North Parcels
Mercury Investigation Work Plan

Olin Niagara Falls Plant
Niagara Falls, New York

Prepared for:

OLIN CORPORATION

Prepared by:

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ABBREVIATIONS AND ACRONYMS

Acronym	Definition
DD	Day
DI	De-ionized
ft bgs	feet below ground surface
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
Hg	Mercury
mg/kg	milligram per kilogram
MM	Month
NJDEP	New Jersey Department of Environmental Protection
NP	North Parcels
NYSDEC	New York State Department of Environmental Conservation
PPE	Personal Protective Equipment
QC	Quality Control
SCO	Soil Cleanup Objective
SOP	Standard Operating Procedure
SPLP	Synthetic Precipitation Leaching Procedure
SS	Stainless Steel
USEPA	United States Environmental Protection Agency
YYYY	Year

1.0 INTRODUCTION

Parcels I and II (North Parcels) are located north of Buffalo Avenue, across from Olin's Niagara Falls, Chlor-Alkali Plant (Figure 1.1). Results from historic sampling and analysis showed sporadic mercury detections in the North Parcels surface soils. The mercury is thought to be associated with brine muds generated in the chlor-alkali process that were used to repair potholes in the 1950s or 1960s.

On April, 1 2014 Olin submitted a work plan for investigation of surface soils in the North parcels to the New York State Department of Environmental Conservation (NYSDEC). In May 2014, Olin conducted the soil investigation in which fifty representative surface soils from the North Parcels were collected and analyzed for total mercury (Hg) (AMEC, 2014). Olin submitted a report in August 2014 summarizing the investigation and comparing the results to the NYSDEC Industrial Soil Cleanup Objective (SCO) for inorganic Hg. It is Olin's understanding that based on the processes associated with generation of the brine mud, that the primary form of Hg should be inorganic salts. In a letter dated December 4, 2014, NYSDEC indicated they would have to assume the form of Hg present was organic unless shown otherwise by chemical analysis. Following a conference call with NYSDEC, Olin submitted a work plan on January 9, 2015 with proposed analytical methods and approaches to determine the speciation of Hg in soil.

Upon further consideration, in a letter dated September 19, 2016, NYSDEC indicated that the appropriate SCO for the site is the published, non site-specific Protection of Groundwater SCO of 0.73 mg/kg for total Hg. In that letter, NYSDEC requested Olin to further delineate Hg levels in soil and evaluate Hg concentrations in groundwater in the North Parcels. This work plan responds to that request and describes the objectives, sample collection and analysis, data evaluation, reporting, and schedule for this additional investigation.

2.0 OBJECTIVES

The solubility of Hg, and hence the leaching potential to impact groundwater, is dependent on the form of Hg present, soil concentrations, soil conditions, and other geochemical factors. The NYSDEC groundwater SCO does not take into account these site-specific parameters. Without developing an understanding of the leaching potential of the Hg form present in the brine muds, it is difficult to interpret soil data results in the context of potential for leaching and potential for impacts to groundwater. This type of understanding is also necessary to prepare a Feasibility Study, if required.

Therefore, the objectives of this work plan are to:

- Evaluate subsurface soil Hg concentrations at specific locations.
- Evaluate Hg leaching potential from site soils.
- Evaluate Hg concentrations in site groundwater over a range of soil conditions.
- Develop a site-specific protection of groundwater SCO that could be used to evaluate what soils would need to be evaluated in the context of a Feasibility Study.

The approach to achieve these objectives is to select five areas distributed across the North Parcels that are incrementally representative of the lowest to highest surface soil Hg concentrations. At each of those locations, additional subsurface soil samples will be collected to evaluate vertical distribution of Hg. Temporary piezometers will be installed at each of the areas to collect groundwater samples. In addition, soils from each area collected will be subjected to the Synthetic Precipitation Leachate Procedure (SPLP) to evaluate the potential leachability of Hg from the soils given that speciation of Hg in soils is not known. Once the site specific leachability of Hg is better understood, then a more meaningful assessment of existing data can be made to expand the delineation of soil laterally and vertically if needed.

3.0 SAMPLE COLLECTION AND ANALYSIS

This section describes the sample collection procedures, decontamination process, analytical method, and health and safety requirements.

3.1 SAMPLE COLLECTION

Five direct-push borings will be advanced. Approximate locations are indicated on Figure 3.1 near previous sample locations (highlighted). These include locations at NP-SS-3, NP-SS-11, NP-SS-19, NP-SS-42, and NP-SS-49. The latitude and longitude of the initial borings were surveyed with a handheld global positioning system (GPS), and a GPS will again be used to reoccupy these locations to collect the proposed samples.

Soil samples will be collected at two-foot depth intervals until reaching the top of the groundwater surface at each location. Groundwater is approximately 10 feet below ground surface (ft bgs). Soil samples will be collected at each location using core barrels with disposable acetate liners. A composited soil sample will be collected from each two-foot depth interval such that each location is anticipated to have five samples coinciding with the two-foot depth intervals of 0-2 ft bgs, 2-4 ft bgs, 4-6 ft bgs, 6-8 ft bgs, and 8-10 ft bgs. Soil samples will be placed in clean, laboratory-supplied, containers. Approximately 25 soil samples will be collected for SPLP and total Hg analysis.

Groundwater samples will also be collected at the five locations following soil sample collection. A temporary well with a prepacked well screen will be installed into the direct-push borings for groundwater sample collection. Groundwater samples will be collected with a peristaltic pump using low-flow sampling techniques. The wells will be purged until water quality parameters have stabilized and the sample is clear. Groundwater samples will be collected for total and dissolved Hg analysis. Samples collected for dissolved Hg analysis will be field filtered using a 0.45 micron filter.

3.2 FIELD QUALITY CONTROL SAMPLES

The following Field Quality Control (QC) samples will be collected:

- Duplicate soil samples for Total Hg analysis will be collected at three sample intervals.
- Triplicate soil samples for SPLP extraction and Hg leachate analysis will be collected at three sample intervals.

- One duplicate groundwater sample will be collected.
- One matrix spike / matrix spike duplicate sample will also be collected (MS/MSD)
- An equipment rinsate blank will be collected for non-disposable equipment used for sample compositing or collection.

3.3 SAMPLE LABELS

The samples to be submitted to the laboratory will be identified and labeled as follows:

1. NP-Z-X-MMDDYYYY (X = 1 – 50 – corresponding to boring location; Z = depth interval)
2. NP-S-DUP0X-MMDDYYYY (for the duplicate soil samples)
3. NP-GW-X-MMDDYYYY (X = 1 – 50 – corresponding to boring location)
4. NP-GW-DUP01-MMDDYYY (for the duplicate groundwater sample)
5. NP-EQBLK-MMDDYYYY (for the equipment rinsate blank)

3.4 DECONTAMINATION

Sample collection tools, utensils, and bowls will be decontaminated prior to sampling, with individually dedicated sets of tools to be used at each of the locations. The tools brought to the site will be decontaminated prior to mobilization and will be wrapped in aluminum foil during transportation to the site. Decontamination of the tools will be as follows:

1. Liquinox and water wash
2. DI water rinse
3. Nitric Acid rinse
4. DI water rinse

After the samples are collected, any excess solids will be placed back into the individual excavations. Field personnel will wear nitrile gloves when handling the samples or sample tools. New gloves will be used in each area. Nitrile gloves and other personal protective equipment (PPE) will be disposed of with Olin's general waste.

3.5 HEALTH AND SAFETY REQUIREMENTS

Safety requirements will be outlined in a separate Health and Safety Plan (HASP). The HASP will be provided to field personnel for review before the investigation, and personnel performing the on-site investigation work will be required to sign an acknowledgement that they are familiar with the HASP.

Personnel engaged in field activities with potential for exposure to contaminants are required to have completed 40 hours of initial Hazardous Waste Operations and Emergency Response (HAZWOPER) training and annual 8-hour refreshers. Site personnel will be required to wear the PPE specified in the HASP while engaged in field activities or while onsite during field activities. Level D PPE (hard hat, safety shoes, and safety glasses) will be required at a minimum for personnel collecting the soil samples. Level D PPE is anticipated to offer sufficient protection to personnel working onsite.

3.6 SAMPLE PRESERVATION AND ANALYSIS

The samples will be properly preserved and shipped to a commercial laboratory for analysis. Upon collection, samples will be preserved by being placed on ice. The soil samples will be analyzed for total Hg by United States Environmental Protection Agency (USEPA) SW-846 Method 7471B. The typical reporting limit for this method is 0.033 mg/kg, which is well below the NYSDEC Protection of Groundwater SCO of 0.73 mg/kg. For samples with a total Hg soil concentration greater than the NYSDEC Protection of Groundwater SCO of 0.73 mg/kg, an SPLP extraction will be performed in accordance with USEPA SW-846 Method 1312. The leachate from the SPLP extractions and the groundwater samples will be analyzed using USEPA SW-846 Method 7470A which has a typical reporting limit of 0.2 micrograms per liter (µg/L).

4.0 DATA EVALUATION AND REPORTING

A Level I completeness check will be performed on the data generated from the samples collected with this work. This verification will include checks that:

- All results are present for the parameters requested on the chain-of-custody for each sample submitted
- Requested methods were utilized
- Reporting limits were adhered to with the exception of dilutions
- Requested reporting units were provided
- The data package includes a definition of any qualifiers
- Exceptions to the data are documented

After the data checks have been performed, the leachate Hg concentrations from the SPLP extractions will be evaluated to develop a site-specific understanding of mercury leachability and propose a site specific Protection of Groundwater SCO for the North Parcels. The total Hg soil sample results will then be compared to the site-specific Protection of Groundwater SCOs for Hg. Groundwater results will be compared to NYSDEC groundwater quality standards for Hg.

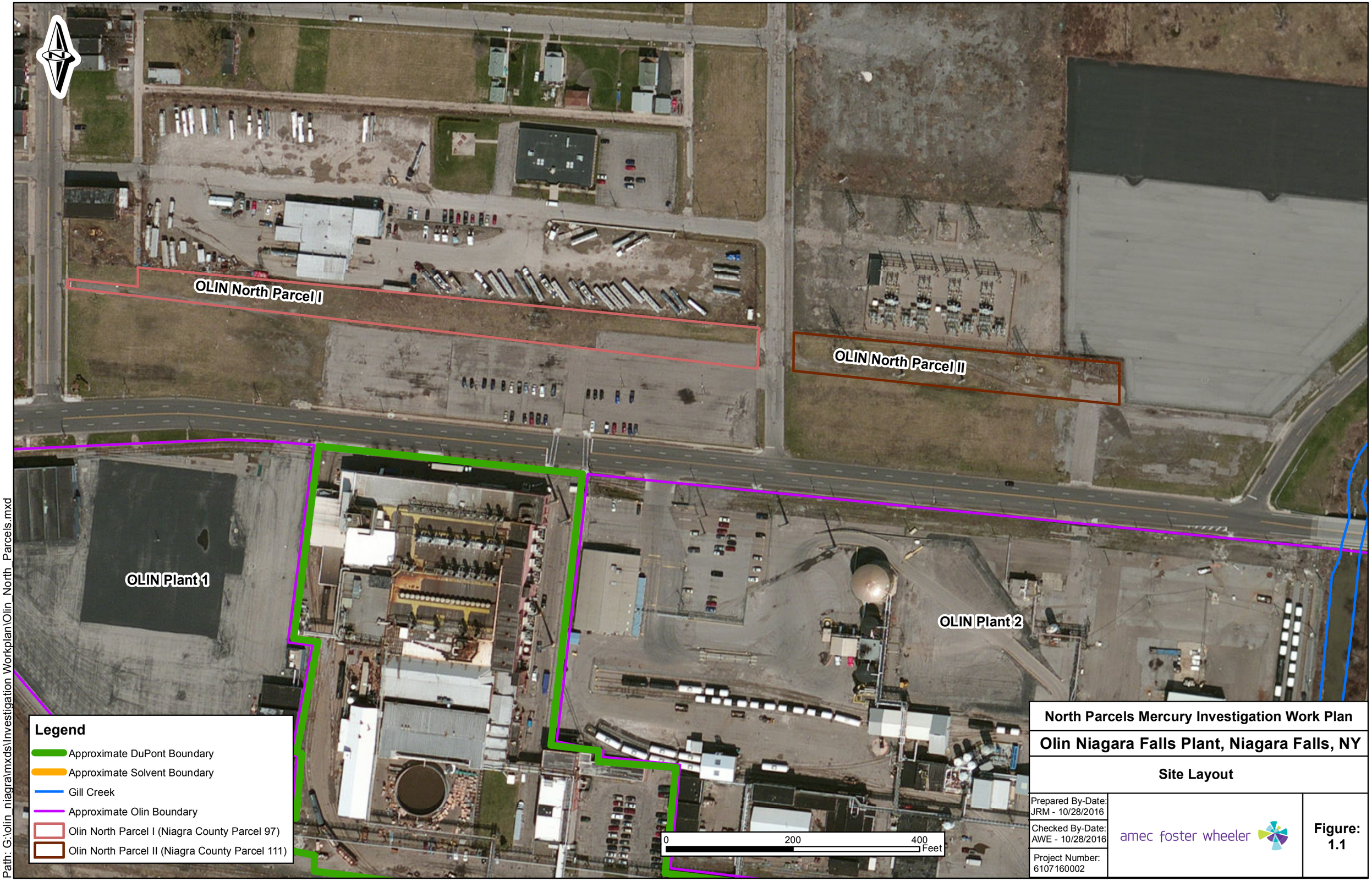
5.0 SCHEDULE

Olin will execute the field work upon approval of the work plan, weather permitting. Olin anticipates the field work will be completed no later than the second quarter of 2017. Analytical results are expected to be available within 30 days of the sampling event. A report of the activities and results will be submitted to NYSDEC within 90 days of the final lab report data validation.

6.0 REFERENCES

AMEC. (2014). *North Parking Lot Soil Investigation, Niagara Falls, New York*. Prepared for Olin Corporation, August 15, 2014.

FIGURES



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North Parcels Mercury Investigation Work Plan

Olin Niagara Falls Plant, Niagara Falls, NY

Site Layout

Prepared By-Date: JRM - 10/28/2016	amec foster wheeler	**Figure: 1.1**
Checked By-Date: AWE - 10/28/2016		
Project Number: 6107160002		

NP-SS-1 0.65
NP-SS-2 0.93
NP-SS-3 5.55
NP-SS-4 7.28
NP-SS-5 1.95
NP-SS-6 1.94
NP-SS-7 6.11
NP-SS-8 1.07
NP-SS-9 0.54
NP-SS-10 20.8
NP-SS-11 0.43
NP-SS-12 0.79
NP-SS-13 2.5
NP-SS-14 2.57
NP-SS-15 15.2
NP-SS-16 17.9
NP-SS-17 3.67
NP-SS-18 19.7
NP-SS-19 53.5
NP-SS-20 2.48
NP-SS-21 5.5
NP-SS-22 14.6
NP-SS-23 3.32
NP-SS-24 12.4
NP-SS-25 3.88
NP-SS-26 2.19
NP-SS-27 1.32
NP-SS-28 3.81
NP-SS-29 3.51
NP-SS-30 1.6
NP-SS-31 2.22
NP-SS-32 2.58
NP-SS-33 1.21
NP-SS-34 1.95
NP-SS-35 0.46
NP-SS-36 2.54
NP-SS-37 1.3
NP-SS-38 3.73
NP-SS-39 2.41
NP-SS-40 5.26
NP-SS-41 3.29
NP-SS-42 25.9
NP-SS-43 0.62
NP-SS-44 4.56
NP-SS-45 2.89
NP-SS-46 5.53
NP-SS-47 1.78
NP-SS-48 8.44
NP-SS-49 10
NP-SS-50 7.72

OLIN Plant 1

OLIN Plant 2

Note: May 2014 Hg results shown (mg/kg)

Legend

- May 2014 Sample Location
- Proposed Sample Location
- Gill Creek
- Approximate Olin Boundary
- Approximate DuPont Boundary
- Approximate Solvent Boundary
- Olin North Parcel I (Niagra County Parcel 97)
- Olin North Parcel II (Niagra County Parcel 111)

0 200 400 Feet

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North Parcels Mercury Investigation Work Plan

Olin Niagara Falls Plant, Niagara Falls, NY

Proposed Sample Locations

Prepared By-Date: JRM - 11/2/2016	amec foster wheeler	**Figure: 3.1**
Checked By-Date: AWE - 11/2/2016		
Project Number: 6107160002		