

**FINAL
TREE SAMPLING PLAN**

**NON-PUBLIC PROPERTIES
NEWHALL STREET NEIGHBORHOOD
HAMDEN, CONNECTICUT**

Prepared for:

**Olin Corporation
Cleveland, Tennessee**

Prepared by:



**MACTEC Engineering and Consulting, Inc.
511 Congress St.
Portland, ME 04101**

August 2009

Revision 0

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MACTEC Project No.: 6107-09-0004

A handwritten signature in black ink that reads "Nelson Walter".

MACTEC Electronic Signature

Nelson Walter, P.E.
Project Manager

A handwritten signature in black ink that reads "Rod Pendleton".

MACTEC Electronic Signature

Rod Pendleton, P.G.
Principal Scientist

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LIST OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CTDEP	Connecticut Department of Environmental Protection
MACTEC	MACTEC Engineering and Consulting, Inc.
mg/kg	milligram per kilogram
MPI	Malcolm Pirnie, Inc.
NPP	Non-Public Properties
Olin	Olin Corporation
RSP	Remedy Selection Plan
Site	Non-Public Properties Study Area, Hamden, Connecticut
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Tree Sampling Plan has been prepared for the remediation of the Non-Public Properties (NPP) study area in Hamden, Connecticut (Figure 1-1). The approach for determining whether or not a tree and/or other significant landscape item will be retained was documented in the Final Design/Generic Remedial Action Plan (MACTEC, 2009a). Summarily, the decision to retain a tree/landscape feature will be based upon the wishes of the Owner(s) in conjunction with analytical testing for lead concentrations in the soil and evaluation by a qualified arborist.

The remainder of this Tree Sampling Plan is organized into the following sections:

Section 2.0	Tree Retention Criteria
Section 3.0	Analytical Methods
Section 4.0	Reporting
Section 5.0	References

This Tree Sampling Plan conforms to the Remedy Selection Plan (RSP) (Connecticut Department of Environmental Protection [CTDEP], 2007a) and Final Design/Generic Remedial Action Plan (MACTEC, 2009a).

1.1 REGULATORY STATUS

The Newhall Street Neighborhood is located in the southern part of Hamden, Connecticut, east of Dixwell Avenue and just north of New Haven. The Newhall Street Neighborhood is approximately an 18-block area that historically consisted of wetlands and low-lying areas. Waste materials were used to fill these areas from the late 1800s to the mid-1900s. Subsequently, homes, public buildings, and parks were built on and next to the historic fill areas.

On April 16, 2003, the CTDEP issued Consent Order No. SRD-128 to Olin (CTDEP, 2003). The Consent Order separated the Hamden Middle School and adjacent area, located in Hamden, Connecticut into Public Properties and Non-Public Properties (NPP) study areas, which together make up the “Site.”

The approximately 64-acre NPP study area has two portions, approximately 5.6 acres and 58.4 acres north of and south of the intervening Public Properties study area, respectively. Based on the Town of Hamden assessors map (revised April 2000), 303 properties were identified in the NPP study area (adjacent properties with common ownership, if known, were counted as one). The NPP consent order boundary is approximately an 18-block area consisting of approximately 230 residential properties. For ease of geographic reference, the city blocks within the consent order boundary are given letters A, C, E, F, H, J, K, L, M, N, P, Q, R, S and T (refer to Figure 1-2).

Waste materials were placed in these areas from the late 1800s to the mid-1900s. Subsequently, homes, public buildings, and parks were built on and next to the waste disposal areas.

In October 2007 the CTDEP issued a final RSP (CTDEP, 2007a). The selected remedy for the approximately 230 residential properties (and other Non-Public Properties) located inside the Consent Order boundary is as follows:

- Excavation of waste fill within the top 4 feet and off-site disposal at authorized facilities;
- Backfilling with clean soil; and
- Restoration of pre-existing features (landscaping, patios, fencing, driveways, etc.) if disturbed during construction.

2.0 TREE RETENTION CRITERIA

During the remediation process, excavation of soil on some properties would require removal of some or all of the significant or ornamental trees and/or other significant landscape items. Because some property owners may want to retain select significant or ornamental trees and/or other significant landscape items, an effort will be made to retain these trees/landscape features if desired by the property owner. To accomplish this will require sampling of the fill beneath the tree/landscape feature and analysis for lead. If concentrations of lead are low enough, it may be possible to leave these features in place.

2.1 DECISION PROCESS

The decision process for whether or not a tree/landscape feature will be retained is outlined in Figure 2-1 and elaborated upon in the following subsections.

2.1.1 COMMUNICATION WITH PROPERTY OWNER(S)

Where feasible and appropriate, desirable or necessary, it may be possible to preserve surface features, such as mature trees, even though they overlie fill. If the tree or other surface feature is located on more than one property (as determined by the drip line from the crown of the tree), all property owners must want to keep the tree for it to be considered for retention, since the decision to leave fill on a property must be made by each property owner. The first and last steps in determining retention of a tree are communication with the Owner(s). After consultation with a property owner, attempted retention of particular trees may be pursued.

2.1.2 EVALUATION OF TREE OR LANDSCAPE ITEM

A qualified arborist or urban forester will evaluate trees that are candidates for attempted retention. In determining the viability of leaving a tree or landscape item in place, the arborist will consider the current health, vigor, age, and species of the tree. The arborist will consult with the remediation Engineer and consider the ability of the tree/landscape item to survive any environmental changes that may occur as a result of the planned excavation activities.

2.1.3 SAMPLING AND ANALYSIS OF FILL

Additional sampling of the fill may be required to evaluate the potential to retain the tree/landscape item. The criteria and approach to confirmatory sampling is consistent with Section 2.2.2 of the Sampling and Analysis Plan (MACTEC, 2009b) and is further detailed herein.

Any decisions to retain trees or other site features within the fill limits will include assessment of analytical results for lead taken within the proximity of the tree or feature (i.e., within the drip line of the tree). Three discreet samples of the surface (0-6 inches below ground surface (bgs) soil will be collected from three locations around the tree and composited into one sample. Three discreet samples of subsurface (6-48 inches bgs) soil will be collected from three locations around the tree and composited into a second sample. Both the surface and subsurface soil samples will be analyzed for lead.

If the composite subsurface (6-48 inch interval) lead concentration in the root zone is greater than 400 but less than 1,200 mg/kg, the volumetric average of lead will be calculated proportionally (with respect to the surface area of the property) with all other lead data from the same property (0-48 inch), including clean backfill. The following scenario is offered for reference: Waste fill is removed from 80% of the surface area on a property and restored with clean backfill. Native soil will remain on 15% of the surface area of the property, with the root area of a retained tree comprising the remaining 5% surface area. The volumetric lead average for the property will then be calculated by weighing the analytical data of clean backfill 80%, native soil data 15%, and the subsurface composite result from around the tree 5%. If the volumetric lead average of the subsurface soil is greater than 400 mg/kg the tree will not be retained. If the lead concentration of the surface soil is less than or equal to 400 mg/kg the tree may be retained; if the lead concentration of the surface soil is greater than 400 mg/kg the tree may be retained only if the surface soil can be remediated (e.g., remove top 6 inches of soil with air knife and vacuum).

Consultation with DEP and DPH will be made regarding the sufficiency of the data and the determination of whether or not to retain the tree.

2.2 EXCAVATION IN VICINITY OF TREES TO BE RETAINED

The procedure for excavating around trees where the desire is to leave the tree in place will be determined by lead concentrations and a qualified arborist or urban forester.

2.3 TREE REPLACEMENT

If the conclusion to retain a tree is made, reasonable efforts will be used to ensure the survival of the tree, but if the tree dies within two years following the remedial activity, it will not be replaced in kind (size, canopy), but replaced with available nursery stock. It should be noted that the fill beneath the retained tree will not be removed as part of the tree replacement effort.

Significant trees that are required to be removed as part of the excavation activities, will not be replaced in kind (size, canopy), but will be replaced with available nursery stock.

2.4 DOCUMENTATION

All sampling and associated documentation will be in accordance with the Sampling and Analysis Plan (MACTEC, 2009b). A permanently bound field notebook indicating the time, date, and location of sample collection if applicable (including a written description and map references), description of the sample preservation, sample identification number, analyses requested, and the name of the laboratory to which any off-site analytical samples were sent will be maintained on-site. The sampling notebook and associated maps, laboratory analytical reports, and copies of chain-of-custody and analysis request forms will be maintained as part of the project records.

When an arborist or urban forester makes a determination about retention of a tree, a memorandum will be placed in the project file and a copy will be provided to the property owner.

3.0 ANALYTICAL METHODS

Samples will be analyzed in accordance with the Sampling and Analysis Plan (MACTEC, 2009b). Fill samples will be analyzed in the field using X-ray fluorescence with 5% of the samples being submitted to a CTDPH-certified laboratory for the analysis of total lead by United States Environmental Protection Agency (USEPA) Method 6010B for quality assurance. Data will be reviewed for completeness as well as the quality parameters provided in the Reasonable Confidence Protocol deliverable in accordance with the Quality Assurance Project Plan for the site.

4.0 REPORTING

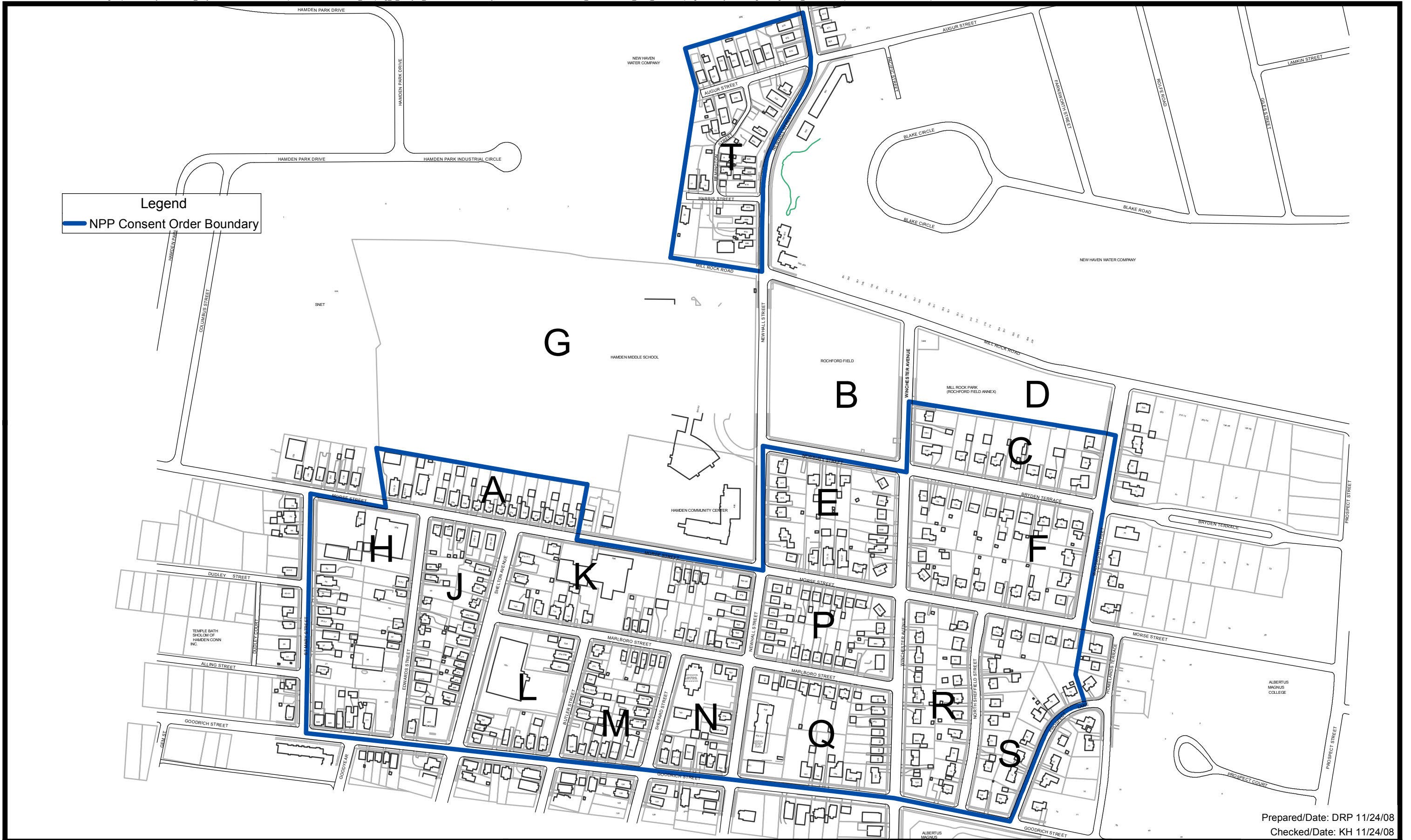
The evaluation of the data obtained during tree sampling will be included in the construction completion reports for individual properties. Summary tables and figures presenting the analytical data will be provided for each report.

5.0 REFERENCES

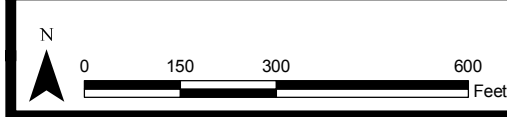
- CTDEP, 2003. Consent Order SRD-128, State of Connecticut vs. South Central Regional Water Authority, State Board of Education, and Olin Corporation, Issued by Connecticut Department of Environmental Protection, April 16, 2003.
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- MACTEC, 2008a. Final Design/Generic Remedial Action Plan, Non-Public Properties, Newhall Street Neighborhood, Hamden, Connecticut, August 19, 2008.
- MACTEC, 2008b. Sampling and Analysis Plan, Non-public Properties, Newhall Street Neighborhood, Hamden, Connecticut, February 2009.
- MPI, 2005. Supplemental Investigation Report & Remedial Action Plan Non-Public Properties Study Area Hamden, Connecticut, March 2005.
- USEPA, 1996. Region 1, EPA New England. Standard Operating Procedure for Elemental Analysis Using the X-Met 920 Field X-Ray Fluorescence Analyzer. SOP # X-MET 920, October 1996.

FIGURES

Legend
— NPP Consent Order Boundary



Prepared/Date: DRP 11/24/08
Checked/Date: KH 11/24/08



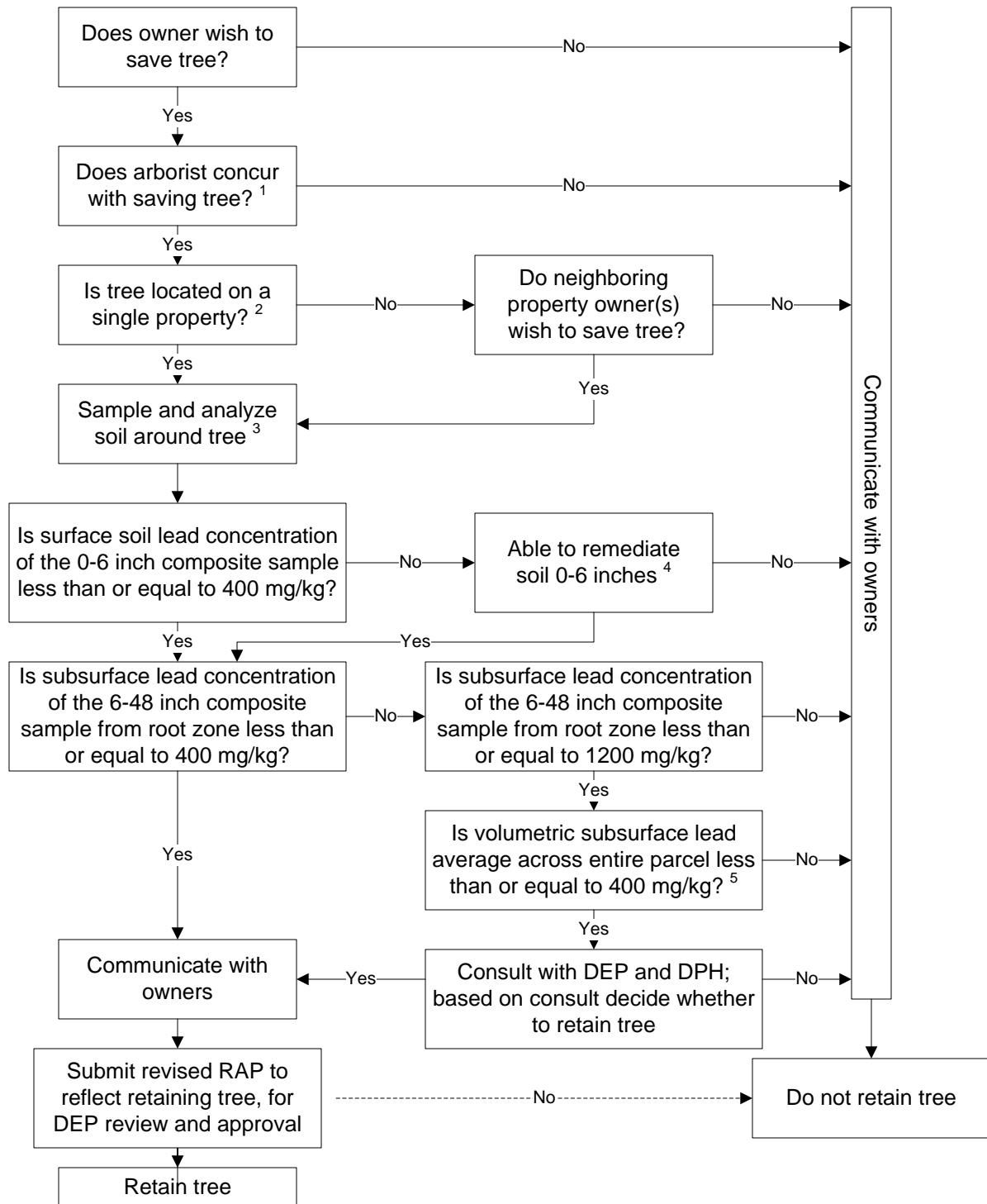
Project 6107-09-0004

Olin Corporation
Newhall Street Neighborhood
Hamden, Connecticut



Figure 1-2
Properties Within Consent Order Boundary

**Figure 2-1
Process for Determining Retention of Trees
Newhall Neighborhood Site Remediation
Olin Chemical Manufacturing Corporation
Hamden, Connecticut**



Notes:

[1] In determining whether to retain a tree, Arborist will consider health of tree and species considerations (desirable/ invasive; able to tolerate remediation)

[2] As determined by drip line from crown of tree located entirely on a single property (or as defined by arborist)

[3] Surface soil:

3 discrete samples from 3 locations around tree; collected 0-6 inches and composited into one sample and analyzed for lead

Subsurface soil:

3 discrete samples from 3 locations around tree; collected 6-48 inches and composited into one sample and analyzed for lead

[4] Methodology to be considered: air knife and vacuum

[5] Determine compliance by volumetric averaging lead result for subsurface soil beneath tree with all other soil lead concentration data on property (0-48 inches) including clean backfill