide	40 CFR 60 Method 8
Sulfuric Acid	40 CFR 60 Method 8

Purgeable Halocarbons

Tetrachloroethene	40 CFR PART 60 1984 Method 18
Trichloroethene	40 CFR PART 60 1984 Method 18

Serial No.: 55584

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Appendix 4

Standard additional information provided in participant Reports

Glossary

TCC Soil Study FAQ Sheet

Example of ToxFAQs™ from CDC/ATSDR SIte

Glossary

Category- the general classification of the chemical constituent. There are five categories that were tested for: metals, pesticides, PCBs, semi-volatiles, and volatiles.

Chemical Constituent- the chemical tested for.

Units

- mg/Kg = milligram/kilogram: a measurement of the number of milligrams of the chemical constituent detected per 1 kilogram of soil sample; can also be reported as ppm (parts per million)

  1 millogram = 0.001 g, or 10^{-3} g;

- ug/Kg = microgram/kilogram: a measurement of the number of micrograms of the chemical constituent detected per 1 kilogram of soil sample; can also be reported as ppb (parts per billion)

  1 microgram = 0.000001 g, or 10^{-6} g

Soil Cleanup Objective (SCO)- A set concentration of a chemical constituent that, if exceeded, has been determined by the New York Department of Environmental Conservation (NYDEC) to require remediation to protect public health (NYDEC Part 375-6.4). The SCOs are included in this document to provide a basis for comparison with the chemical concentrations actually detected in the tested soil sample.

Source- the document that provided the SCOs used in this report. The most conservative SCOs of four different sources were used for the chemicals tested in this soil study:

a. State of New York, Department of Environmental Conservation, Part 375, Residential Soil Cleanup Objectives

b. State of New York, Department of Environmental Conservation, Technical and Administrative Guidance Memorandum (TAGM), Recommended Soil Cleanup Objectives

c. State of New York, Department of Environmental Conservation, CP-51/Soil Cleanup Guidance

d. State of Pennsylvania, Department of Environmental Protection, Statewide Health Standards Medium-Specific Concentrations (SHS MSC), Residential Soil

e. State of Massachusetts, Department of Energy and Environmental Affairs, Massachusetts Contingency Plan, Method 1 Standards; S-1

Data- the concentration of the chemical found in the tested soil sample.

Qualitative Interpretation

Results from the lab analysis can be summarized in four different categories:

Undetected	The lab instrument being used to analyze the soil sample was unable to detect the chemical in question.
Below SCO	The chemical was detected, but the concentration fell below the SCO for that chemical.
Above SCO	The chemical was detected, and the concentration was greater than the SCO for that chemical.
-	The SCO for the chemical being tested for could not be found.

Dilution – Dilution indicates how much liquid solvent is present in the sample during analysis compared to the established method. Fractions and multiples are utilized in this column because each method requires different quantities of solvent to perform the analysis. If the samples are too concentrated, the "dilution" will show more liquid solvent was added to the sample to measure an accurate concentration. A full number (multiple) will be reported to indicate how many times the sample was diluted compared to the method's requirement. Similarly, if very little contamination is present, the sample may be concentrated by removing liquid solvent. In such cases, the dilution will report a value less than one (1) to indicate the fraction of liquid solvent that was used during the final analysis.

Results Reported to – "Reports reported to" establishes which value, the MDL or RL, is utilized as the minimum value to be included on the results report.

- If there is less contamination than the established method detection limit or reporting limit, the results will be reported as the value of the MDL to provide a conservative risk assessment projection value.
- If there is more than the MDL and less than the RL, the RL value will be reported to provide a conservative risk assessment value.
- If more than the RL value is detected, the amount detected by the method is reported.

MDL – "method detection limit" or "MDL" is the smallest amount of the chemical compound that the testing lab can reliably *detect* without accidentally reporting a false positive, in which the analytical procedure reports the presence of the contaminant when it is actually not present.

RL – Report limit or method reporting limit is the lowest amount of the chemical compound that the testing lab can reliably *quantify* without providing an inaccurate value or concentration.

The RL is always greater than the MDL because more of the contaminant is needed by the instruments to determine the concentration than to simply determine if the chemical is present or absent. ALS determines their RL daily to ensure small changes in soil, moisture, and temperature do not create daily variations.

Report Basis – Report basis indicates how the concentrations of each chemical was determined for the sample. For the purposes of this study, all results are determined for the soil as if it were dry soil. Results are reported to “dry” soil because moisture content changes daily with weather. Water is removed to give more consistent and meaningful results.

1.09 - Results in blue indicate the chemical compounds was detected at a value that is greater than the reporting limit (RL).

170 J - Results in green indicate the chemical compound was detected at a level that is below the reporting limit (RL) and above the method detection limit (MDL).

0.04 U - Results with no highlighting indicate the chemical compounds was not detected in the soil sample. The value that is given is the MDL limit. The “U” value indicates concentration is “under” or Below the limit of reporting.

Numbers with a:

- **U**: Chemical was analyzed for, but not detected.
- **J**: the reported value is an estimate because the concentration is between the RL and the MDL
- **B**: The chemical was also detected in the background sample (Blank) and may have contributed to the calculated value.
- **P**: Concentration was more than 40% different between two instruments.

TONAWANDA COKE SOIL STUDY

FREQUENTLY ASKED QUESTIONS

UB, CITIZEN SCIENCES COMMUNITY RESOURCES AND SUNY FREDONIA

In federal court, the Tonawanda Coke Corporation was convicted of breaking serious environmental laws. Their pollution may have endangered the health and environment in our community. As a result of the court case, they are now required to fund work to help the community study and address its effects. The Tonawanda Coke Soil Study began planning in 2016. To learn more about the history of this issue, please visit www.csresources.org.

1. WHY ARE WE DOING SOIL TESTING?

Soil testing results will help the community learn how much pollution entered the soil around the plant. This knowledge is the first step toward cleaning up the mess left behind.

2. WHERE WILL WE BE SAMPLING?

Sampling will take place in the areas that are most likely to be affected. This includes: Eastern Grand Island 14072, Town and City of Tonawanda 14150, Kenmore 14217, and Black Rock/ Riverside 14207 and north western part of 14216.

3. WHO IS CONDUCTING THE STUDY?

This study is being conducted by faculty, research staff and students from the University at Buffalo Department of Chemistry, led by Professor Joe Gardella, as well as staff from the local nonprofit Citizen Science Community Resources, led by Jackie James-Creedon, and faculty and students from SUNY Fredonia Department of Chemistry led by Professor Michael Milligan.

In addition, EPA and DEC staff have been assigned to assist the study. Residents are an important part of this study's success!

4. WHAT IS THE PLAN FOR THE SOIL STUDY?

This study will have two phases. During the first phase, we will collect 300 samples from around the community, so that we understand which areas have been most affected. During the second phase, we will return to those areas to determine the size of hot spots in those areas.

5. WHEN WILL YOU START?

We are currently gathering equipment and locations for soil testing. We hope to begin testing in the Spring of 2017.

6. WHO WILL DO THE TESTING?

Testing will be done by an environmental testing laboratory.

7. WHAT ARE THE TARGET CHEMICALS OF THE TESTS?

Samples will be tested for a large range of EPA Priority pollutants by a NYS Dept of Health Certified Testing Laboratory and by UB and SUNY Fredonia. These will include heavy metals, volatile organic chemicals, Semi-volatile organic compounds, pesticide residues, PCBs, Polycyclic Aromatic Hydrocarbons and other products of the emissions from Tonawanda Coke.

8. HOW WILL YOU KNOW WHAT IS EMITTED FROM TONAWANDA COKE?

The Court ordered Tonawanda Coke to provide a soil sample from the business site, a sample of coke product and to sample the air emissions from the factory. This, along with additional testing conducted by UB and SUNY Fredonia, will help us understand whether Tonawanda Coke is the cause of the pollution.

9. HOW WILL THE SAMPLES BE TAKEN?

A study team will go door to door to ask for permission to sample soil from the top two inches of yard. We will be looking for areas that are uncovered by plants or grass. Results will be reported to the owner first. With permission, we will include their results in a map of the region's pollution.

10. WHAT ROLES WILL COMMUNITY MEMBERS HAVE IN THE DEVELOPMENT OF THE TESTING AND INTERPRETATION OF RESULTS?

We are excited to include community members in this project! We will be working with a Community Advisory Committee to help foster participation. We will need volunteers for soil sampling, volunteers for permission to test property, community input on project boundaries and how results will be shared and disseminated to the public.

CONTACT INFORMATION:

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Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

Polycyclic Aromatic Hydrocarbons

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Appendix 5

Budget reports from UB and CSCR (Fredonia Budget report in Appendix 1)

UB Expenditure Summary through Dec 31, 2017

CSCR Final first year expenditure report

The Research Foundation of State University of New York
PO Box 9 Albany, NY 12201

RF F208 Report

Sponsor: US District Court for the Western District of New	Report Date: 02/19/18
Sponsor Address: 2 Niagara Square, Buffalo, NY 14202	RF Award No: 76458
	Sponsor ID# : 110cr00219WMSHKS

Report Type: Interim	Report Period From: 08/12/16 To: 12/31/17

Title of Project: UB Soil Sample Study: Determining the Environmental Impact of Coke Oven Emissions Originating from Tonawanda Coke C

Under direction of : Gardella, Dr. Joseph A	Award Period From: 08/12/16 To: 12/31/18

Award Authorized for Expenditure	
Award	$712,906.62
Authorized Transfer from Previous Year	
Total Award Authorized For Expenditures	$712,906.62

-Cash Reconciliation-	
Total Award Authorized For Expenditures	$712,906.62
Less: Cash Received to Date	$712,906.62
Balance	$0.00
Unexpended Award Balance	$373,378.91

-Expenditures-	
Salary and Wages	$126,182.45
Employee Benefits	$46,749.57
Consultant Services	$0.00
Equipment	$0.00
Supplies	$6,956.69
Travel Domestic	$1,500.00
Travel Foreign	$0.00
Tuition and Fees	$0.00
Fellowships & Part. Support	$112.00
Subaward	$73,376.00
Conference & Training	$0.00
General Services	$79,151.00
Postage	$0.00
Miscellaneous	$5,500.00
SUBTOTAL DIRECT COSTS	$339,527.71
F&A Cost Rate: 0.00 %	$0.00
TOTAL	$339,527.71
Expenditure Previously Reported	$0.00
TOTAL EXPENDITURES	$339,527.71
UNEXPENDED AWARD BALANCE	$373,378.91

Comments:

This is an interim report of expenditures.

I hereby affirm that the foregoing report is true in all respects and that all the expenditures and obligations indicated above have been made within the provisions of the grant or contract.

Signature: [signature]

Name, Title: Maryssa Kunes
AR Financial Reporting Coordinator

Citizen Science Community Resources Inc.
For Wellness Institute/UB Contract
Profit and Loss Standard
October 2016 through December 2017

12:54 PM
02/02/18
Accrual Basis

	Oct '16 - Dec '17
Ordinary Income/Expense	
Income	
UB Income	73,376.00
Total Income	73,376.00
Expense	
Management Fee-WI	2,201.28
Bank Fees	386.30
Compensation-Well Inst	47,250.00
Compensation-Well Inst, admin	890.00
Payroll Taxes	1,930.65
Computer Equipment	2,589.10
Contract Services	
Outside Contract Services	1,866.93
Total Contract Services	1,866.93
Insurance - Liability, D and O	1,949.00
Marketing	3,151.73
Meetings	1,989.59
Miscellaneous Expense	469.24
Office Expense	2,104.95
Printing and Copying	314.72
Operations	
Postage, Mailing Service	5.61
Total Operations	5.61
Telephone	1,795.91
Training	3,074.00
Travel	1,125.90
Video Camera & Projector	688.46
Volunteer Appreciation	857.77
Total Expense	74,641.14
Net Ordinary Income	-1,265.14
Net Income	**-1,265.14**