

subcontractors, laboratories and consultants retained to perform any portion of the Work performed pursuant to these Orders, within fourteen (14) days of the effective date of these Orders or upon date of retention. Respondent shall ensure that all contractors, subcontractors, laboratories and consultants retained to perform Work pursuant to these Orders comply with the applicable provisions of these Orders.

III. DEFINITIONS

5. Unless otherwise expressly provided herein, all terms used in these Orders or in any appendices shall have the same meaning as used in Chapters 3734 and 6111 of the Ohio Revised Code ("ORC"), the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §9601, *et seq.*, and the rules promulgated thereunder. Whenever the terms listed below are used in these Orders or in any appendices attached hereto and incorporated herein, the following definitions shall apply.

a. "Contaminant(s)" and "contamination" shall mean (1) any "hazardous waste" under ORC § 3734.01(J); (2) any "industrial waste" under ORC §6111.01(C); and/or (3) any "other wastes" under ORC §6111.01(D), including any release of one or more of the same.

b. "Day" shall mean a calendar day unless expressly stated to be a business day. "Business day" shall mean a day other than a Saturday, Sunday, or state holiday. In computing any period of time under these Orders, where the last day would fall on a Saturday, Sunday, or state holiday, the period shall run until the close of the next business day.

c. "Design Mitigation Work Plan" shall mean the work plan developed to address the Non-Facility Known Mitigation Properties (Appendix C).

d. "Facility" or "Facilities" shall mean the Plant 1 Site and the Plant 2 Site.

e. "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan, codified at 40 C.F.R. Part 300 (1990), as amended.

f. "Non-Facility Known Mitigation Properties" shall mean the properties identified in Section IV., Paragraph 6.h., as well as the properties identified in the Pre-Design Assessment Report pursuant to Section VI, Paragraph 11.b., where the indoor air and sub-slab sampling results indicate levels of contamination that require mitigation activities.

g. "Non-Facility Potential Mitigation Properties" shall mean the properties identified in Section IV., Paragraph 6.i., to be investigated for vapor intrusion exposure and potential mitigation activities.

h. "Non-Facility Site Properties" shall collectively mean the Non-Facility Known Mitigation Properties and the Non-Facility Potential Mitigation Properties. These Non-Facility Site Properties are not owned by Respondent.

i. "Ohio EPA" shall mean the Ohio Environmental Protection Agency and its designated representatives.

j. "Paragraph" shall mean a portion of these Orders identified by an arabic numeral or an upper or lower case letter.

k. "Parties" shall mean Respondent and the Ohio EPA.

l. "Pre-Design Assessment Work Plan" shall mean the work plan developed to address the Non-Facility Potential Mitigation Properties (Appendix D).

m. "Plant 1 Site" shall mean the eleven parcels that together are the 13.041 acre facility property located at 2455 Dayton-Xenia Road, in Greene County, Ohio. The Greene County Auditor lists the parcel numbers of these eleven lots as B03000200320001700, B42000500200011600, B42000600250008400, B03000200330000600, B42000600250008300, B03000200330000100, B03000200330012200, B03000200330012000, B03000200330012100, B42000600250002700, and B03000200330014100.

n. "Plant 2 Site" shall mean the 4.579 acre parcel located at 530 Orchard Lane, in Greene County, Ohio. The Greene County Auditor lists the parcel number of 530 Orchard Lane as B03000200330020800.

o. "Respondent" shall mean the General Electric Company, which is the parent company of Unison Industries, LLC, the successor in interest to the former Elano Corporation.

p. "Response Costs" shall mean all costs incurred by Ohio EPA including, but not limited to, payroll costs, contractor costs, travel costs, direct costs, indirect costs, legal and enforcement-related costs, oversight costs, laboratory costs, the costs of reviewing or developing plans, reports, and other items pursuant to these Orders, verifying the Work, or otherwise implementing or enforcing these Orders.

q. "Section" shall mean a portion of these Orders identified by a roman numeral.

r. "Sites" shall mean the Plant 1 Site, the Plant 2 Site, and the Non-Facility Site Properties, where treatment, storage, and/or disposal of contaminants, and/or the discharge into waters of the state of contaminants has occurred, including any other area where such contaminants may have migrated or threatens to migrate.

s. "Statement of Work" ("SOW") shall mean the statement of work for the development and implementation of the Pre-Design Assessment Work Plan and the Design Mitigation Work Plan (collectively, "Work Plans") as set forth in Appendix A to these Orders.

t. "Vapor Intrusion Mitigation Interim Action" shall mean the Work Plans and work needed to address exposure and potential exposure to volatile organic compound ("VOC") vapors at the Non-Facility Known Mitigation Properties and the Non-Facility Potential Mitigation Properties.

u. "Work" shall mean all activities Respondent is required to perform under these Orders.

IV. FINDINGS OF FACT, DETERMINATIONS, AND CONCLUSIONS OF LAW

6. All findings of fact, determinations, and conclusions of law necessary for the issuance of these Orders pursuant to ORC Sections 3734.13, 3734.20, 3745.01 and 6111.03 have been made and are outlined below. The Respondent does not admit to any finding of fact or law. The Director of Ohio EPA has determined the following:

a. The Respondent is the owner and operator of the Plant 1 Site and the Plant 2 Site.

b. The Respondent is a "person" as defined in ORC Sections 3734.01(G) and 6111.01(I).

c. The Plant 1 Site and the Plant 2 Site are hazardous waste facilities, solid waste facilities or other locations where hazardous waste was treated, stored or disposed, as defined in Section 3734.01(N) of the ORC and where contaminants listed in the next finding may have come to be located.

d. The predominant contaminants at the Plant 1 Site and the Plant 2 Site are volatile organic compounds ("VOCs"). The VOCs present at and/or

emanating from the Sites include: 1,1 dichloroethane; 1,1,1 trichloroethane ("TCA"); trichloroethene ("TCE"); 1,1 dichloroethene; 1,2 dichloroethane; and tetrachloroethene ("PCE").

e. 1,1 dichloroethane, TCA, TCE, 1,1 dichloroethene, 1,2 dichloroethane, and PCE detected at the Plant 1 Site and the Plant 2 Site are "industrial wastes" and/or "other wastes" as defined in ORC 6111.11 (C) and (D), and/or "hazardous wastes" as defined in ORC Section 3734.01(J).

f. A judicial consent order was issued on July 15, 1996, requiring the former Elano Corporation (now Unison Industries, LLC, a wholly-owned subsidiary of Respondent) to conduct a Remedial Investigation/Feasibility Study ("RI/FS"), Interim Action, Remedial Design/Remedial Action ("RD/RA"), and Operation and Maintenance ("O & M") at for the Plant 1 Site and the Plant 2 Site. (hereinafter, "the 1996 Consent Order"). A provision addressing additional work related to these tasks was not included in the 1996 Consent Order.

g. In 2009, during preparation of the Feasibility Study for the Plant 1 Site and the Plant 2 Site, Ohio EPA determined that the vapor intrusion pathway evaluation was outdated and additional assessment was necessary using the most recent guidance and standards. This assessment was conducted to evaluate the pathway of VOCs from the Sites' groundwater through the subsurface to indoor air and potential for subsequent human exposure at the Non-Facility Site Properties. At the request of Ohio EPA, a Soil Vapor Intrusion Assessment ("SVIA") was initiated by Brown and Caldwell beginning in 2009 and supplemented by April, May and August 2013 addenda to the SVIA Report ("SVIAR"). The SVIA evaluated data from groundwater, soil gas, sub-slab soil gas, indoor air, and outdoor air samples in the vicinity of the Non-Facility Site Properties from 2009 to 2013.

h. The SVIA evaluated structures on four Non-Facility Site Properties and concluded that the vapor intrusion pathway was complete for contaminants (i.e., PCE and/or TCE) from soil gas to subslab soil gas to indoor air at structures on these four evaluated Non-Facility Site Properties. However, in May of 2012, USEPA updated the Regional Screening Levels (RSLs) to reflect new toxicity values for PCE. The updated RSLs for PCE reflect an increase in the screening levels by an order of magnitude. When the four Non-Facility Site Properties were evaluated using the updated RSLs, it was determined that two of the properties no longer have a complete pathway for vapor intrusion, one property requires additional monitoring, and one property requires mitigation. The property requiring mitigation is herein identified as a Non-Facility Known Mitigation Property.

i. Based on the evaluation at the four above-referenced properties, the potential for vapor intrusion was predicted at other Non-Facility Site Properties where soil gas sampling was conducted, but no sub-slab soil gas or indoor air sampling was performed. The predicted indoor air values were calculated from site-specific attenuation factors ("AFs") for the four above-referenced properties where groundwater, soil gas, sub-slab soil gas, and indoor air data were measured. The site-specific AFs were then applied to measured soil gas concentrations to identify which properties or locations had predicted indoor air concentrations that would indicate a potential concern for vapor intrusion. These properties are referred to herein as Non-Facility Potential Mitigation Properties and are listed on Table 1 of the Pre-Design Assessment Work Plan, incorporated by reference herein as Appendix D.

j. Based on the SVIAR, Ohio EPA and Respondent have concluded that Additional Work is needed at the Non-Facility Site Properties. The Non-Facility Known Mitigation Properties require vapor intrusion mitigation systems to be installed to prevent vapor intrusion exposure. The Non-Facility Potential Mitigation Properties require investigation and may require vapor intrusion mitigation systems to be installed in order to prevent vapor intrusion exposure. This Additional Work is to be conducted under these Vapor Intrusion Mitigation Interim Action Orders.

k. Respondent prepared a Design Mitigation Work Plan, developed in conformance with the SOW (Appendix A) and the guidance documents (Appendix B), and submitted the Work Plan to Ohio EPA for review. Following Ohio EPA's review and comment, Respondent resubmitted the Work Plan to Ohio EPA for approval. Ohio EPA has approved the Work Plan, which is attached hereto and incorporated by reference herein as Appendix C.

l. Respondent prepared a Pre-Design Assessment Work Plan, developed in conformance with the SOW (Appendix A) and the guidance documents (Appendix B), and submitted the Work Plan to Ohio EPA for review. Following Ohio EPA's review and comment, Respondent resubmitted the Work Plan to Ohio EPA for approval. Ohio EPA has approved the Work Plan, which is attached hereto and incorporated by reference herein as Appendix D.

m. The migration and threatened migration of hazardous wastes, industrial wastes and/or other wastes, into the soil, ground water, and surface water at or from the Sites constitutes a discharge of hazardous, industrial and/or other wastes into "waters of the State," as that term is defined in ORC Section 6111.01(H).

n. The unpermitted discharge of hazardous waste, industrial waste

and/or other wastes into "waters of the State" is prohibited by ORC Section 6111.04. No discharge permit was issued to the Respondent.

o. The conditions at the Sites constitute a substantial threat to public health or safety or the environment or are causing or contributing to or threatening to cause or contribute to water pollution or soil contamination, within the meaning of Section 3734.20(B).

p. The Work required by these Orders will contribute to the prohibition or abatement of the discharge of industrial wastes or other wastes into the waters of the state.

q. In issuing these Orders, the Director has given consideration to, and based his determination on, evidence relating to the technical feasibility and economical reasonableness of complying with these Orders and to evidence relating to conditions calculated to result from compliance with these Orders, and their relation to benefits to the people of the state to be derived from such compliance.

V. GENERAL PROVISIONS

7. Objectives of the Parties

The objectives of the Parties in entering into these Orders are to conduct pre-design sampling and measurements on structures at the Non-Facility Potential Mitigation Properties where a complete or potentially complete vapor pathway is identified in the approved SVIAR, and to design, install and operate soil vapor mitigation systems in structures at the Non-Facility Known Mitigation Properties where sub-slab and indoor air results are above Ohio EPA screening levels, in a manner that will protect public health, safety and the environment.

8. Commitment of Respondent

Respondent shall perform the Work in accordance with these Orders, including but not limited to, the SOW, Work Plans approved by Ohio EPA, guidance documents listed in Appendix B, and all standards, specifications, and schedules set forth in or developed pursuant to these Orders. Respondent shall also reimburse Ohio EPA for Response Costs as provided in these Orders.

9. Compliance With Law

a. All activities undertaken by Respondent pursuant to these Orders shall be performed in accordance with the requirements of all applicable federal and state laws

and regulations.

b. Respondent shall perform the activities required pursuant to these Orders in a manner which is not inconsistent with the NCP. The Ohio EPA believes that activities conducted pursuant to these Orders, if approved by the Ohio EPA, would be considered to be consistent with the NCP.

c. Where any portion of the Work requires a permit or approval, Respondent shall timely submit applications and take all other actions necessary to obtain such permits or approval. These Orders are not, and shall not be construed to be, a permit issued pursuant to any statute or regulation.

VI. PERFORMANCE OF WORK BY RESPONDENT

10. Supervising Contractor

All Work performed pursuant to these Orders shall be under the direction and supervision of a contractor with expertise in hazardous waste site investigation and remediation. Prior to the initiation of the Work, Respondent shall notify Ohio EPA in writing of the name of the supervising contractor and any subcontractor to be used in carrying out the terms of these Orders. In the event that Respondent needs to change the supervising contractor or any subcontractor, Respondent shall notify Ohio EPA in writing within five (5) days of the change.

11. Implementation of Soil Vapor Intrusion Pre-Design Assessment and Design Mitigation Work Plans

a. No later than forty-five (45) days after the effective date of these Orders, Respondent shall commence implementation of the Design Mitigation Work Plan (Appendix C) and the Pre-Design Assessment Work Plan (Appendix D).

b. No later than one hundred and twenty (120) days after receipt of the final analytical data package associated with the Pre-Design Assessment Work Plan, Respondent shall submit to Ohio EPA a Pre-Design Assessment Report providing recommendations for mitigation, continued monitoring, and no further action at the Non-Facility Potential Mitigation Properties. Such properties recommended for mitigation shall become Non-Facility Known Mitigation Properties subject to the Design Mitigation Work Plan.

c. No later than sixty (60) days after Ohio EPA approves the Pre-Design Assessment Report, Respondent shall submit to Ohio EPA structure-specific design plans and specifications for each Non-Facility Known Mitigation Property recommended

for mitigation pursuant to the Pre-Design Assessment Report.

d. Ohio EPA will review the structure-specific design plans and specifications pursuant to the procedures set forth in Section XII, Review of Submittals, of these Orders. Upon approval of the structure-specific design plans and specifications by Ohio EPA and the property-owner, Respondent shall implement the approved structure-specific design plans and specifications prepared pursuant to the Design Mitigation Work Plan.

e. All structure-specific design plans and specifications shall be developed in conformance with the SOW (Appendix A), the guidance documents (Appendix B), and the Design Mitigation Work Plan (Appendix C). In the structure-specific design plans and specifications, Respondent shall present the justification for the proposed omission of any of the tasks of the SOW because of work that has already been performed or work that is not appropriate to the Non-Facility Known Mitigation Properties. Any omission proposed by Respondent is subject to the review and approval of the Ohio EPA. Respondent may rely upon existing data and/or information to the extent that Respondent can demonstrate that field and laboratory QA/QC procedures acceptable to Ohio EPA were followed in the generation of the data and/or information. Respondent shall include all supporting documentation in the structure-specific design plans and specifications for existing data and/or information and clearly identify the intended use(s) and data quality objectives for such data and/or information. Ohio EPA will evaluate the adequacy of supporting QA/QC documentation and determine the acceptability of all existing data and/or information during review of the structure-specific design plans and specifications.

f. No later than sixty (60) days after Respondent completes implementation of the structure-specific design plans and specifications for all Non-Facility Known Mitigation Properties recommended for mitigation pursuant to the Pre-Design Assessment Report, Respondent shall submit to Ohio EPA a Mitigation Final Report.

g. If Ohio EPA determines that any additional or revised guidance documents significantly affect the Work to be performed under these Orders and such additional or revised guidance documents present new information relating to substantial risk to public health or safety or the environment at the Non-Facility Site Properties, Ohio EPA will notify Respondent, and the Work Plans and other affected documents shall be modified accordingly.

h. Should Respondent identify any inconsistency between any of the laws and regulations and guidance documents which Respondent is required to follow by these Orders, Respondent shall notify the Ohio EPA in writing of each inconsistency and the effect of the inconsistencies upon the Work to be performed. The Respondent shall also recommend, along with a supportable rationale justifying each

recommendation, the requirement Respondent believes should be followed. Respondent shall implement the affected Work as directed by the Ohio EPA. In the event of any inconsistency between the SOW (Appendix A) and the approved Work Plans (Appendices C and D), the more specific requirement or provision shall control Respondent's Work under these Orders.

i. Ohio EPA will review all plans, reports or other deliverables required under the approved Work Plans pursuant to the procedures set forth in the Review of Submittals Section of these Orders. The Respondent shall submit all plans, reports, or other deliverables required under the approved Work Plans, in accordance with the approved schedule, for review and approval pursuant to Section XII, Review of Submittals, of these Orders.

j. Within seven (7) days of the effective date of these Orders, unless otherwise mutually agreed to by the Parties, the Respondent shall meet with the Ohio EPA to discuss the requirements of the approved Work Plans.

VII. ADDITIONAL WORK

12. Ohio EPA or Respondent may determine that in addition to the tasks defined in the approved Work Plans, additional Work may be necessary to accomplish the Objectives of the Parties as provided in Section V, General Provisions, paragraph 7, Objectives of the Parties, of these Orders.

13. Within thirty (30) days of receipt of written notice from Ohio EPA that additional Work is necessary, unless otherwise specified in writing by Ohio EPA, Respondent shall submit a proposed work plan, including a schedule, for the performance of the additional Work ("Additional Work Plan"). In addition, Respondent shall submit revisions to any other schedules impacted by the additional Work. If Respondent disputes the necessity of additional Work, Respondent shall initiate the procedures for dispute resolution set forth in the Dispute Resolution Section of these Orders within fourteen (14) days after receipt of Ohio EPA's notification of the need for additional Work. The Additional Work Plan shall conform to the standards and requirements set forth in the documents attached to these Orders as Appendices A, B, C, and D [i.e., the SOW, list of relevant guidance documents, and approved Work Plans]. Upon approval of the Additional Work Plan and schedule by Ohio EPA pursuant to Section XII, Review of Submittals, of these Orders, Respondent shall implement the approved Additional Work Plan in accordance with the schedule contained therein.

14. If Respondent determines that additional Work is necessary, Respondent shall submit a proposal to Ohio EPA to explain what the additional Work is, why the additional Work is necessary, and what impact, if any, the additional Work will have on

the approved Work Plans and schedules. If Ohio EPA concurs with the request to perform additional Work, Respondent shall submit an Additional Work Plan, including a schedule, for the performance of additional Work. The Additional Work Plan shall conform to the standards and requirements set forth in the documents attached to these Orders as Appendices A, B, C, and D. Upon approval of the Additional Work Plan and schedule by Ohio EPA pursuant to Section XII, Review of Submittals, of these Orders, Respondent shall implement the approved Additional Work Plan in accordance with the schedules contained therein. Additional Work does not include any activity performed in response to an emergency for which Respondent submits to Ohio EPA written notice of the performed activity.

VIII. SAMPLING AND DATA AVAILABILITY

15. Unless otherwise agreed to by the Site Coordinators, as identified pursuant to Section X, Designated Site Coordinators, of these Orders, Respondent shall notify Ohio EPA not less than seven (7) days in advance of all sample collection activity. Upon request, Respondent shall allow split and/or duplicate samples to be taken by Ohio EPA or its designated contractor. Ohio EPA shall also have the right to take any additional samples it deems necessary. Upon request, Ohio EPA shall allow Respondent to take split and/or duplicate samples of any samples Ohio EPA takes as part of its oversight of Respondent's implementation of the Work.

16. Within seven (7) days of Respondent's receipt of a request by Ohio EPA, Respondent shall submit to Ohio EPA copies of the results of all sampling and/or tests or other data in the possession of Respondent or its contractors, including raw data and original laboratory reports, generated by or on behalf of Respondent with respect to these Orders. An electronic copy shall also be provided in a format approved by Ohio EPA. Respondent may submit to Ohio EPA any interpretive reports and written explanations concerning the raw data and original laboratory reports. Such interpretive reports and written explanations shall not be submitted in lieu of original laboratory reports and raw data. Should Respondent subsequently discover an error in any report or raw data, Respondent shall promptly notify Ohio EPA of such discovery and provide the correct information.

IX. ACCESS

17. Ohio EPA and its contractors shall have access at all reasonable times to the Sites and any other property to which access is required for the implementation of these Orders, to the extent access to the property is controlled by the Respondent. Access under these Orders shall be for the purposes of conducting any activity related to these Orders including, but not limited to the following:

- a. Monitoring the Work;
- b. Conducting sampling;
- c. Inspecting and copying records, operating logs, contracts, and/or other documents related to the implementation of these Orders;
- d. Conducting investigations, tests and other activities associated with the implementation of these Orders; and
- e. Verifying any data and/or other information submitted to Ohio EPA.

18. To the extent that the Sites or any other property to which access is required for the implementation of these Orders is owned or controlled by persons other than the Respondent, the Respondent shall use its best efforts to secure from such persons access for the Respondent and the Ohio EPA and its contractors as necessary to implement these Orders. Copies of all access agreements obtained by the Respondent shall be provided promptly to Ohio EPA, except to the extent such agreements contain confidential information, in accordance with Section XVI, Access to Information, of these Orders. If any access required to implement these Orders is not obtained within ninety (90) days of the effective date of these Orders, or within ninety (90) days of the date Ohio EPA notifies the Respondent in writing that additional access beyond that previously secured is necessary, the Respondent shall promptly notify the Ohio EPA in writing of the steps the Respondent has taken to attempt to obtain access. Ohio EPA may, as it deems appropriate, assist the Respondent in obtaining access.

19. Notwithstanding any provision of these Orders, the State of Ohio retains all of its access rights and authorities, including enforcement authorities related thereto, under any applicable statute or regulation including but not limited to ORC §§3734.20 and 6111.05.

X. DESIGNATED SITE COORDINATORS

20. Within five (5) days of the effective date of these Orders, Respondent shall notify Ohio EPA, in writing, of the name, address and telephone number of its designated Site Coordinator and Alternate Site Coordinator. If a designated Site Coordinator or Alternate Site Coordinator is changed, the identity of the successor will be given to the other Party at least five (5) days before the change occurs, unless impracticable, but in no event later than five (5) days after the change is made.

21. As used in these Orders, the term "Site Coordinator" refers interchangeably to the Site Coordinator and the Alternate Site Coordinator designated for a named Party. If any designated Site Coordinator is changed, the identity of the successor will be given to the other Party at least five (5) days before the changes occur, unless impracticable, but in no event later than the actual day the change is made.

22. To the maximum extent practicable, except as specifically provided in these Orders, communications between the Respondent and Ohio EPA concerning the implementation of these Orders shall be made between the Site Coordinators. To the maximum extent practicable, the Respondent's Site Coordinator shall be available for communication with Ohio EPA regarding the implementation of these Orders for the duration of these Orders. Each Site Coordinator shall be responsible for ensuring that all communications from the other Party are appropriately disseminated and processed. To the maximum extent practicable, the Respondent's Site Coordinator shall be present on the Site or on call during all hours of Work at the Sites.

23. Without limitation of any authority conferred on Ohio EPA by statute or regulation, the Ohio EPA Site Coordinator's authority includes, but is not limited to the following:

- a. Taking samples and directing the type, quantity and location of samples to be taken by Respondent pursuant to an approved Work Plan;
- b. Observing, taking photographs, or otherwise recording information related to the implementation of these Orders, including the use of any mechanical or photographic device;
- c. Directing that the Work stop whenever the Site Coordinator for Ohio EPA determines that the activities at the Sites may create or exacerbate a threat to public health or safety, or threaten to cause or contribute to air or water pollution or soil contamination;
- d. Conducting investigations and tests related to the implementation of these Orders;
- e. Inspecting and copying records, operating logs, contracts and/or other documents related to the implementation of these Orders; and
- f. Assessing Respondent's compliance with these Orders.

XI. PROGRESS REPORTS AND NOTICE

24. Unless otherwise directed by Ohio EPA, Respondent shall send a written progress report to the Ohio EPA by the fifteenth (15th) day of every month. Respondent shall continue to send the monthly progress report until such time as all vapor mitigation systems required to be installed at the Non-Facility Known Mitigation Properties, pursuant to the Design Mitigation Work Plan, are in the operation, maintenance and monitoring phase of the Work conducted under these Orders. At a minimum, the progress reports shall:

- a. Describe the status of the Work and actions taken toward achieving compliance with the Orders during the reporting period;
- b. Describe difficulties encountered during the reporting period and actions taken to rectify any difficulties;
- c. Describe activities planned for the next month;
- d. Identify changes in key personnel;
- e. List target and actual completion dates for each element of activity, including project completion; and
- f. Provide an explanation for any deviation from any applicable schedules.

25. When all vapor mitigation systems required at the Non-Facility Known Mitigation Properties, pursuant to the Design Mitigation Work Plan, have been installed and are in the operation, maintenance and monitoring phase of the Work conducted under these Orders, Respondent shall send a written progress report to the Ohio EPA annually on or before the thirty-first (31st) day of January of each year.

26. Progress reports (one copy only) shall be sent either by e-mail with confirmed receipt or by hard copy to the addresses listed below. All other documents (two copies) required to be submitted to Ohio EPA pursuant to these Orders shall be sent to the following addresses:

Ohio Environmental Protection Agency
50 West Town Street
P.O. Box 1049
Columbus, Ohio 43216-0149
ATTN: DERR Records Room

Director's Final Findings and Orders
General Electric Company, Greene County, Ohio

Email: records@epa.state.oh.us

Ohio EPA
Southwest District Office
Division of Environmental Response and Revitalization
401 East 5th Street
Dayton, OH 45402
ATTN: Chuck Mellon
Email: chuck.mellon@epa.ohio.gov

All correspondence to Respondent shall be directed to the following address:

GE Corporate Environmental Programs
ATTN: Paul Hare, Program Manager
319 Great Oaks Blvd.
Albany, NY 12203
Email: paul.hare@ge.com

XII. REVIEW OF SUBMITTALS

27. Ohio EPA shall review any work plan, report, or other item required to be submitted pursuant to these Orders. Upon review, Ohio EPA may in its sole discretion: (a) approve the submission in whole or in part; (b) approve the submission upon specified conditions; (c) require modification of the submission; (d) approve contingent upon modification of the submission; (e) disapprove the submission in whole or in part; or (f) any combination of the above.

28. In the event of approval, approval upon condition, modification, or approval contingent upon modification of any submission by the Ohio EPA, Respondent shall proceed to take any action required by the submission as approved, conditionally approved, or modified by Ohio EPA.

29. In the event that Ohio EPA initially disapproves a submission, in whole or in part, and notifies Respondent of the deficiencies, Respondent shall, within thirty (30) days or such longer period of time as specified by Ohio EPA in writing, correct the deficiencies and resubmit the revised submission to Ohio EPA for approval. The revised submission shall incorporate all of the uncontested changes, additions, and/or deletions specified by Ohio EPA in its notice of deficiency. To the extent that Respondent contests any changes, additions, and/or deletions specified by the Ohio EPA, Respondent shall initiate the procedures for dispute resolution set forth in Section XIII, Dispute Resolution, of these Orders, within thirty (30) days after receipt of Ohio EPA's notification of disapproval of a submission. Notwithstanding the notice of

deficiency, Respondent shall coordinate with Ohio EPA to proceed with those actions required by a non-deficient portion of the submission that are unrelated to and/or independent of the deficient portion of the submission.

30. In the event that Ohio EPA disapproves a revised submission, in whole or in part, and notifies the Respondent in writing of the deficiencies, Respondent shall within thirty (30) days, or such longer period of time as specified by Ohio EPA in writing, either (a) correct the deficiencies and incorporate all changes, additions, and/or deletions, and submit the revised submission to Ohio EPA for approval or (b) initiate the dispute resolution process pursuant to Section XIII, Dispute Resolution, of these Orders. If Respondent fails to submit a revised submission incorporating all changes, additions, and/or deletions within thirty (30) days, or such period of time as specified by Ohio EPA in writing, or alternatively, fails to initiate the dispute resolution process pursuant to Section XIII, Dispute Resolution, of these Orders, Respondent shall be considered in breach and/or violation of these Orders.

31. All work plans, reports, or other items required to be submitted to Ohio EPA under these Orders shall, upon approval by Ohio EPA, be deemed to be incorporated in and made an enforceable part of these Orders. In the event that Ohio EPA approves a portion of a work plan, report, or other item, the approved portion shall be deemed to be incorporated in and made an enforceable part of these Orders.

XIII. DISPUTE RESOLUTION

32. The Site Coordinators shall, whenever possible, operate by consensus. In the event that there is a dispute about the adequacy of any work plan, report, or other item required to be submitted pursuant to the Additional Work or Review of Submittals Sections of these Orders, the Respondent shall have fourteen (14) days from the date the dispute arises to invoke the dispute resolution procedures of this Section by notifying Ohio EPA in writing of the dispute. The Parties shall have fourteen (14) days for informal negotiations with respect to the dispute. This informal dispute resolution period may be extended by agreement of Ohio EPA for up to a maximum of thirty (30) additional days. At the end of the informal dispute resolution period, the Respondent shall have fourteen (14) days to institute the formal dispute resolution procedures of this Section by notifying Ohio EPA's Site Coordinator in writing.

33. The Respondent's written notification instituting the formal dispute resolution procedures shall include the technical rationale supporting the Respondent's position. If Respondent's written notice and technical rationale in support of its position are not received by Ohio EPA within fourteen (14) days from the end of the informal dispute resolution period, the formal dispute resolution procedures may not be invoked for the disputed issue(s) and the dispute shall be considered resolved. Ohio EPA shall

have thirty (30) days from the date the Respondent's formal written dispute position is received to reduce Ohio EPA's position to writing. Ohio EPA's writing shall include the technical rationale supporting Ohio EPA's position. Following the exchange of written positions, the Site Coordinators shall have an additional fourteen (14) days to resolve the formal dispute. If Ohio EPA concurs with the position of the Respondent, then the work plan, report, or other items required to be submitted pursuant to these Orders shall be modified accordingly.

34. If Ohio EPA does not concur with the Respondent's position, Ohio EPA's Site Coordinator shall notify the Respondent in writing. Upon receipt of such written notice, the Respondent shall have fourteen (14) days to forward a written statement of the dispute to the Division of Environmental Response and Revitalization ("DERR") Assistant Chief and request a review of the decision regarding the dispute. If Ohio EPA does not receive such written statement and request from the Respondent within fourteen (14) days of Respondent's receipt of Ohio EPA's written notification of non-concurrence, Ohio EPA will adopt the written position of its Site Coordinator and the work plan, report or other item required to be submitted pursuant to these Orders, or any other item subject to the dispute resolution procedures of this Section, shall be modified accordingly. If Ohio EPA receives such written statement and request from the Respondent within fourteen (14) days of Respondent's receipt of Ohio EPA's written notification of non-concurrence, the DERR Assistant Chief will resolve the dispute based upon and consistent with these Orders, the SOW, the work plans, and applicable federal and state laws and regulations. The decision of the DERR Assistant Chief is considered final for the purposes of these Orders.

35. The pendency of a dispute under this Section shall extend only the time period for completion of the tasks related to the matters in dispute, except that upon mutual agreement of the Parties, any time period may be extended as is deemed appropriate under the circumstances. Elements of the Work not affected by the dispute shall be completed in accordance with applicable schedules and time frames.

XIV. UNAVOIDABLE DELAYS

36. Respondent shall cause all Work to be performed in accordance with applicable schedules and timeframes unless any such performance is prevented or delayed by an event which constitutes an unavoidable delay. For purposes of these Orders, an "unavoidable delay" shall mean an event beyond the control of Respondent which prevents or delays performance of any obligation required by these Orders and which could not be overcome by due diligence on the part of the Respondent. Increased cost of compliance shall not be considered an event beyond the control of the Respondent.

37. Respondent shall notify Ohio EPA in writing within five (5) days after the occurrence of an event which Respondent contends is an unavoidable delay. Such written notification shall describe the anticipated length of the delay, the cause or causes of the delay, the measures taken and to be taken by Respondent to minimize the delay, and the timetable under which these measures will be implemented. Respondent shall have the burden of demonstrating that the event constitutes an unavoidable delay.

38. If Ohio EPA does not agree that the delay has been caused by an unavoidable delay, Ohio EPA will notify Respondent in writing. If Ohio EPA agrees that the delay is attributable to an unavoidable delay, Ohio EPA will notify Respondent in writing of the length of the extension for the performance of the obligations affected by the unavoidable delay.

XV. REIMBURSEMENT OF COSTS

39. Ohio EPA has incurred and continues to incur Response Costs in connection with the Sites. Respondent shall reimburse Ohio EPA for all Response Costs incurred both prior to and after the effective date of these Orders.

40. Within sixty (60) days of receipt of an itemized invoice of Response Costs incurred prior to the effective date of these Orders, Respondent shall remit a check to the Ohio EPA for the full amount claimed.

41. For Response Costs incurred after the effective date of these Orders, Ohio EPA will submit to Respondent an itemized invoice of its Response Costs for the previous year. Within sixty (60) days of receipt of such itemized statement, Respondent shall remit payment for all of Ohio EPA's Response Costs for the previous year. If Respondent does not remit payment of Response Costs within sixty (60) days after receipt of such invoice, Respondent shall remit payment for the unpaid balance and the interest accrued on the unpaid balance. Interest shall accrue beginning thirty sixty (60) from the date of the invoice until the date payment is remitted, and shall be calculated at the rate specified by ORC §5703.47(B) or any subsequent rate adjustments.

42. Respondent shall remit payments to Ohio EPA pursuant to this Section as follows:

- a. Payment shall be made by bank check payable to "Treasurer, State of Ohio" and shall be forwarded to Fiscal Officer, Office of Fiscal Administration, Ohio EPA, P.O. Box 1049, 50 West Town Street, Columbus, Ohio 43216-0149.
- b. A copy of the transmittal letter and check shall be sent to the Fiscal Officer,

DERR, Ohio EPA, P.O. Box 1049, 50 West Town Street, Columbus, Ohio 43216-0149, ATTN: Terri McCloskey, or her successor, and to the Site Coordinator, Ohio EPA, Southwest District Office, Division of Environmental Response and Revitalization, 401 East Fifth Street, Dayton, Ohio 45402.

- c. Each payment shall identify the name and address of the Party making payment, the Site name, and Ohio EPA's revenue number identified on the associated invoice.

XVI. ACCESS TO INFORMATION

43. Upon request, Respondent shall provide to Ohio EPA, within fourteen (14) days, copies of all documents and information within its possession or control or that of its contractors or agents relating to events or conditions at the Sites including, but not limited to manifests, reports, correspondence, or other documents or information related to the Work. This provision shall not be a limitation on any request for information to the Respondent by Ohio EPA made under state or federal law for information relating to events or conditions at the Sites.

44. Respondent may assert a claim that documents or other information submitted to the Ohio EPA pursuant to these Orders are confidential under the provisions of OAC 3745-49-03 or 3745-50-30(A) or ORC Section 6111.05(A). If no such claim of confidentiality accompanies the documents or other information when submitted to the Ohio EPA, the documents or information may be made available to the public without notice to the Respondent.

45. Respondent may assert that certain documents or other information are privileged under the attorney-client or any other privilege recognized by state law. If Respondent makes such an assertion, Respondent shall provide the Ohio EPA with the following: (1) the title of the document or information; (2) the date of the document or information; (3) the name and title of the author of the document or information; (4) the name and title of each addressee and recipient; (5) a general description of the contents of the document or information; and (6) the privilege being asserted by Respondent.

46. No claim of confidentiality shall be made with respect to any data, including, but not limited to, all sampling, analytical and monitoring data, and laboratory or interpretive reports.

47. Respondent shall preserve for the duration of these Orders and for a period of five (5) years after the Orders' termination, all documents and other information within its possession or control, or within the possession or control of its contractors or agents, which in any way relate to the Work, notwithstanding any

document retention policy to the contrary. Respondent may preserve such documents by microfiche, or other electronic or photographic device. At the conclusion of this document retention period, Respondent shall notify Ohio EPA at least sixty (60) days prior to the destruction of these documents or other information and, upon request, shall deliver such documents and other information to Ohio EPA.

XVII. MODIFICATIONS

48. These Orders may be modified by agreement of the Parties. Modifications shall be in writing, signed by the authorized representative of the Respondent and by the Director, and shall be effective on the date entered in the Journal of the Director of Ohio EPA.

XVIII. INDEMNITY

49. Respondent agrees to indemnify, save, and hold harmless Ohio EPA from any and all claims or causes of action arising from, or related to, the implementation of these Orders or to events or conditions at the Sites, including any acts or omissions of Respondent, its officers, employees, receivers, trustees, agents, or assigns, and its successors in interest. Said indemnification shall not apply to acts or omissions of the State of Ohio, its employees, agents or assigns at, on, upon, or related to the Sites if said acts are negligent, performed outside the scope of employment or official responsibilities, or performed with malicious purpose, in bad faith, or in a wanton or reckless manner. Ohio EPA shall not be considered a party to and shall not be held liable under any contract entered into by Respondent in carrying out the activities pursuant to these Orders. Ohio EPA agrees to provide notice to Respondent within thirty (30) days after receipt of any claim that may be the subject of indemnity as provided in this Section, and to cooperate with Respondent in the defense of any such claim or action against Ohio EPA.

XIX. OTHER CLAIMS

50. Nothing in these Orders shall constitute or be construed as a release from any claim, cause of action, or demand in law or equity against any person, firm, partnership, or corporation, not subject to these Orders, for any liability arising from, or related to, events or conditions at the Sites.

XX. RESERVATION OF RIGHTS

51. Ohio EPA reserves the right to seek legal and/or equitable relief to enforce the terms and conditions of these Orders, including penalties against Respondent for noncompliance with these Orders. Except as provided herein, Respondent reserves any rights it may have to raise any legal or equitable defense in any action brought by or on behalf of Ohio EPA to enforce the terms and conditions of these Orders.

52. Ohio EPA reserves the right to terminate these Orders and/or perform all or any portion of the Work or any other measures in the event that the requirements of these Orders are not wholly complied with within the time frames required by these Orders. Except as provided herein, Respondent reserves any rights it may have to raise any legal or equitable defense in any action brought by or on behalf of Ohio EPA.

53. Ohio EPA reserves the right to take any action under applicable law against Respondent if conditions at the Sites, previously unknown to the State, are discovered after the effective date of these Orders, or information is received, after the effective date of these Orders and these previously unknown conditions or this previously unknown information shows that the Vapor Intrusion Mitigation Interim Action is not protective of public health or safety or the environment.

54. Subject to Section XXI, Agreement Not To Refer, of these Orders, Ohio EPA reserves the right to take any action under applicable law, including but not limited to any enforcement action, or action to recover costs, or action to recover damages to natural resources, pursuant to ORC Chapters 3734, 3745, or 6111, or any available legal authority as a result of past, present, or future violations of state or federal laws or regulations or the common law, and/or as a result of events or conditions arising from, or related to, the Sites.

55. Respondent reserves all rights, claims, demands and causes of action it may have against any and all persons and entities who are not Parties to these Orders, including rights of contribution against any other parties who may be liable for actual or threatened releases of contaminants at the Sites.

XXI. AGREEMENT NOT TO REFER

56. During the implementation of these Orders, and provided Respondent is in compliance with these Orders, Ohio EPA agrees not to refer to the Ohio Attorney General's Office for enforcement, or to take administrative enforcement action against Respondent or its present or future agents, successors, subsidiaries or assigns for Work required under these Orders. Upon termination of these Orders pursuant to Section XXII, Termination, of these Orders, Ohio EPA agrees to not refer Respondent to the Ohio Attorney General's Office for enforcement, or to take administrative enforcement action against Respondent or its present or future agents, successors,

subsidiaries or assigns for Work required under these Orders.

XXII. TERMINATION

57. Respondent's obligations under these Orders shall terminate upon Ohio EPA's written approval of Respondent's written certification to Ohio EPA that all Work required to be performed under these Orders, including the payment of Response Costs has been completed. The Respondent's certification shall contain the following attestation: "I certify that the information contained in or accompanying this certification is true, accurate, and complete." This certification shall be submitted by Respondent to Ohio EPA and shall be signed by a responsible official of the Respondent. The termination of Respondent's obligations under these Orders shall not terminate the Respondent's obligations under the Reservation of Rights, Access to Information, Indemnity, Other Claims, and Agreement Not to Refer Sections of these Orders.

XXIII. WAIVER AND AGREEMENT

58. In order to resolve disputed claims, without admission of fact, violation, or liability, Respondent agrees that these Findings and Orders are lawful and reasonable, and agrees to perform all actions required of Respondent by these Orders and this Cost Recovery Settlement Agreement.

59. The Respondent hereby waives the right to appeal or otherwise seek administrative or judicial review of the issuance, terms and conditions, and service of these Orders either in law or equity.

60. Notwithstanding the limitations herein on the Respondent's right to appeal or seek administrative or judicial review, the Ohio EPA and the Respondent agree that if these Orders are appealed by any other party to the Environmental Review Appeals Commission or any court, the Respondent retains the right to intervene and participate in such appeal. In such event, Respondent shall continue to comply with these Orders notwithstanding such appeal and intervention unless these Orders are stayed, vacated or modified.

XXIV. EFFECTIVE DATE

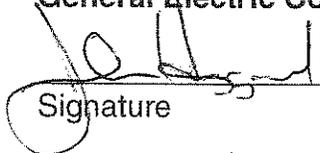
61. The effective date of these Orders shall be the date these Orders are entered in the Journal of the Director of Ohio EPA.

XXV. SIGNATORY AUTHORITY

62. Each undersigned representative of a Party to these Orders certifies that he or she is fully authorized to enter into these Orders and to legally bind such Party to these Orders.

IT IS SO AGREED:

General Electric Company (Respondent)


Signature

7/17/2014
Date

John Haggard
Printed Name

Leader, Remediation
Title

OHIO ENVIRONMENTAL PROTECTION AGENCY


Craig W. Butler, Director

SEP 02 2014
Date

APPENDIX A

IA SOW

APPENDIX B

List of Relevant Guidance Documents

APPENDIX C

Design Mitigation Work Plan

APPENDIX D

Pre-Design Assessment Work Plan

APPENDIX A

STATEMENT OF WORK (SOW) FOR MITIGATING THE SOIL VAPOR TO INDOOR AIR EXPOSURE PATHWAY IN OCCUPIED STRUCTURES

PURPOSE:

The purpose of conducting the work described herein is to perform pre-design sampling and analyses for residential structures at the Non-Facility Potential Mitigation Properties where a complete or potentially complete vapor pathway is identified in the approved Soil Vapor Intrusion Assessment Report, and to design, install and operate soil vapor mitigation systems at the Non-Facility Known Mitigation Properties where the vapor pathway is demonstrated to be complete and sub-slab and indoor air results are above screening levels as defined by the Ohio Environmental Protection Agency (Ohio EPA). Successful completion of the required work shall result in the mitigation of unacceptable risks from the vapor intrusion pathway until such time that it can be demonstrated that the pathway is no longer a threat to human health. Vapor intrusion mitigation is an interim measure to address current exposures.

Field analytical data meeting appropriate Data Quality Objectives will be required to verify field screening and modeling results.

TASKS:

1. Conduct pre-design assessment and design studies and obtain all other necessary data
2. Design, implement, operate and maintain mitigation system(s).

DELIVERABLES:

1. Pre-Design Assessment Report
2. Detailed Plans and Specifications for Non-Facility Known Mitigation Properties
3. Mitigation Final Report
4. Monthly Progress Reports
5. Annual Operation, Maintenance and Monitoring Reports

1.0 WORK PLAN IMPLEMENTATION

1.1 Pre-Design Assessment Work Plan

Respondent shall implement the approved Pre-Design Assessment Work Plan, which addresses the requirements of a Sampling and Analysis Plan (SAP), which consists of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). Additionally, Respondent shall develop a Health and Safety Plan (HSP) prior to initiation of field activities. Respondent shall collect data sufficient to evaluate the need for, and, if required, design vapor mitigation systems. At the completion of these efforts, Respondent shall submit a Pre-Design Assessment Report to Ohio EPA. The Pre-Design Assessment Work Plan has been approved by Ohio EPA.

Respondent has included in the Pre-Design Assessment Work Plan a summary and general findings of the Soil Vapor Intrusion Assessment Report submitted by Brown and Caldwell and dated May 31, 2012. Based on this information, Respondent has developed and included in the Pre-Design Assessment Work Plan a Conceptual Site Model (CSM). Respondent has used the CSM to assist in the identification of structures where pre-design assessment is necessary to further evaluate the potential vapor pathway. These structures are referred to as the Non-Facility Potential Mitigation Properties. The initial step in the pre-design assessment is to conduct further indoor air and sub-slab sampling as well as conduct a visual survey of occupied structures on the Non-Facility Potential Mitigation Properties. In many cases, the information obtained from this survey will serve as the primary basis for the design of the vapor mitigation system pursuant to the Design Mitigation Work Plan, should mitigation be required.

The Pre-Design Assessment Work Plan describes in detail the tasks necessary to perform the work required by this SOW, provides a supporting rationale for performing each task in the manner described, identifies the materials and procedures required for each task, and describes the work products to be submitted to the Ohio EPA, including required deliverables and meetings with Ohio EPA, and shall comply with federal, state and local laws and regulations which apply to the work to be performed. The Pre-Design Assessment Work Plan includes a schedule for accomplishing the required work which extends through and includes submittal of the Pre-Design Assessment Report.

1.2 Design Mitigation Work Plan

Upon confirmation that a residential structure becomes a Non-Facility Known Mitigation Property (in accordance with the procedures set forth in the Pre-Design Assessment Work Plan), Respondent shall implement the approved Design Mitigation Work Plan. The Design Mitigation Work Plan has been approved by Ohio EPA.

Mitigation efforts include securing an access agreement with the building owner and tenant, conducting an initial site visit to gather any additional information critical to

design, performing initial communications testing beneath the slab, designing, installing and commissioning the mitigation system, conducting long-term operation, maintenance and monitoring activities, and preparing and submitting a Mitigation Final Report.

The Design Mitigation Work Plan describes in detail the tasks necessary to perform the work required by this SOW, provides a supporting rationale for performing each task in the manner described, identifies the materials and procedures required for each task, and describes the work products to be submitted to the Ohio EPA, including required deliverables and meetings with Ohio EPA, and shall comply with federal, state and local laws and regulations which apply to the work to be performed. The Design Mitigation Work Plan includes a schedule for accomplishing the required work which extends through and includes submittal of the Mitigation Final Report.

Since Ohio EPA has approved the Design Mitigation Work Plan, Respondent shall implement the work in accordance with the schedules described within the Work Plan and the Vapor Intrusion Mitigation Interim Action Orders (Orders).

1.3 Sampling and Analysis Plan (SAP)

Respondent has prepared a SAP consisting of the following:

A. *Field Sampling Plan (FSP)*

The FSP specifies and details activities necessary to obtain data for the Non-Facility Site Properties and provides detailed standard operating procedures (SOPs) for those activities. The FSP describes sampling objectives; equipment and procedures; sample types, locations, and frequencies; and parameters of interest; and is tied to the schedules contained in the Pre-Design Assessment and Design Mitigation Work Plans.

B. *Quality Assurance Project Plan (QAPP)*

The QAPP addresses investigations to be conducted at the Non-Facility Site Properties, including but not limited to the following:

1. A project description;
2. Analytical methods and laboratory procedures;
3. Data Quality Objectives (DQOs) tied to the intended use(s) for all pre-existing and all data proposed for collection;

4. Quality assurance objectives for data such as the required precision, accuracy, completeness, representativeness, and comparability of data;
5. Chain of custody procedures during sample collection and in the laboratory;
6. The type and frequency of calibration procedures during sample collection and in the laboratory;
7. Preventative maintenance procedures and schedule and corrective action procedures for field and laboratory instruments;
8. Specific procedures to assess data precision, representativeness, comparability, accuracy, and completeness of specific measurement parameters; and
9. Data documentation and tracking procedures.

The modeling section of the QAPP applies to all models used to conduct the Pre-Design Assessment and Design Mitigation Work Plans and is consistent with the U.S. EPA document "*Guidance for Quality Assurance Project Plans for Modeling*" referenced in Appendix C.

C. *Health and Safety Plan (HSP)*

Prior to initiating the work required under both the Pre-Design Assessment and Design Mitigation Work Plans, Respondent will prepare a HSP which complies with the requirements of applicable federal, state, and local laws. The HSPs will identify problems or hazards that may be encountered at the Non-Facility Site Properties and describe in detail each related pre-design assessment and mitigation procedure. The HSPs include procedures for protecting third parties such as visitors and the surrounding community. The HSPs will be consistent with:

1. NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (1985);
2. Section 111(C)(6) of CERCLA;
3. U.S. EPA Order 1440.3 -- Respiratory Protection;
4. EPA Order 1440.2 -- Health and Safety Requirements for

- Employees Engaged in Field Activities;
5. U.S. EPA Occupational Health and Safety Manual;
 6. U.S. EPA Standard Operating Safety Guides (Publication 9285.1-03, PB92-963414, June 1992);
 7. OSHA regulations, particularly in 29 CFR 1910 and 1926;
 8. State and local regulations; and
 9. Non-Facility Site Properties' conditions.

2.0 PRE-DESIGN ASSESSMENT REPORT

Respondent shall summarize the data collected according to the approved Pre-Design Assessment Work Plan in the Pre-Design Assessment Report. The Pre-Design Assessment Report shall provide recommendations for mitigation, continued monitoring, and no further action at the Non-Facility Potential Mitigation Properties. Such properties recommended for mitigation shall become Non-Facility Known Mitigation Properties and subject to the Design Mitigation Work Plan.

3.0 MITIGATION SYSTEM DESIGN AND IMPLEMENTATION

Following implementation of the Pre-Design Assessment Work Plan and the identification of Non-Facility Known Mitigation Properties, Respondent shall submit plans and any required permit applications for the vapor mitigation systems (VMS) required at the Non-Facility Known Mitigation Properties in accordance with the schedule in the approved Orders and the Pre-Design Assessment Work Plan. Respondent's plans for each structure identified as a Non-Facility Known Mitigation Property shall include a description of the mitigation technologies selected. In most cases, the most reliable and cost-effective mitigation system will include some type of active depressurization technology (ADT).

3.1 Detailed Plans and Specifications

The Detailed Plans and Specifications (DPS) for each Non-Facility Known Mitigation Property shall be submitted in accordance with the schedule contained in the Orders and the Pre-Design Assessment Work Plan. The structure-specific DPS shall include but not be limited to final construction drawings, specifications, plans, and design analyses with supporting calculations. Applications for any required permits shall be

submitted simultaneously with the structure-specific DPS. Following Ohio EPA and property owner approval of the structure-specific DPS and receipt of any necessary construction permits, Respondent shall initiate construction of the approved VMS in accordance with the schedules contained in the Orders and the Design Mitigation Work Plan. The structure-specific DPS for each Non-Facility Known Mitigation Property shall become appendices to the Design Mitigation Work Plan.

3.2 Operation and Maintenance (O&M) Plan

An O&M plan shall be submitted to Ohio EPA prior to the completion of construction. Appropriate elements are listed in Exhibit 1. Plan elements listed in Exhibit 1 are for illustrative purposes and should not limit the content of the O&M plan.

3.3 Design Changes During Construction

During construction, unforeseen site conditions, and other problems associated with the project may require either major or minor changes to the approved design. Design changes require prior approval of Ohio EPA and may require modification of permit(s) to install to ensure that the intent and scope of the approved structure-specific DPS is maintained. Changes to the VMS design which require Ohio EPA approval prior to implementation include:

- A. Those which involve the deletion or addition of a major component of the approved VMS;
- B. Those which result in a less effective treatment for wastes associated with the Non-Facility Site Properties;
- C. Any changes which may result in an increased exposure to contaminants and/or risk to human health or the environment at the Non-Facility Site Properties;
- D. Those which result in a significant delay in the completion of the VMS; and
- E. Any other changes which alter the scope or objectives of the approved VMS.

3.4 Construction Completion

As the construction of the VMS nears completion, the following activities shall be completed by Respondent to ensure proper construction completion and transition to the O&M phase.

A. *Mitigation Final Report*

A Mitigation Final Report shall be prepared and submitted by Respondent within 60 days of completing construction of all Non-Facility Known Mitigation Properties. The Mitigation Final Report shall include the following:

1. A synopsis of the construction work defined in the Detailed Plans and Specifications and certification that this work was performed;
2. An explanation of any modifications to the work defined in the Detailed Plans and Specifications and why they were necessary for the project;
3. Certification that the constructed VMS is operational and functional and constructed according to the approved plans and specifications.

EXHIBIT 1

Basic Elements of an Operation and Maintenance (O&M) Plan

- A. Normal O&M
 - 1. Description of tasks for operation
 - 2. Description of tasks for maintenance
 - 3. Description of prescribed treatment or operating conditions
 - 4. Schedules showing the frequency of each O&M task

- B. Potential Operating Problems
 - 1. Description and analysis of potential operating problems
 - 2. Sources of information regarding potential operating problems
 - 3. Description of means of detecting problems in the operating systems
 - 4. Common remedies for operating problems

- C. Routine Monitoring and Laboratory Testing
 - 1. Description of monitoring tasks
 - 2. Description of required laboratory tests and interpretation of test results
 - 3. Required QA/QC procedures
 - 4. Monitoring schedule

- D. Alternative O&M
 - 1. Description of alternate procedures to prevent undue hazard, should systems fail
 - 2. Vulnerability analysis and additional resources requirements should a failure occur

- E. Safety Plan
 - 1. Description of safety procedures, necessary equipment, etc. for site personnel
 - 2. Description of safety tasks required in the event of systems failure

- F. Equipment
 - 1. Description of equipment necessary to the O&M plan
 - 2. Description of installation of monitoring components
 - 3. Description of maintenance of site equipment
 - 4. Replacement schedule for equipment and installed components

G. Records and Reporting Mechanisms Required

1. Daily operating logs
2. Laboratory records
3. Mechanism for reporting emergencies
4. Personnel and maintenance records
5. Monthly reports to Ohio EPA

APPENDIX B

GENERAL GUIDANCE DOCUMENT AND REFERENCE LIST FOR USE WITH OHIO EPA DERR REMEDIAL RESPONSE PROGRAM STATEMENTS OF WORK AND ORDERS

Statement of Purpose and Use of this General Guidance Document and Reference List:

Statement of Purpose and Use of This Guidance Document List:

The purpose of this list of Ohio EPA and U.S. EPA policies, directives and guidance documents is to provide a reference of the documents that provide direction and guidance for conducting work at Remedial Response sites. *The listed documents incorporate by reference any documents listed therein.* Certain sites may have contaminants or conditions that are not fully addressed by the documents in this list. There is an evolving body of policy directives, guidance and research documentation that should be used, as needed, to address circumstances not encompassed by the documents in this list. For sites where activities are conducted in response to an administrative or judicial order, this list will be an attachment to the order and will govern the work conducted. When entering into or issuing an order for any site, Ohio EPA reserves the right to modify this list to fully address the site conditions.

Analytical Methods

Compendium of Methods for Determination of Toxic Organic Compounds in Ambient Air second edition, Compendium Method TO-14A, EPA/625/R-96/010b, U.S. EPA, January 1999. See also: *Air Toxics – Monitoring Methods*.

SW 846. Test Methods for Evaluating Solid Waste, 3rd Edition and updates (online), originally dated November 1986.

Standard Methods for the Examination of Water and Waste Water, American Public Health Association, 18th Edition 1992, and recent editions (online).

U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, U.S. EPA, EPA-540-R-04-004, OSWER 9240.1-45, October 2004.

U.S. EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, U.S. EPA, EPA-540-R-08-01, June 2008.

ARARs

Applicable or Relevant and Appropriate Requirements (ARARS), U.S. EPA (online).

ARARs Table, Ohio EPA DERR, Remedial Response Program. [This is a list of generic ARARs that is periodically updated and subject to change.]

CERCLA Compliance with Other Laws Manual - Part 1 and Part 2, OSWER Directive 9234.1-01, EPA/540/G-89/006, August 1988, and OSWER Directive 9234.1.02, EPA/540/G-89/009, August 1989.

Ohio EPA Rules (online).

Use of Applicable or Relevant and Appropriate Requirements (ARARs) in the Ohio EPA Remedial Response Program, Ohio EPA DERR, September 2003.

Attainment of Cleanup Goals

Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media, U.S. EPA, EPA 230/02-89-042, February 1989.

Methods for Evaluating the Attainment of Cleanup Standards, Volume 2: Ground Water, U.S. EPA, EPA 230-R-92-014, July 1992.

Methods for Evaluating the Attainment of Cleanup Standards, Volume 3: Reference-Based Standards for Soils and Solid Media, U.S. EPA, EPA 230-R-94-004, December 1992.

Background Guidance

Use of Background for Remedial Response Sites, Technical Decision Compendium, Ohio EPA DERR, August 2009.

Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, U.S. EPA, EPA 540-R-01-003 OSWER 9285.7-41, September 2002.

Role of Background in the CERCLA Cleanup Program, OSWER 9285.6-07P, April 2002.

Data Quality Objectives

Data Quality Evaluation Statistical Toolbox (Data QUEST) Users Guide, U.S. EPA ORD, EPA/600/R-96/085 (EPA QA/G-9D), December 1997. No longer available. For a link to other free software for performing data quality assessment, see [Quality-Related Resources – Software](#).

[*Data Quality Objectives Decision Error Feasibility Trials Software \(DEFT\) – Users Guide*](#), U.S. EPA, EPA QA/G-4D, EPA/240/B-01/007, September 2001.

[*Data Quality Objectives Process for Hazardous Waste Site Investigations*](#), U.S. EPA, EPA/600/R-00/007 (EPA QA/G-4HW), January 2000.

[*Data Quality Objectives Process for Superfund, Interim Final Guidance*](#), OSWER Directive 9355.9-01, EPA540-R-93-071, September 1993.

[*Data Quality Objectives Process Summary*](#), DERR-00-DI-32 Ohio EPA DERR Remedial Response Program, January 2002.

[*Guidance for Data Quality Assessment: Practical Methods for Data Analysis*](#), U.S. EPA, EPA/600/R-96/084 (EPA QA/G-9), QAOO Update, July 2000.

[*Guidance on Systematic Planning Using the Data Quality Objectives Process*](#), U.S. EPA, EPA QA/G-4, EPA/240/B-06/001, February 2006.

Data Usability in Risk Assessment

[*Guidance for Data Usability in Risk Assessment \(Part A\)*](#), U.S. EPA, OSWER 9285.7-09A, April 1992

[*Guidance for Data Usability in Risk Assessment \(Part B\)*](#), U.S. EPA, OSWER 9285.7-09B, May 1992

Ecological Risk Assessment

[*Ecological Risk Assessment Guidance Document*](#), Ohio EPA DERR Remedial Response Program, April 2008.

[*Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*](#), U.S. EPA, EPA/540/R-97/006, September 1997.

Ecological Soil Screening Levels, U.S. EPA, online.

Guidance for Developing Ecological Screening Levels, U.S. EPA, OSWER 9285.7-55, November 2003 (revised February 2005).

Guidelines for Ecological Risk Assessment, U.S. EPA, EPA/630/R-95/002F, April 1998.

Feasibility Studies (Developing Cost Estimates)

A Guide to Developing and Documenting Cost Estimates During the Feasibility Study, U.S. EPA and U.S. Army Corps of Engineers, EPA 540-R-00-002, July, 2000. Appendix A (Internet Resources), Appendix B (Cost Adjustment Factors), Appendix C (Example Cost Templates), Appendix D (Glossary)

Ground Water Investigation

Ground Water Sampling and Monitoring Using Direct Push Technologies, U.S. EPA, OSWER 9200.1-51, EPA 540/R-04/005, August, 2005.

Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring Programs, Ohio EPA/DDAGW, Final, February 1995 (as updated).

VLEACH: A One-Dimensional Finite Difference Vadose Zone Leaching Model, Version 2.2a, U.S. EPA, Hazardous Sites Control Division, Contract No. 68-01-251, May 2007.

Health and Safety Plan

American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices, ISBN: 1-882417-46-1, 2002.

NIOSH Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, DHHS (NIOSH) Publication No. 85-115, October 1985.

NIOSH Pocket Guide to Chemical Hazards, National Institute for Occupational Safety and Health (online, last updated November 2010).

OSHA Regulations particularly in 29 CFR 1910 and 1926

OSHA Regulation 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response; U.S. Department of Labor (OSHA).

OSHA Regulation 29 CFR 1910.134, Respiratory Protection Standard;

U.S. EPA Standard Operating Safety Guides (Publication 9285.1-03, PB92-963414, June 1992 (chapters 1-3, 4-7, 8-11))

Section 111(c)(6) of CERCLA

Human Health Risk Assessment

Application of Bioavailability in the Assessment of Human Health Hazards and Cancer Risk, Ohio EPA DERR, Remedial Response Program, August 2009.

Assessing Compounds without Formal Toxicity Values Available for Use in Human Health Risk Assessment, Ohio EPA DERR, Remedial Response Program, April 2010.

Exposure Factors Handbook (Final), U.S. EPA, EPA/600/P-95/002Fa-c, August 1997.

Human Health Cumulative Carcinogenic Risk and Non-carcinogenic Hazard Goals for DERR Remedial Response Program, Ohio EPA DERR, August 2009.

Risk Assessment Guidance for Superfund (RAGS) Volume 1: Human Health Evaluation Manual (Part A), U.S. EPA, EPA/540/1-89/002, December 1989.

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March 28, 2012 updates

APPENDIX C
DESIGN MITIGATION WORK PLAN

WORK PLAN

**Design Mitigation Work Plan
Former Elano Corporation Sites**

**General Electric Company
Alpha, Ohio**

April 2014
Revised May 2014



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Design Mitigation Work Plan Former Elano Corporation Sites

General Electric Company
Alpha, Ohio



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LIST OF ABBREVIATIONS

BC	Brown and Caldwell
BWD	Block Wall Depressurization
COC	Constituent of Concern
CTP	Communication Test Point
CTSH	Communication Test Suction Hole
CVOCs	Chlorinated Volatile Organic Compounds
GE	General Electric Company
GIS	Geographic Information System
HASP	Health and Safety Plan
HRV	Heat Recovery Ventilation
HVAC	Heating, Ventilation and Air Conditioning
ICV	Inaccessible Crawlspace Ventilation
IV	Increased Ventilation
Ohio EPA	Ohio Environmental Protection Agency
PCE	Tetrachloroethene
PID	Photo-ionization Detector
PPE	Personal Protective Equipment
SVI	Soil Vapor Intrusion
SV	Soil Vapor
SMD	Sub-Membrane Depressurization
SSD	Sub-Slab Depressurization
SSPR	Sub-Slab Pressurization
SSP	Sub-Slab Suction Point
SSV	Sub-Slab Ventilation
TCE	Trichloroethene
Unison	Unison Industries, LLC
"wc	Inches of Water Column

1. INTRODUCTION

O'Brien & Gere prepared this Soil Vapor Intrusion (SVI) Design Mitigation Work Plan (Work Plan) on behalf of Unison Industries, LLC (Unison), a wholly-owned subsidiary of the General Electric Company (GE) for the former Elano Corporation Sites located in Alpha, Ohio in response to the Ohio Environmental Protection Agency's (Ohio EPA's) SVI Interim Action Mitigation Order. Specifically, this Work Plan addresses residential structures for which SVI mitigation is required pursuant to the criteria described in the Pre-Design Assessment Work Plan and as subsequently identified in the Pre-Design Assessment Final Report to be submitted to Ohio EPA.

This Work Plan includes the following components:

- Project objectives and deliverables;
- Proposed scope of work and schedule;
- Mitigation system design and technical rationale including pre-mitigation evaluation and system installation methods;
- Proposed post-installation indoor air sampling including a proposed sampling schedule and sample collection methods;
- Field data collection and analytical methods;
- Field and laboratory quality assurance objectives and methods; and
- Regulatory reporting requirements.

1.1 SITE LOCATION

The former Elano Corporation Sites and surrounding properties of interest are located in Alpha, Ohio, approximately three miles west of Xenia and twelve miles southeast of Dayton, Ohio. The study area extends south from Dayton-Xenia Road to the Little Miami River and Factory Road to the west. A north-south property line approximately 2000 feet east of South Orchard Lane represents the eastern boundary of the study area. The Plant 1 property, approximately 13.1 acres, includes a groundwater extraction and treatment system with an associated air stripping tower (installed as part of an interim response action). The Plant 2 property, approximately 5.16 acres and located a short distance south and east of Plant 1 on South Orchard Lane, includes a groundwater extraction and treatment system with

an associated low-profile air stripper (also installed as part of an interim response action).

1.2 SITE CONDITIONS

Areas overlying the identified plume of groundwater affected by chlorinated volatile organic compounds (CVOCs) include Plant 1 and properties immediately east and west, Plant 2, properties located in the generally north-south corridor between Plants 1 and 2, and properties immediately east, west and south of Plant 2. The groundwater plume is divided into three separate areas of impact: Areas A, B and C.

- » Area A - On and adjacent to Plant 1
- » Area B - The middle plume crossing the bike trail and U.S. 35
- » Area C - On and surrounding Plant 2, continuing to the Little Miami River to the south.

Geographically, the area of interest is located near where the drainages of Beaver Creek, Little Beaver Creek and the Little Miami River converge. Little Beaver Creek flows to the southeast and discharges into Beaver Creek in the north-central portion of the project area. Beaver Creek, trending northeast/southwest through the northern portion of the project area, joins Little Beaver Creek and turns south approximately 5,000 feet to its confluence with the Little Miami River flowing to the southwest. The properties located adjacent to and between Plants 1 and 2 consist of a combination of residential and commercial land use, roadways and creeks. The Village of Alpha, Ohio is located in the central portion of the project area (*i.e.*, Area B).

Prior soil vapor investigations^{1,2} performed by the consulting firm, Brown & Caldwell (BC), under contract to Ohio EPA, identified two primary constituents of concern (COCs) for potential SVI at the site, trichloroethene (TCE) and tetrachloroethene (PCE). However, as requested by Ohio EPA, the Pre-Design Assessment Work Plan also includes the analysis of sub-slab soil gas and indoor air samples for nine additional CVOCs, namely:

- » Carbon tetrachloride;
- » Chloroethane;
- » 1,1-Dichloroethane;
- » 1,2-Dichloroethane;
- » 1,1-Dichloroethene;
- » *cis*-1,2-Dichloroethene;
- » *trans*-1,2-Dichloroethene;
- » 1,1,1-Trichloroethane; and
- » Vinyl Chloride.

1.3 OBJECTIVE

During preparation of the Pre-Design Assessment Work Plan, O'Brien & Gere identified residential parcels with structures, respective owners and contact information through review of the Greene County, Ohio Auditor's property tax data base and on-line geographic information system (GIS) mapping service (see **Figures 1, 2, 3** and **Table 1**). The structures identified in Table 1 are slated for pre-design assessment (indoor air and sub-slab soil vapor sampling and analysis) to identify whether mitigation of the vapor intrusion pathway is required pursuant to the decision-making criteria outlined in the Pre-Design Assessment Work Plan.

The objective of this Design Mitigation Work Plan is to outline the design, installation and post-installation principles that will be followed when a structure has been identified for mitigation under the Pre-Design Assessment Final Report submitted to Ohio EPA. The property-specific design plans and specifications for each structure will be included as separate sub-appendices to Appendix C of this Work Plan. The annual operation, maintenance and monitoring (OM&M) activities for each mitigation system are discussed in Section 5 of this Work Plan.

1.4 ORGANIZATION

This Work Plan is organized as follows:

Section 1 – Introduction

Section 2 – Property Access

Section 3 – Design Visit(s) and Testing

Section 4 – Design and Installation of Mitigation System(s)

Section 5 – Operation, Maintenance & Monitoring of Mitigation System(s)

Section 6 –Reporting

2. PROPERTY ACCESS

When conducting the initial design visit(s) (described below in detail) at the structure(s) identified for mitigation in the SVI Interim Action Mitigation Order or under the Pre-Design Assessment Final Report, O'Brien & Gere intends to rely upon the existing property access agreements with the property owners for implementation of the Pre-Design Assessment Work Plan. Once the property-specific designs plans and specifications are prepared for a structure, a new or amended access agreement will be negotiated with the property owner to allow for installation of the mitigation system as well as continued access for any operation, maintenance and monitoring.

Access agreements will be distributed in person by O'Brien & Gere and/or GE, with responses requested within two weeks from the date of receipt. O'Brien & Gere and/or GE will follow up with non-responsive property owners via telephone calls and/or visits until access is granted or denied. O'Brien & Gere will maintain records indicating the status of property access for each property of interest, including the number of attempts to contact property owners who are non-responsive. As a final measure for non-responsive property owners, O'Brien & Gere and/or GE will send a letter with the access agreement via certified mail, return receipt requested.

3. DESIGN VISIT(S) AND TESTING

The most commonly accepted SVI mitigation method is sub-slab depressurization (SSD). SSD is preferred due to its effectiveness and, in many cases (especially with newer structures), its simple design and operation. SSD systems generally consist of an exhaust fan connected to vertical sub-slab suction points (SSPs) that penetrate the building's slab. SSD systems extract air (and soil gas) through the fan and exhaust the air to the outdoor atmosphere to prevent migration to and accumulation within the interior of the structure.

Each SSD system is designed specifically for the building in which it will be installed. For this reason, O'Brien & Gere's technical approach for SVI mitigation consists of a step-wise process designed to select the appropriate mitigation system/method for each structure.

3.1 DESIGN VISIT(S)

An initial design visit will be conducted to evaluate and document construction details and the physical condition of each structure that requires mitigation. The following will be completed during the design visit (unless already completed during implementation of the Pre-Design Assessment Work Plan):

- » Develop a scaled sketch of the lowest level of the building, including measurements of interior walls.
- » Photograph and document the existing structure conditions.
- » Identify crawlspaces, either accessible or inaccessible, in the lowest level of the building where there is an occupied space above.
- » Identify pre-existing back-draft conditions by testing combustion devices located within the lowest level of the building.
- » Identify features that may facilitate soil gas entry indoors (*e.g.*, utility penetrations, sump pumps, drains, etc.).
- » Identify cracks and openings in the slab to be sealed during installation.
- » Conduct diagnostic testing (sub-slab communication testing, as discussed in the following subsection) to confirm the potential

effectiveness of SSD technology and to develop a preliminary design of the mitigation system.

- » Review proposed system details, such as fan, pipe and stack locations, with the property owner.

Information collected during the initial design visit will be documented on the Initial Design Visit Checklist Form provided in Appendix A.

3.2 SUB-SLAB COMMUNICATION TESTING

Sub-slab communication testing is performed for each structure requiring mitigation in order to demonstrate that conditions in the sub-slab are suitable for depressurization. Sub-slab communication testing generally consists of drilling 1-inch diameter communication test suction holes (CTSHs) in central locations of the slab and 3/8-inch diameter communication test points (CTPs) near the lateral corners of the slab. A vacuum is applied to the CTSHs and vacuum readings are recorded at each of the CTPs. Sub-slab communication test results will be recorded on the Initial Design Visit Checklist Form provided in Appendix A.

Results of the sub-slab communication testing are used to establish the area of influence generated by each proposed SSP. Subsequently, the number and distribution of SSPs in the slab will be incorporated into a final design, including piping routes and system fan location(s). A typical design drawing and technical specifications for an SSD system is included in Figure 4. Each SSD system will be designed with the objective of achieving a post-construction measurable differential pressure of at least -0.004 inches of water ("wc).

3.3 ASBESTOS/MOLD/LEAD-BASED PAINT EVALUATION

An evaluation will be conducted for the presence of materials suspected of containing asbestos, mold or lead-based paint. This evaluation will be constrained to the portions of the structure that may potentially be disturbed during system installation. Findings related to asbestos, mold or lead-based paint will be recorded on the Initial Design Visit Checklist Form provided in Appendix A. As appropriate, asbestos, mold or lead-based paint samples may be collected in those portions of the structure; a complete asbestos, mold or lead-based paint survey of the building will

not be performed. Samples collected as part of this evaluation will be collected and analyzed in accordance with state and federal regulations. The

property owner and Ohio EPA will be provided with the results of any samples collected.

4. DESIGN AND INSTALLATION OF MITIGATION SYSTEM(S)

After the design visit and testing described in Section 3 is completed for a given structure, design plans and specifications will be developed for the mitigation system for that specific structure. The plans and specifications will be certified by a Professional Engineer licensed by the State of Ohio. Once approved by OEPA and the property owner, the design plans and specifications for a given structure will be incorporated into Appendix C of this Work Plan, and the mitigation system will be installed once an access agreement (either a new agreement or amendment of an existing agreement) has been negotiated with the property owner and required building and/or electrical permits have been obtained.

If the results of the asbestos/mold/lead-based paint evaluation suggest that asbestos, mold and/or lead-based paint will be disturbed during system installation, the asbestos, mold and/or lead-based paint will be abated prior to system installation. Such abatement will be conducted in accordance with state and federal guidelines in only those portions of the structure that may be disturbed during system installation, not for the entire structure. Any required abatement of asbestos, mold and/or lead-based paint will be completed at no cost to the property owner.

4.1 SSD MITIGATION SYSTEMS

Based upon O'Brien & Gere's experience, a typical SVI mitigation system utilizing SSD in a residential structure generally includes:

- » One Radon Away GP-501 fan, or equivalent high flow/low vacuum fan;
- » One fan housing;
- » One rain cap;
- » One condensate bypass;
- » Up to two SSPs;
- » Up to 80 feet of Schedule 40 polyvinyl chloride (PVC) pipe;
- » Up to two PVC gate valves; and
- » Up to two u-tube manometers.

Each SVI mitigation system fan is installed on the building's exterior in accordance with local and state

electrical codes. The discharge pipe from the fan is routed vertically and extends at least one foot above the building eave; no roof penetrations are typically made. Each system is installed with a rain cap, condensate bypass, and fan housing (cover) to extend the life of the fan.

Each SSP is installed with a pressure gage (u-tube manometer or magnehelic gage) to alert building occupants of a system failure. When multiple SSPs are installed on a single SVI mitigation system, each SSP has a gate valve to allow for the balancing of induced sub-slab vacuum across the slab. Labels, placed on each SSP, provide a telephone number of an appropriate contact that the occupant can call for questions and repairs.

System piping is typically Schedule 40 PVC; pipe diameter is property-specific. System piping is sloped to allow for proper drainage of condensation.

Observable slab cracks and other openings are often sealed, caulked, or covered. Floor drains that are not connected to the municipal sewer are typically replaced with Dranjer-type devices that allow water to travel down the drain but do not allow vapors to migrate up the drain. Sump covers are sealed, as appropriate.

The local municipality typically needs to be notified upon completion of system installation so that applicable building and/or electrical inspections can be scheduled.

4.2 ALTERNATIVE MITIGATION SYSTEMS

If the physical features (*e.g.*, layout, condition, etc.) of a given structure or the results of sub-slab communication testing are not favorable for SSD, then an alternative mitigation method will be evaluated. If deemed appropriate, an alternative mitigation method will be assessed, beginning with the design visit. Alternative mitigation methods include, but are not limited to:

- » Sealing of floors and/or walls;
- » Partial SSD;
- » Sub-membrane depressurization (SMD);
- » Block wall depressurization (BWD);
- » Sub-slab ventilation (SSV);
- » Sub-slab pressurization (SSPR);
- » Heat recovery ventilation (HRV);
- » Inaccessible crawlspace ventilation (ICV);
- » Heating ventilation and air conditioning (HVAC) system modification;
- » Increased ventilation (IV);
- » Building pressurization; and
- » Combination of any of the above mitigation methods.

The installation of mitigation systems employing techniques other than SSD will be based upon property- and method-specific considerations.

4.3 STRUCTURE-SPECIFIC DESIGN PLANS AND SPECIFICATIONS

The details of the SVI mitigation system design for each structure requiring mitigation will be developed and, once approved by OEPA and the property owner, will be included as a sub-appendix in Appendix C of this Work Plan. The design for each structure shall include one or more design drawings, prepared under the direction of and certified by a Professional Engineer licensed by the State of Ohio, showing the design plans and system specifications for that structure.

The installation of a mitigation system will proceed upon approval of the design plans and specifications by Ohio EPA and the property owner, an access agreement (either a new agreement or amendment of an existing agreement) is in place with the property owner, and any required building and electrical permits have been obtained.

Following system installation, the mitigation system will be commissioned in accordance with the protocol discussed in Section 5 of this Work Plan. Commissioning results will be documented in the Installation and Operation Commissioning Checklist Form contained in Appendix B. These checklists will be provided to Ohio EPA as they are generated.

4.4 HEALTH AND SAFETY

Prior to initiation of field activities associated with this Work Plan (including design visit[s], testing and mitigation system installation), O'Brien & Gere will develop a site-specific Health and Safety Plan (HASP). The HASP will identify and provide mitigation strategies for physical, biological and chemical hazards that may pose risk to O'Brien & Gere personnel, property owners and/or other occupants. The HASP will identify the nearest hospital and health care clinic for emergency and non-emergency treatment, and provide a travel route to those facilities from the site (with attached maps and directions). The plan will also include a list of contacts for emergency (fire, police, EMS) and non-emergency purposes (personnel for both Unison and O'Brien & Gere). Potential contact with and/or exposure to CVOCs will be evaluated and discussed in the HASP. The HASP will contain Material Safety Data Sheets for the eleven CVOCs listed in the Pre-Design Assessment Work Plan as well as the materials that O'Brien & Gere anticipates using during system installation activities.

Personal protective equipment (PPE), communication and work-zone monitoring requirements suitable for the level of risk will be evaluated and specified for chemical exposure, noise exposure as well as physical and biological hazards anticipated during implementation of the Work Plan.

The HASP will be submitted to Ohio EPA under separate cover after the effective date of the SVI Interim Action Mitigation Order but before commencing any of the field work associated with this Work Plan.

4.5 WASTE MANAGEMENT

During the course of mitigation activities, certain construction debris (*i.e.*, concrete and excess construction supplies) may be generated and will require disposal. Such materials will be treated as non-hazardous waste and disposed accordingly.

Other construction-related waste (*i.e.*, soil) may also be generated during construction activities. Efforts will be made to minimize the volume of soil that needs to be removed from within each structure. If soil does need to be removed, it will be containerized. Representative soil will be screened at the structure(s) with a photo-ionization detector (PID) using the jar headspace method, and visual signs of potential impacts will be noted. The drummed soil then will be transported to the Unison facility (either Plant 1 or Plant 2, whichever is closer to the structure being mitigated) for subsequent characterization and proper off-site disposal. If significant headspace readings [greater than 10 parts per million (ppm)] are obtained during the PID screening, or there are visual signs of potential impacts, then the drummed soil will be sampled for laboratory analysis using the Toxicity Characteristic Leaching Procedure (TCLP) for VOCs and/or metals (depending on the results of the PID screening and visual observations) to further characterize the soil before off-site transportation. If no significant headspace readings are obtained during the PID screening, and there are no visual signs of potential impacts, then the drummed soil will be managed as non-hazardous waste.

Potentially hazardous household items (*e.g.*, paint cans, spray cans, chemicals, oil) that may be present in a structure to be mitigated will not be disposed by GE; these items (if any) will remain at the structure.

5. OPERATION, MAINTENANCE & MONITORING OF MITIGATION SYSTEM(S)

After installation, each mitigation system will be commissioned to document that it was installed properly, is achieving the design criteria, and is performing in accordance with defined performance specifications discussed in this subsection. Additionally, annual operation, maintenance and monitoring activities (OM&M) will be conducted to ensure proper operation of each system.

5.1 SSD SYSTEM START-UP ACTIVITIES

Each vapor mitigation system employing SSD will be designed and commissioned with the objective to achieve a measurable differential pressure of at least -0.004 "wc measured across the slab. If the design criteria cannot be achieved, alternative mitigation measures will be evaluated on a case-by-case basis. Pressure field extension testing will be conducted to confirm that depressurization is occurring across the slab. Combustion devices located on the slab area that pull air from within the space and exhaust it outdoors will be operating at the time of the commissioning to represent "worst-case" conditions (that is, maximum building depressurization). This approach, when combined with the target differential pressure of -0.004 "wc during conditions of maximum building depressurization, is indicative that the slab will then remain depressurized under the range of expected operating conditions.

The static pressure at each SSP (u-tube manometer/magnehelic readings) and at the fan inlet will be recorded. These measurements will define the operating performance of each system as it achieves depressurization across the slab.

Results of the commissioning will be recorded on the Installation and Operation Commissioning Checklist Form provided in Appendix B.

As-built drawing(s) will be prepared (based on the design drawing[s]) for each commissioned system. These drawings will show, at a minimum, the locations of suction points, piping, and fans on a plan view of the depressurized slab.

The system components will be described and pointed out to each property owner. Property owners will be provided with a fact sheet that instructs them on how to check the system and how to request non-routine maintenance if they suspect a problem with the system.

Following system commissioning, indoor air samples will be collected to evaluate the effect of the mitigation systems on indoor air concentrations. Samples will be collected and analyzed in accordance with the procedures outlined in the Pre-Design Assessment Work Plan. The confirmation indoor air sampling event for each structure requiring mitigation will occur during the first available heating season after commissioning the mitigation system.

5.2 ALTERNATIVE MITIGATION SYSTEM START-UP ACTIVITIES

The commissioning of any mitigation systems employing techniques other than SSD will be based upon property- and method-specific considerations. The commissioning approach for these types of systems (if any) will be reviewed and approved by Ohio EPA prior to system installation (*i.e.*, as part of the design process).

5.3 OPERATION, MAINTENANCE & MONITORING

Operation and maintenance (O&M) activities for the mitigation systems will be completed on an annual basis. O&M activities will include an annual visit to each structure with a mitigation system to verify operation of the fan and to record the vacuum measurements for each system via a u-tube manometer or other process parameters in the event that something other than a SSD system is used as the mitigation technology. O&M visits will also include making or arranging for repairs to the fan or system piping, as required. Visits to the residential properties will also include a visual inspection of the basements. Significant changes in basement structural conditions or additional or modified heating/ventilation systems that could impact effective operation of the mitigation system will be documented using photographic means.

6. REPORTING

6.1 MITIGATION FINAL REPORT

Upon completion of the system installation and start up activities, a Mitigation Final Report will be submitted to Ohio EPA. This report will include the as-built drawing(s) for each mitigated structure, the differential pressure measurements at each CTP, and the results of the post-mitigation indoor air sampling event for each structure.

6.2 MONTHLY PROGRESS REPORTS

In accordance with the SVI Interim Action Mitigation Order, monthly progress reports will be prepared and

submitted to Ohio EPA until all mitigation systems required to be installed under the order are in the OM&M phase. These reports will summarize the work completed during the reporting period and provide a description of any activities anticipated for the upcoming month.

6.3 ANNUAL OM&M REPORTS

Following submittal of the Mitigation Final Report to Ohio EPA, OM&M of the mitigation system(s) will be documented in annual reports. These reports will be submitted to Ohio EPA by January 31st each year.

7. REFERENCES

¹*Final Soil Vapor Intrusion Assessment Report, Addendum to Remedial Investigation Report.* Elano Corporation Sites, Alpha, OH. Brown and Caldwell. May 2, 2012.

²*Draft Soil Vapor Intrusion Assessment Report Addendum.* Elano Corporation Sites, Alpha, OH. Brown and Caldwell. April 4, 2013.

Table 1
Target Properties for Pre-Design Assessment Areas A, B and C

Map ID	Mailing Address	City
Area A		
1	2403 Dayton Xenia Rd	BEAVERCREEK OH 45434
BC#3	2441 Dayton Xenia Rd	BEAVERCREEK OH 45434
Area B		
2	2420 MAPLE ST	ALPHA OH 45301
3	2408 MAPLE DR	ALPHA OH 45301
4	2441 MAPLE ST	ALPHA OH 45301
5	PO BOX 9	ALPHA OH 45301
6	BOX 24	ALPHA OH 45301
7	2409 MAPLE ST	ALPHA OH 45301
8	2397 MAPLE ST	ALPHA OH 45301
10	2387 MAPLE ST	ALPHA OH 45301
11	2375 MAPLE ST PO BOX 76	ALPHA OH 45301
12	2390 PHIL HUBBLE DR	ALPHA OH 45301
13	PO BOX 64	ALPHA OH 45301
14	331 SUTTON RD	XENIA OH 45385
15	25 E SCHANTZ AVE	DAYTON OH 45409
16	742 ALPHA RD	ALPHA OH 45301
17	740 ALPHA RD	ALPHA OH 45301
19	738 ALPHA RD	ALPHA OH 45301
BC#13	PO BOX 32	ALPHA OH 45301
BC#15	410 MERRICK DR	BEAVERCREEK OH 45434
BC#17	2430 MAPLE DR	ALPHA OH 45301
BC#20	745 ALPHA RD	ALPHA OH 45301
BC#21	1113 CHRISTI CIR	BEAVERCREEK OH 45434
BC#26	2421 MAPLE DR	ALPHA OH 45301
Area C		
BC#5	472 Orchard Lane	ALPHA OH 45301
BC#6	PO Box 62	ALPHA OH 45301

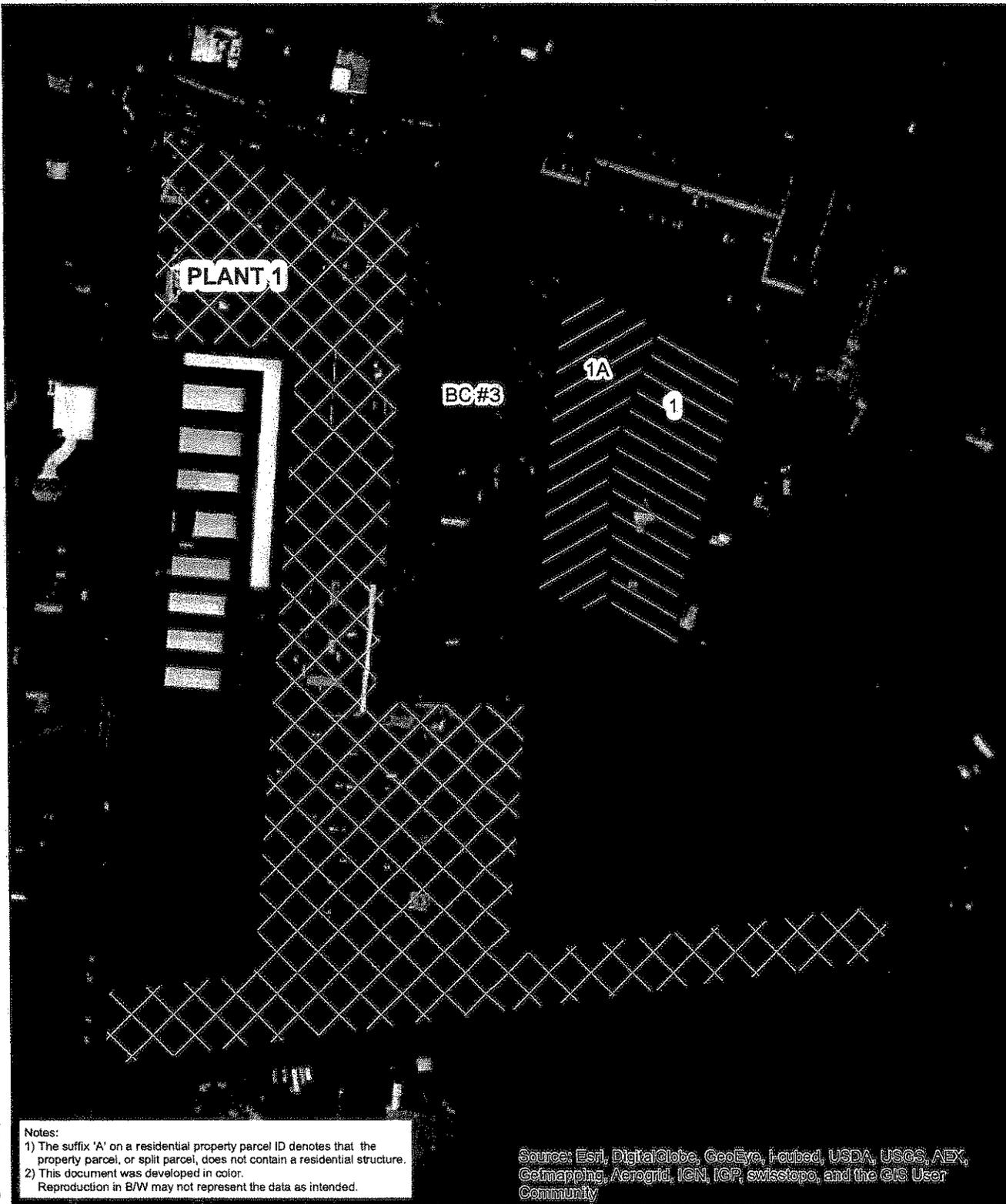
Source: Pre-Design Assessment Work Plan, O'Brien & Gere, December 2013.



FIGURE 1

I:\CH2m-Hill-Hdc-10361\STD\SIGS\Elano\MXD\Ecfrs\001 - Figure 1 - Area A - r3.mxd

PLOTDATE: 05/14/13 ONeillUM



Notes:
 1) The suffix 'A' on a residential property parcel ID denotes that the property parcel, or split parcel, does not contain a residential structure.
 2) This document was developed in color.
 Reproduction in B/W may not represent the data as intended.

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

-  PLANT 1
-  RESIDENTIAL PROPERTY WITH STRUCTURES (POTENTIALLY IMPACTED PER BROWN AND CALDWELL)
-  RESIDENTIAL PROPERTY WITH STRUCTURES (NOT PREVIOUSLY IDENTIFIED)
-  RESIDENTIAL PROPERTY WITHOUT STRUCTURES (NOT PREVIOUSLY IDENTIFIED)

**FORMER ELANO CORPORATION SITES
 ALPHA, OHIO**

MARCH 2014

**SITE LAYOUT
 AREA A**

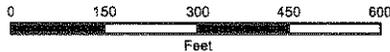
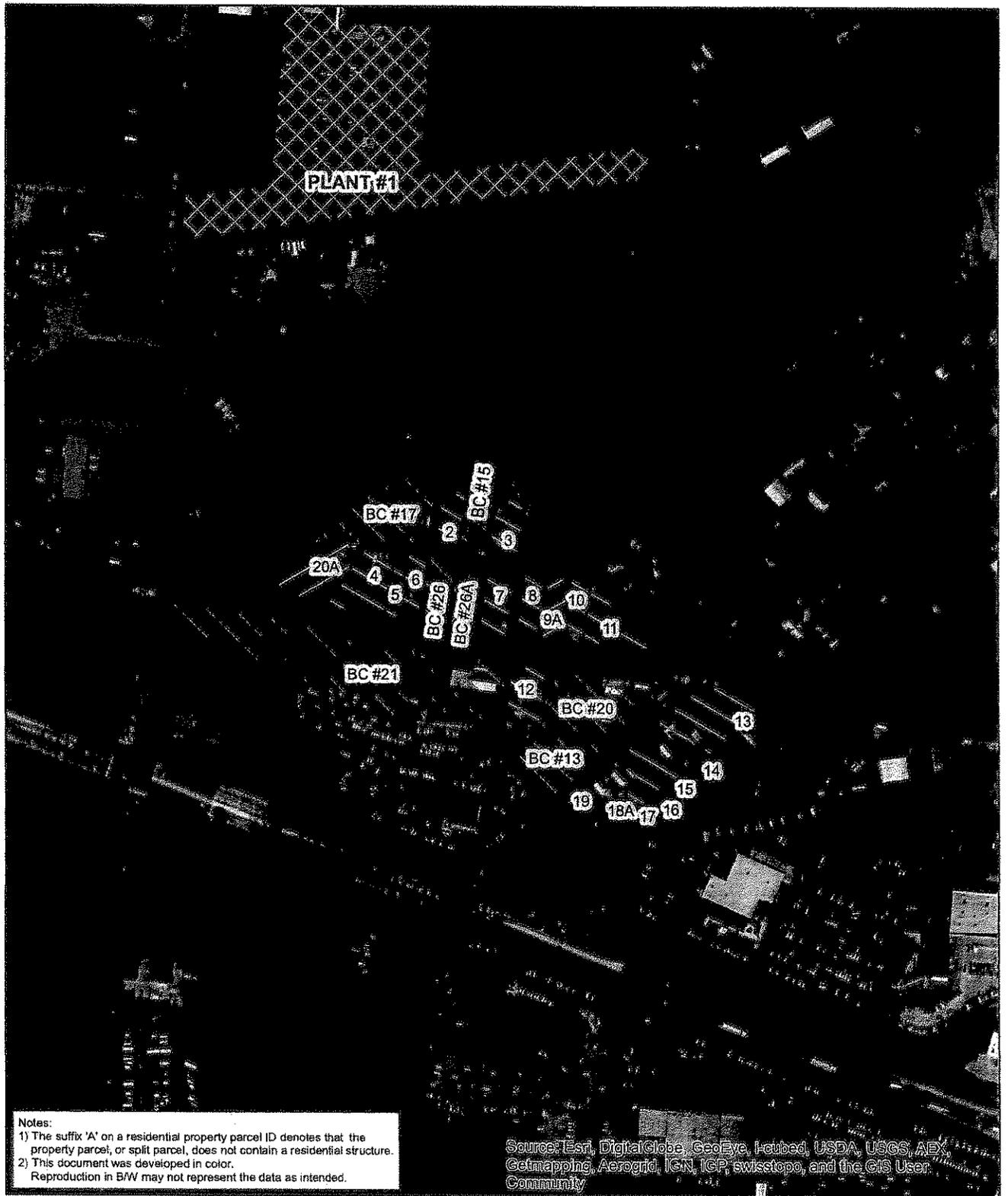


FIGURE 2

I:\Ch2m-Hill-Hdc-103611\STD\SIGIS\EI\ano\MXD\EI\dfs004 - Figure 2 - Area B - R3.mxd



PLOTDATE: 05/14/13 ONeRJM

Notes:
 1) The suffix 'A' on a residential property parcel ID denotes that the property parcel, or split parcel, does not contain a residential structure.
 2) This document was developed in color.
 Reproduction in B/W may not represent the data as intended.

Source: Esri, DigitalGlobe, GeoEye, I-Found, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

-  PLANT 1
-  RESIDENTIAL PROPERTY WITH STRUCTURES (POTENTIALLY IMPACTED PER BROWN AND CALDWELL)
-  RESIDENTIAL PROPERTY WITHOUT STRUCTURES (POTENTIALLY IMPACTED PER BROWN AND CALDWELL)
-  RESIDENTIAL PROPERTY WITH STRUCTURES (NOT PREVIOUSLY IDENTIFIED)
-  RESIDENTIAL PROPERTY WITHOUT STRUCTURES (NOT PREVIOUSLY IDENTIFIED)

**FORMER ELANO CORPORATION SITES
 ALPHA, OHIO**

MARCH 2014

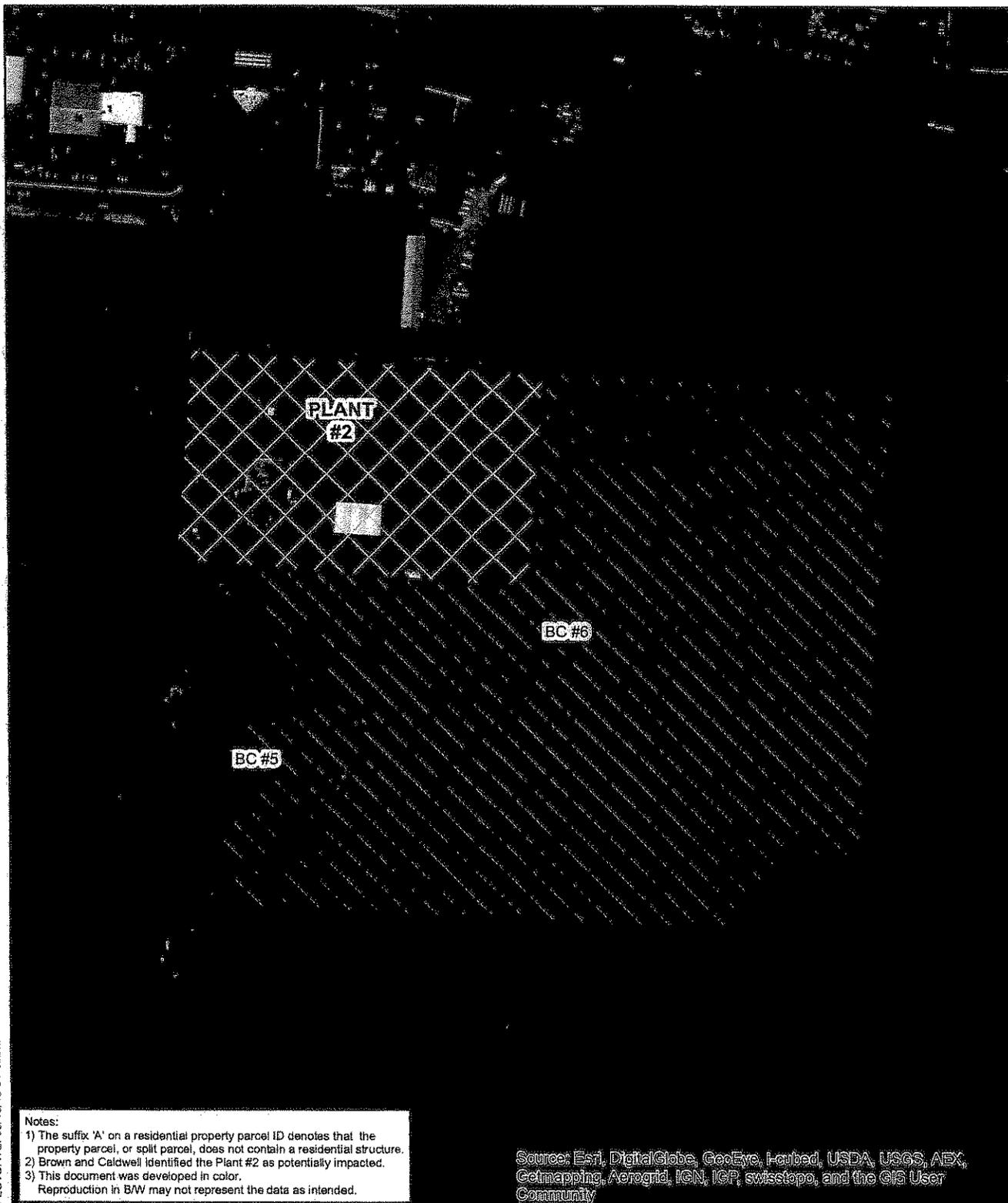
**SITE LAYOUT
 AREA B**



FIGURE 3

I:\Ch2m+Hill-Idc.10361\STDS\GIS\Elano\MXD\Elitis\005 - Figure 3 - Area C-R3.mxd

PLOTDATE: 05/13/13 ONeillUM



Notes:
 1) The suffix 'A' on a residential property parcel ID denotes that the property parcel, or split parcel, does not contain a residential structure.
 2) Brown and Caldwell identified the Plant #2 as potentially impacted.
 3) This document was developed in color.
 Reproduction in B/W may not represent the data as intended.

Source: Esri, DigitalGlobe, GeoEye, Earthstar, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

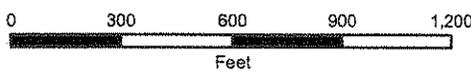
LEGEND

-  PLANT 2
-  RESIDENTIAL PROPERTY WITH STRUCTURES (POTENTIALLY IMPACTED PER BROWN AND CALDWELL)

FORMER ELANO CORPORATION SITES
 ALPHA, OHIO

MARCH 2014

**SITE LAYOUT
 AREA C**



*Initial Design Visit
Checklist Form*



Initial Design Visit Checklist Form

Structure Address: _____

Date of Design Visit: _____

Structure ID #: _____

Design Team: _____

Initial Backdraft Test Checklist

Was an initial backdraft test performed? Yes No

On what combustion appliances was a backdraft test performed? Hot Water Heater Furnace / Boiler Dryer
Other: _____

Is there an existing backdraft on any appliance? Yes No
(If yes, explain)

Were winter conditions simulated during tests? Yes No
(Doors/windows closed, heating appliances running)

Was there precipitation during the previous 24 hours? Yes No

What is the apparent wind speed? Calm Light Strong

Smoke Test Checklist

Was smoke test performed on the following:

Floor drains Yes No N/A If yes, did smoke enter? Yes No

Sumps (except sanitary sumps) Yes No N/A If yes, did smoke enter? Yes No

Floor/wall cracks, openings, and penetrations Yes No N/A If yes, did smoke enter? Yes No

Open-top block foundation walls Yes No N/A If yes, did smoke enter? Yes No

Are there areas of the slab that are not visible or accessible? Yes No

Are there other cracks present that do not draw smoke? Yes No

NOTE: Indicate on sketch where smoke was drawn during smoke test.



Initial Design Visit Checklist Form

Structure Address: _____

Date of Design Visit: _____

Structure ID #: _____

Design Team: _____

Documentation Checklist (Basement Sketch, Exterior Sketch)

Were structure address, design team initials, and front of building included on sketches? Yes No

Were asbestos sample locations included on sketches (where applicable)? Yes No N/A

Were dimensions included on sketches for the following (where applicable)?

Communication test points and suction holes Yes No

Foundation walls and interior walls Yes No

Accessible crawlspace length, width, and height Yes No N/A

Inaccessible crawlspace length, width, and height Yes No N/A

Location of fan, exhaust stack Yes No

Were digital photographs taken of existing conditions (pre-installation)? Yes No

Is there visual pre-existing structure damage? Yes No

Was the site cleaned-up and left as found? Yes No

Comments:

*Installation and Operation
Commissioning
Checklist Form*



Installation and Operation Commissioning Checklist Form

Address: _____

Structure ID #: _____

Performed by: _____

Date: _____

System Performance Data

Fan Inlet Static Pressure (vacuum)

Fan System	1	2	3	4	5
Fan Model					
U-Tube Reading ("w.c.)					

- Is each fan mounted securely? Yes No
- Coupling connections secure? Yes No
- Is excessive noise heard when fan is running? Yes No
- Is set point indicated on speed controller? Yes No NA
- Is the pipe and conduit penetration sealed to the structure's exterior? Yes No
- If fan vacuum is at maximum, measure velocity at each SSP (record below).
- Does the SSP velocity meet criteria (> 1 ft/min)? Yes No NA

Sub-Slab/Sub-Membrane SSP Static Pressure (vacuum)

SSP#	Static Pressure (" w.c.)	Fan System	Velocity at SSP (ft/min)

Final Communication Test Results (Sub-Slab)

Communication test point					
Manometer reading (" w.c. vacuum)					
Does smoke enter? (sub-slab ventilation systems only)					
Communication test point					
Manometer reading (" w.c. vacuum)					
Does smoke enter? (sub-slab ventilation systems only)					

- Were all fans in operation during final communication test? Yes No
- Were all valves locked after final communication test? Yes No NA
- Was the pressure reading at each test point ≤ -0.004 " w.c.? Yes No NA
- Was maximum building depressurization simulated during test? Yes No
- Was there precipitation during the previous 24 hours? Yes No
- What was the apparent wind speed? Calm Light Strong



Installation and Operation Commissioning Checklist Form

Address: _____

Structure ID #: _____

Performed by: _____

Date: _____

Accessible Crawlspace Performance Inspection (Sub-membrane Depressurization)

Was each membrane joint and perimeter smoke tested and found to be sealed?

Yes No NA

Is the manometer reading $\geq 1/10"$ w.c. vacuum?

Yes No NA

Inaccessible Crawlspace Data (Ventilation)

NA

	Crawlspace 1	Crawlspace 2	Crawlspace 3	Crawlspace 4
SSP#				
Crawlspace volume (ft ³)				
Suction pipe diameter (in.)				
Target velocity (ft/min)				
Measured velocity (ft/min)				
Meets criteria ($\geq 90\%$) - Y or N				

Backdraft Test Results

Was commissioning backdraft test performed?

Yes No

Was backdraft test conducted under maximum building depressurization?

Yes No

On what combustion appliances was a backdraft test performed? *

- Hot Water Heater Dryer Fireplace (damper closed)
 Furnace / Boiler Fireplace (damper opened)
 Other _____

Was any combustion appliance not operable and could not be tested?

Yes No

If yes, which appliances:

Is there is a backdraft on any appliance?

Yes No

(If yes, explain) **

Was a previous backdraft condition present during any previous visit?

Yes No NA

* Do not operate whole house fan during backdraft test.

** If backdraft exists, shut down SSD system. Backdraft will need to be corrected prior to re-energizing system.

** If backdraft exists, please notify the property owner.

Owner was notified on: (date) _____



Installation and Operation Commissioning Checklist Form

Address: _____

Structure ID #: _____

Performed by: _____

Date: _____

Electrical System Installation Inspection

- Are all electrical connections secure? Yes No
- Are all switches locked on? Yes No NA
- Are audible alarm(s) present and working? Yes No NA
- Is each junction box closed? Yes No NA
- Is the conduit/wire properly supported? Yes No NA
- Are appliances affected by fan operation? Yes No

Pipe System Performance

- Are all pipe runs properly supported (6'-horizontal/8'-vertical)? Yes No
- Were 10% of all pipe joints smoke tested? Yes No
- Did smoke enter? Yes No
- Are manometers installed at each suction point? Yes No NA
- Are system suction point seals accessible? Yes No
- System suction points are sealed to the slab? Yes No
- Each component is installed? Yes No
- Excessive noise is heard in piping joints? Yes No

Slab/Wall Repair Performance

- Were drawing-identified slab and wall crack repairs/modifications smoke tested? Yes No NA
- Did smoke enter? Yes No NA
- Are there other visible cracks that did not draw smoke? Yes No
- Are there areas of the slab and/or walls that are not visible (e.g. finished areas)? Yes No
- Are there areas of the slab and/or walls that are not accessible (e.g. stored items)? Yes No
- Are utility penetrations sealed so they don't draw smoke? Yes No NA
- Is top course of block wall open? Yes No NA
- Did top course of block wall draw smoke after sealing? Yes No NA
- Are sump cover(s) present and sealed properly? Yes No NA
- Is sump cover structurally sound? Yes No NA
- Check and clean Dranjer(s)? Yes No NA
- Smoke Dranjer(s)? Yes No NA

Labeling Inspection

- Correct labels applied in the proper locations? Yes No
- Commissioned value written on SSP sticker? Yes No
- Is SSDS breaker identified in the electrical panel? Yes No



Installation and Operation Commissioning Checklist Form

Address: _____

Structure ID #: _____

Performed by: _____

Date: _____

System Exhaust

- Are there vents to occupiable attic space? Yes No
- Are HVAC units installed in attic space? Yes No
- Are there any roof mounted air intakes that supply air into the structure? Yes No
- Is building equipped with a whole house fan(s)? Yes No
- Has Homeowner been informed to only operate the whole house fan(s) with all windows open? Yes No NA
- Does the condensate line appear to be functioning correctly? Yes No
- Are all fan exhaust stacks installed? Yes No
- At least **1 foot** above the eave of the roof? Yes No Distance above eave: _____
- At least **10 ft** above ground level? Yes No
- At least **10 ft** away from any windows, doors, chimneys, or other openings into conditioned or otherwise occupied spaces? Yes No Distance from opening: _____
- If not 10 ft away, at least **2 ft** above windows, doors, chimneys, or other openings into conditioned or otherwise occupied spaces? Yes No NA Distance above opening: _____
- Is it sufficiently sealed where downspout meets PVC pipe? Yes No NA

Documentation

- Were digital photographs taken of post-installation conditions? Yes No
- Was Homeowner provided "Operational Fact Sheet"? Yes No
- Was a field modification form completed to record installation changes? Yes No NA
- Was the drawing updated to show installed components? Yes No

Comments:

*Structure-Specific Mitigation
System Designs and
Specifications*



Appendix C-1

498 Orchard Lane

APPENDIX D
PRE-DESIGN ASSESSMENT WORK PLAN

WORK PLAN

Pre-Design Assessment Work Plan

**Former Elano Corporation Sites
Alpha, OH**

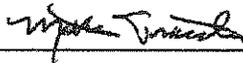
December 2013
Revised July 2014



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Pre-Design Assessment Work Plan

Former Elano Corporation Sites
Alpha, OH



MATTHEW TRAISTER, P.E., VICE PRESIDENT
O'Brien & Gere Engineers, Inc.

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LIST OF ABBREVIATIONS

BC	Brown and Caldwell
BDL	Below Detection Limit
CVOC	Chlorinated Volatile Organic Compound
COC	Constituent of Concern
CLP	Contract Laboratory Protocol
HASP	Health and Safety Plan
HVAC	Heating, ventilation and air conditioning
Hg	Mercury
IA	Indoor Air
IDW	Investigation-Derived Waste
µg/m³	Micrograms per Cubic Meter
mL/min	Milliliters per Minute
MDL	Method Detection Limit
MS/MSD	Method Spike/Method Spike Duplicate
OA	Outdoor Air
OBG	O'Brien & Gere
Ohio EPA	Ohio Environmental Protection Agency
PCE	Tetrachloroethene
PID	Photoionization Detector
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
SAP	Sampling and Analysis Plan
SV	Soil Vapor
SIM	Selective Ion Mode
SS	Sub-slab
SVI	Soil Vapor Intrusion
SVIAR	Soil Vapor Intrusion Assessment Report
Unison	Unison Industries
USEPA	United States Environmental Protection Agency
VIA	Vapor Intrusion Assessment

1. INTRODUCTION

O'Brien & Gere has prepared this Soil Vapor Intrusion (SVI) Pre-Design Assessment Work Plan (Work Plan) on behalf of Unison Industries, LLC (Unison) for the former Elano Corporation Sites located in Alpha, OH in response to the Ohio Environmental Protection Agency's (Ohio EPA's) Soil Vapor Intrusion Interim Action Mitigation Order. Essentially an extension of the Soil Vapor Intrusion Assessment (SVIA) conducted by Brown and Caldwell (BC) beginning in 2009 and culminating in April 2013 with the SVIA Report (SVIAR) Addendum, this additional work is intended to eliminate uncertainty regarding soil vapor intrusion into potential residential structures. Specifically, this Work Plan contains a summary of overall project objectives, a proposed scope of work and deliverables as well as technical rationale, field and analytical methods, data processing and interpretation procedures, quality assurance and objectives and reporting requirements.

Commercial properties (with or without structures) which have been previously determined to be potentially affected, and/or have not yet been assessed, may be addressed under a subsequent work plan depending on the results of this residential assessment.

1.1 SITE LOCATION

The former Elano Corporation sites and surrounding properties of interest are located in Alpha, Ohio, approximately three miles west of Xenia and twelve miles southeast of Dayton, Ohio. The study area extends south from Dayton-Xenia Road to the Little Miami River and Factory Road to the west. A north-south property line approximately 2000 feet east of South Orchard Lane represents the eastern boundary of the study area. The Plant 1 property, approximately 13.1 acres, can be entered from Dayton-Xenia Road and Factory Road. The property boundary of Plant 1 is fenced on three sides: east, west, and south. Plant 1 is comprised of the facility building and office, hazardous waste storage area, drum storage, loading dock, aboveground chemical storage tank, aboveground propane tanks, asphalt parking areas and driveways, concrete slab (near south parking lot) and a gravel parking lot. A groundwater extraction and treatment system, including an associated air stripping tower (installed as part of an interim response action), is also located on Plant 1 property.

The Plant 2 property, approximately 5.16 acres, located a short distance south and east of Plant 1 on South Orchard Lane, is accessible from all sides. The main entrance is on the west side off South Orchard Lane. The southern property boundary of Plant 2 is fenced, separating it from residential property to the south. Plant 2 consists of the facility building, two paved parking areas, a concrete pad and raised loading dock, concrete drum storage area, aboveground tanks, a storage shed, and a second groundwater extraction and treatment system tower that is completely fenced in. There are two below-ground septic tanks (one active and one inactive). The active tank's leach-field is located on the neighboring property to the east. A property easement for utilities associated with the groundwater extraction and treatment system, located just east of the facility, is situated along the property's southern boundary.

1.2 SITE CONDITIONS

Areas overlying the identified plume of groundwater affected by chlorinated volatile organic compounds (CVOCs) include Plant 1 and surrounding properties immediately east and west, Plant 2, properties located in the generally north-south corridor between Plants 1 and 2, and properties immediately east, west and south of Plant 2. The groundwater plume is divided into three separate areas of impact: Areas A, B and C.

- Area A - On and surrounding Plant 1
- Area B - The middle plume crossing the bike trail and U.S. 35
- Area C - On and surrounding Plant 2, continuing to the Little Miami River to the south.

Geographically, the area of interest is located near where the drainages of Beaver Creek, Little Beaver Creek, and the Little Miami River converge. Little Beaver Creek flows to the southeast and discharges into Beaver Creek in the north-central portion of the project area. Beaver Creek, trending northeast/southwest through the northern portion of the project area, joins Little Beaver Creek and turns south approximately 5,000 feet to its confluence with the Little Miami flowing to the southwest.

The properties located adjacent to and between Plants 1 and 2 consist of a combination of residential and commercial land use, roadways and creeks. The

Village of Alpha, Ohio is located in the central portion of the project area (i.e. Area B) and at one time had several domestic drinking water wells.

A number of these residential wells were abandoned in 2000, 2001, and 2003, in order to prevent the wells from becoming potential conduits for vertical migration of affected groundwater from the upper aquifer to the lower aquifer.

The former Elano Corporation sites are included in a Remedial Investigation (RI), Feasibility Study (FS) and subsequent Interim Remedial Action (IRA) conducted under the direction of the Ohio EPA. Historic and ongoing investigations have been conducted on a variety of media since discovery of groundwater impacts in the 1980s. Consequently, more than 100 monitoring wells and piezometers have been installed in the project area. Groundwater monitoring is now conducted semi-annually to gauge progress of IRA efforts. To date, the RI, FS and initial SVIA Reports have been completed and finalized. The SVIAR Addendum is still considered draft as of the date of this Work Plan.

The SVIA performed by BC for Ohio EPA identified two primary constituents of concern (COCs) for potential SVI at the site, trichloroethene (TCE) and tetrachloroethene (PCE). However, as requested by Ohio EPA, this Work Plan also includes the analysis of sub-slab soil gas and indoor/outdoor air samples for nine additional CVOCs, namely:

- Carbon tetrachloride
- Chloroethane
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1-Dichloroethene
- *cis*-1,2-Dichloroethene
- *trans*-1,2-Dichloroethene
- 1,1,1-Trichloroethane
- Vinyl Chloride

1.3 OBJECTIVES

O'Brien & Gere conducted a review of the Greene County, Ohio Auditor's property tax data base and on-line GIS mapping service to identify residential parcels with structures for this assessment, respective owners and contact information (see **Figures 1, 2, 3**

and **Table 1**). Based on this review, the proposed pre-design assessment scope of work is expanded from that indicated in Ohio EPA's Interim Action Mitigation Order, to include assessment of structures on 26 residential parcels in the areas surrounding and between the above-mentioned facilities previously identified by BC to be potentially affected or where soil vapor, sub-slab vapor and/or indoor air sampling were not conducted.

The scope of work envisioned under the Ohio EPA's Interim Action Mitigation Order would consist of two distinct phases:

- Pre-design assessment of residential structures
- Mitigation of residential structures

Each phase of the work is covered under its own individual work plan. This Work Plan covers the pre-design assessment phase. A separate Design Mitigation Work Plan (Reference 1) covers the mitigation phase.¹ Both phases will be conducted in general conformance with Ohio EPA guidance (Reference 2). The results from each phase of work will also be captured in separate reports.

Furthermore, there will be overlap in the two phases, with the mitigation of one or more residential structures occurring while the pre-design assessment is still being performed; this serves to expedite the abatement process where possible.

This Work Plan addresses the first phase of work (the pre-design assessment of residential structures) and consists of up to two rounds (heating season/summer season) of sub-slab soil vapor, indoor and outdoor air sampling, analysis, data interpretation and decision-making criteria needed to evaluate whether:

- Abatement is warranted
- Additional monitoring is appropriate
- The structure is not at risk for SVI and can be removed from the program.

As the pre-design assessment phase is performed, additional residential structures may be identified for mitigation based on evaluation of the analytical results in accordance with the approach presented in Section 2 of this Work Plan. Any structure identified

¹ Ohio EPA has determined based on the existing data that one residential structure should proceed to mitigation. That structure is not included in this Work Plan, but is included in the Design Mitigation Work Plan.

for mitigation will move from this Work Plan to the Design Mitigation Work Plan, which will be appended to include the structure-specific designs and specifications for mitigation approved by Ohio EPA and the property owner. Conversely, the second phase (*e.g.* abatement) would be performed under a separate Work Plan submitted to, and approved by, Ohio EPA.

Commercial parcels with structures which have been previously determined to be potentially affected and/or have not yet been assessed may be addressed under a subsequent work plan depending on the results of the pre-design assessment performed in accordance with this Work Plan.

1.4 ORGANIZATION

This Work Plan is organized as follows:

Section 1 – Introduction

Section 2 – Technical Approach

Section 3 – Data Evaluation and Reporting

Section 4 – References

2. TECHNICAL APPROACH

O'Brien & Gere's technical approach for this assessment is a step-wise approach designed to evaluate the risk for soil vapor intrusion into residential structures based on COC concentrations detected in sub-slab soil vapor and indoor air and how those results relate to the risk-based screening levels presented in this Work Plan. This provides a method for quickly determining after each of the two sampling events (heating season/summer season) which residential structures (if any) should proceed to mitigation and be included in the Design Mitigation Work Plan.

Ohio EPA also established cumulative risk-based goals². Therefore, after two sampling events per structure are completed and during preparation of the Pre-Design Assessment Report, cumulative risk calculations will be performed for each residential structure that has not proceeded to mitigation under the Design Mitigation Work Plan. These cumulative risk calculations will include those CVOCs determined to be present in each structure due to SVI. The results of the structure-specific cumulative risk calculations will be presented in the Pre-Design Assessment Report submitted to Ohio EPA for review and approval. This process may result in the identification of additional residential structures for mitigation.

Prior to submitting the Pre-Design Assessment Report to Ohio EPA, the following methodology will be employed:

- Installation of sub-slab soil vapor sample points and collection of sub-slab soil vapor samples from beneath 26 residential structures
- Collection of indoor and outdoor air samples from within and outside 26 residential structures
- Utilize United States Environmental Protection Agency's (USEPA's) Regional Screening Levels (RSLs) for residential indoor air as primary action levels

² In addition to the risk-based screening levels presented in this Work Plan for TCE and PCE, Ohio EPA has established cumulative risk-based goals for those CVOCs found to be present in a structure due to SVI; namely, 1×10^{-5} for carcinogenic CVOCs and a hazard quotient of 1 for non-carcinogenic CVOCs.

- » PCE = 9.4 micrograms per cubic meter (ug/m³)
- » TCE = 0.43 (ug/m³)
- Adopt a default USEPA (Reference 3) sub-slab soil vapor-to-indoor air attenuation factor of 0.03
 - » Selection of this attenuation factor is further supported by site-specific attenuation factors observed during the SVIA performed by BC
- Calculate COC sub-slab soil vapor screening levels based on the default USEPA attenuation factor of 0.03
 - » Residential indoor air RSLs divided by default attenuation factor
 - > PCE residential indoor air RSL = 9.4 (ug/m³)
 - PCE sub-slab soil vapor screening level = $9.4 \text{ (ug/m}^3\text{)}/0.03 = 313 \text{ (ug/m}^3\text{)}$
 - > TCE residential indoor air RSL = 0.43 (ug/m³)
 - TCE sub-slab soil vapor screening level = $0.43 \text{ (ug/m}^3\text{)}/0.03 = 14 \text{ (ug/m}^3\text{)}$
- Classification of structures sampled based on concentration ranges of COCs observed (percentage of screening levels) in sub-slab soil vapor and indoor air samples into the following groups for decision-making purposes:
 - » **Mitigation Warranted**
 - > COC concentrations greater than or equal to the screening level for PCE and/or TCE in indoor air **AND** also greater than or equal to the corresponding screening level for PCE and/or TCE in sub-slab soil vapor (complete VI pathway).
 - » **No Further Action Recommended**
 - > COC concentrations < 75% of the screening level for PCE and/or TCE in sub-slab soil vapor regardless of corresponding indoor air concentrations **UNLESS**, using a "multiple lines of evidence approach," site-specific factors (*e.g.*, earthen floors, laid-up stone walls) suggest that SVI may otherwise be occurring, in which case additional monitoring may be warranted.

» **Additional Monitoring Warranted**

- › COC concentrations greater than the screening level for PCE and/or TCE in sub-slab soil vapor and corresponding indoor air concentrations between 25 and 99% of their respective indoor air screening levels (potential for VI pathway)
- › COC concentrations \geq 75% (but less than 100%) of the screening value for PCE and/or TCE in sub-slab soil vapor **AND** corresponding indoor air concentrations \geq 75% (but less than 100%) of indoor air screening levels (potentially complete VI pathway).

This decision framework, which is illustrated in the flowchart presented as Figure 4, is intended to provide a general guideline of how the results of the pre-design assessment will be evaluated. The framework will be used in conjunction with a “multiple lines of evidence” approach for each structure that is sampled, including, but not limited to, an analysis of Ohio EPA’s cumulative risk-based goals during preparation of the Pre-Design Assessment Report for those structures that have not proceeded to mitigation under the Design Mitigation Work Plan.

For each of the 26 structures, it is anticipated that sub-slab soil vapor, indoor air and outdoor air sampling will be conducted over the course of two consecutive heating/cooling seasons. Exceptions include those structures that follow the shaded path identified in Figure 4, which leads to mitigation after a single sampling event. The scope for the initial task consists of, depending upon property owner approval, the installation of :

- Two sub-slab soil vapor samples for residential structures having a footprint of less than 1500 ft²
- Three sub-slab soil vapor samples for residential structures having a footprint between 1500 ft² and 5,000 ft²
- Up to two indoor air samples from each structure for which sub-slab soil vapor samples are collected

Indoor air samples will be collected in the lowest inhabitable space within the structure (*e.g.*, including full and partial basements) and the primary living space (*e.g.*, first floor).

If a structure has only an uninhabitable crawlspace beneath its primary living space, attempts will be made to secure an indoor air sample from that crawlspace. However, in such instances, samples collected from the primary living space will be used for comparison against relevant screening levels. The crawlspace air sample will not be used in the decision framework (see Figure 4), but will be used as part of the “multiple lines of evidence” approach.

It is expected that one ambient air sample will be collected for each set of structures sampled (concurrent with indoor air sampling) in a general sample area (subject to sample schedule and owner/tenant approvals). Ambient sample locations will be located upwind of target structures to the extent practical. The technical approach described above is illustrated in the screening matrix provided as **Tables 2 and 3**.

2.1 PRE-ASSESSMENT TASK

2.1.1 Scope of Work Development

In order to focus and direct pre-design assessment efforts, O’Brien & Gere conducted a review of the SVIAR and SVIAR Addendum submitted by BC in May 2012 and April 2013, respectively. This review consisted of the following:

- Examination of soil vapor, sub-slab vapor and indoor air analytical results, screening levels, and attenuation factors utilized;
- The spatial distribution of residential parcels evaluated with respect to prior SVIA results generated in all three areas; and,
- Land use and structures present.

The May 2012 SVIAR identified a total of seven potentially-affected residential properties with structures in Areas A, B and C. In January 2013, BC conducted additional SVIA activities in Areas B and C in an effort to complete delineation of the soil vapor plume in these areas. However, none of the potentially-affected residential parcels identified in the May 2012 SVIAR were eliminated as a result of BC’s additional work and one structure has moved to the mitigation phase.

Review of the two prior reports indicates that additional parcels located above or near the soil vapor plume were not identified in the previous SVIA in Areas A and B. These parcels are adjacent to and/or

contiguous with parcels identified as potentially-affected and, therefore, in O'Brien & Gere's opinion, represent data gaps.

O'Brien & Gere identified a total of 20 additional residential parcels on which the Green, County Auditor's tax database indicates at least one residential structure exists (one in Area A, 18 in Area B and one in Area C) that were not previously identified or assessed by BC and were not included in the May 2012 SVIAR or the April 2013 SVIAR Addendum. O'Brien & Gere conducted a review of the Greene County, Ohio Auditor's property tax data base and on-line GIS mapping service to identify the parcels of interest, respective owners and contact information (see **Figures 1, 2, 3** and **Table 1** for summary information). Based on the above information, the proposed scope for this Work Plan is expanded from the six remaining potentially-affected residential parcels with structures listed in Ohio EPA's Interim Action Mitigation Order, to include residential structures identified on an additional 20 parcels.

The locations of these 26 parcels are generally consistent with being above, or immediately proximate to, the suspected groundwater and soil vapor plumes at the former Elano Corporation sites. Thus, the scope of this Work Plan consists of individually assessing sub-slab soil vapor conditions and indoor air quality within existing residential structures on each of the above-mentioned 26 parcels (assuming one structure per parcel) and evaluation of potential SVI and exposure pathway within each structure.

2.1.2 Communications

Ohio EPA shall be notified and provided the opportunity to participate in GE's direct communications with residential or commercial property owners regarding the work to be performed under the Work Plan. These activities include, but are not limited to:

- Review and comment on access requests and letters communicating analytical results (and interpretation of results) for any residential or commercial properties sampled as part of this Work Plan;

- Participation in meetings with residential or commercial property owners related to any work performed according to the Work Plan;
- Participation in initial site visits, sampling activities, etc. for any structures to be sampled according to the Work Plan.

This section applies only to GE's direct communications with property owners. It does not inhibit GE's ability to communicate more broadly with the public at large about the work at the Elano site.

2.1.3 Property Access

Following Ohio EPA approval of this Work Plan, O'Brien & Gere will submit for Ohio EPA's review and approval, notification letters, property access agreement request forms and property owner questionnaires specifying the following:

- Purpose for access
- Scope of work
- Duration of access requested
- No cost obligation by property owner
- Contact information request
- General availability request

Upon approval from Ohio EPA, O'Brien & Gere will distribute these documents to the property owners identified in Table 1.

Access agreement letters will be distributed by O'Brien & Gere in person, with responses requested within 10 business days from the date of receipt. O'Brien & Gere will follow-up with non-responsive property owners via telephone calls and/or visits until access is granted or denied. O'Brien & Gere will maintain records indicating the status of property access for all properties of interest to include the number of attempts to contact property owners who are non-responsive. As a final measure, O'Brien & Gere will send a notification via certified mail requesting a response.

2.1.4 Sampling and Analysis Plan and QA/QC Requirements

This Work Plan documents the proposed field sampling and analytical methodologies for sub-slab soil vapor and indoor air, and also constitutes a Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP). O'Brien & Gere's

standard operating procedures (SOPs, see **Appendix A**) are included, and Ohio EPA's SVI technical guidance will also supplement this Work Plan. The quality assurance and control (QA/QC) protocol will encompass field sampling and decontamination QA/QC procedures (field blanks and lab blanks), laboratory analytical procedures and proposed data validation efforts for both sub-slab soil vapor and indoor air.

O'Brien & Gere has a standardized procedure and form(s) for evaluating and documenting the construction of existing structures (see example structure survey forms and product inventory form in **Appendix B**). In addition, sub-slab vapor point installation, sampling, and decommissioning for each individual construction type (basement, slab on-grade, stone foundation, crawl space, *etc.*) will be documented. Additional forms and procedures may also be developed to identify and document potential issues (potential indoor access issues, health and safety hazards such as biological hazards, asbestos or lead) that may require mitigation prior to initiation of indoor assessment activities.

2.1.5 Health and Safety Plan Development

Prior to initiation of pre-design assessment field activities, O'Brien & Gere will develop a site-specific Health and Safety Plan (HASP). The HASP will identify and provide mitigation strategies for physical, biological and chemical hazards that may pose risk to O'Brien & Gere personnel, property owners and/or other occupants. The HASP will identify the nearest hospital and health care clinic for emergency and non-emergency treatment, and provide a travel route to those facilities from the site (with attached maps and directions). The plan will also include a list of contacts for emergency (fire, police, EMS) and non-emergency purposes (personnel for both Unison and O'Brien & Gere). Potential contact with and/or exposure to CVOCs will be evaluated and discussed in the HASP. The HASP will contain Material Safety Data Sheets for TCE, PCE and the materials that O'Brien & Gere anticipates using during its pre-design assessment.

Personal protective equipment (PPE), communication and work-zone monitoring requirements suitable for the level of risk will be evaluated and specified for chemical exposure, noise exposure as well as physical and biological hazards anticipated during implementation of the Work Plan.

The HASP will be submitted under separate cover following review and approval of the proposed scope of work documented in this Work Plan.

2.2 ASSESSMENT TASK

2.2.1 Sub-Slab Soil Vapor Point Installation and Site Reconnaissance

Upon securing access to a subject property/structure, O'Brien & Gere will coordinate with the property owner and/or structure occupant to schedule an initial visit prior to sub-slab soil vapor point installation. O'Brien & Gere personnel will conduct a structure survey and product inventory for the structure, and complete the associated forms.

Subject to property owner/tenant approval, materials containing, or treated with CVOCs will be removed from the premises to the extent practical and returned to their location after the sampling event described below. Such materials may be identified through a review of the Material Safety Data Sheets (MSDS), the use of a ppbRAE (or equivalent) and/or other publicly-available information. In cases where the materials are not removed from the property, O'Brien & Gere will document such incidents on the building and chemical survey forms.

For structures with a basement and/or slab-on-grade construction, a minimum of one, semi-permanent sub-slab vapor point will be installed to facilitate collection of sub-slab vapor from approximately three inches below the base of the concrete slab. An electric hammer drill with a 3/8-inch diameter bit will be used to penetrate the concrete slab floor (depth depending on thickness of slab) and advance into the sub-base fill material beneath.

If necessary, the drill bit will be advanced 2 to 3 inches into the sub-slab material to create an open cavity. A section of food-grade (inert) Teflon® or other appropriate tubing will be inserted through the drilled hole. The annular space between the hole and tubing will be sealed using 100% beeswax or another inert, non-shrinking sealing compound such as Permagum®. **Figure 5** (adapted from the literature²) illustrates proposed sub-slab vapor point general construction design. Materials used in construction and exact construction details may vary from this figure depending on field conditions observed during installation.

2.2.2 General Sampling Approach

Sampling personnel will avoid activities immediately before and during the sampling that may contaminate the sample (*e.g.*, using markers, fueling vehicles, *etc.*).

To the extent practical, weather information (temperature, barometric pressure, rainfall, wind speed, and wind direction) will be recorded at the beginning of each sampling event. Substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling may also be recorded. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (*e.g.*, local airport or national weather service station). Sampling location(s) will be identified on a floor plan that also indicates any slab breeches (*e.g.*, utility penetrations, sumps, drains, and cracks), if any, and locations of heating, ventilation and air condition (HVAC) equipment.

2.2.3 Sub-Slab Soil Vapor Point Sampling

Sub-slab soil vapor points will be sampled according to O'Brien & Gere's established SOP (**Appendix A**). Sub-slab vapor samples will be collected by following the steps outlined below.

In order to demonstrate that there are no leaks in the sub-slab soil vapor sampling system, a tracer gas evaluation is employed to assess the integrity of the sub-slab vapor probe seal and assess the potential for introduction of ambient (basement or crawl space) air into the sub-slab vapor sample. The following tracer gas testing procedure uses in-field tracer gas measurements and tracer gases (*e.g.*, helium) that can be measured by portable detectors.

- After the sub-slab soil vapor probe has been installed, sealed and purged, place a chamber (such as a plastic container or bucket) over the sample location
- Retain helium tracer gas around the sub-slab sample location by filling the chamber with helium gas
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting or equivalent (*e.g.*, pinch clamp) at the bottom to let the ambient air out while introducing tracer gas. A tracer gas detector will be attached to the valve fitting at the bottom of the chamber to verify the presence of the tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >50%
- The chamber will have a gas-tight fitting or sealable penetration to allow the sub-slab vapor sample tubing to pass through and exit the chamber
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract sub-slab soil vapor at a rate of no more than 0.2 liters per minute (lpm). Using the pump, draw a suitable volume of sub-slab soil gas into the Tedlar bag (the volume should be great enough to achieve a stable value on the helium detector)
- Use the tracer gas detector to measure the tracer gas concentration in the Tedlar Bag
- Record the tracer gas concentrations in the chamber and in the sub-slab vapor sample

If the evaluation indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement of the sample collection. A non-detectable level of tracer gas is preferred; however, if the evaluation indicates a low potential for introduction of ambient (basement or crawl space) air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the sub-slab soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated during the data validation process and in the sampling report.

Once acceptable tracer gas results are achieved and documented, connect the probe (tubing) to the flow controller and sample canister and proceed with sub-slab vapor sample collection procedures detailed below.

- Sub-slab soil vapor samples will be collected over a continuous 24-hour period.
- Purge the tubing using a vacuum pump or gas-tight syringe (~60 cubic centimeters). Calculate the volume of air in the tubing and purge one to three tubing volumes prior to sample collection at a rate no greater than 0.2 lpm

- Use an evacuated Summa® passivated (or equivalent) canister to collect the sub-slab vapor sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in this Work Plan. The sampling flow rate should always be less than 0.2 lpm. The canisters for sub-slab soil vapor sampling will be batch certified as clean by the laboratory.
- Batch-certified clean Summa® canisters will be used to collect sub-slab soil gas samples
- Remove the protective brass or plastic plug from canister. Connect a NIST-traceable vacuum gauge to the canister and record the initial canister vacuum
- Remove the NIST-traceable vacuum gauge and connect the pre-calibrated flow controller to the canister
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge. A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form and sample form for each sample
- Connect the tubing from the sub-slab vapor sampling probe to the flow controller using a nut and ferrule set
- Completely open the valve on the canister. Record the time that the valve is opened (beginning of sampling) and the canister pressure on the vacuum gauge provided with the flow controller
- Photograph the canister and the area surrounding the canister
- Monitor the vacuum pressure in the canister routinely during sampling, when practical
- Stop sample collection after the scheduled duration of sample collected, but when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be analyzed, but the results will be flagged as potentially having a negative bias. In such cases, another sample may need to be collected.
- Close the canister valve. Record the date and time that sample collection was stopped
- Remove the flow controller from the canister
- Connect a NIST-traceable vacuum gauge to the canister and record the final canister vacuum. Remove the vacuum gauge and attach the brass or plastic protective plug to the canister. As noted above, if there is no residual vacuum in the sample, the sample will be analyzed, but the results will be flagged as potentially having a negative bias. In such cases, another sample may need to be collected
- Attach labels/tags (sample name, time/date of sampling, *etc.*) to the canister as directed by the laboratory
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file
- Deliver or ship the samples to the laboratory within one business day of sample collection
- Seal the probe with a plastic cap.
- When decommissioning the sample probe (after the structure is no longer being monitored), seal the hole with polyurethane caulk, concrete or equal.

2.2.4 Indoor Air Sample Collection

Up to three indoor air samples will be collected from each structure concurrently with sub-slab soil vapor sampling during the initial sampling event. In all cases, at least one sample will be collected from the lowest inhabitable floor within the structure. In addition, another indoor air sample may be collected

from the first (*e.g.*, main) floor living area, or from uninhabitable crawlspace(s) (if present). Indoor samples will be collected by following the steps outlined below:

- Indoor air samples will be collected over a period of 24 hours.
- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (*e.g.*, using markers, fueling vehicles, *etc.*)
- Record weather information (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and indoor temperature and humidity at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (*e.g.*, a local airport)
- Identify sampling location(s) on a floor plan that also identifies locations of HVAC equipment, chemical storage areas, garages, doorways, stairways, sumps, drains, utility perforations, north direction, and separate footing sections
- Use an evacuated Summa® passivated (or equivalent) stainless-steel canister to collect the indoor air sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection (*i.e.*, 24 hours). The sampling flow rate should always be less than 0.2 lpm. The canisters will be individually certified as clean by the laboratory
- Place the canister at the sampling location. The sample should be collected from breathing height (*e.g.*, three to five feet above-ground). Either place the canister on a stable platform or attach a length of inert tubing to the flow controller inlet and support it such that the sample inlet will be at the proper height
- Remove the protective plug (either brass or plastic) from canister. Connect a NIST-traceable vacuum gauge to the canister and record the initial canister vacuum
- Remove the NIST-traceable vacuum gauge and connect the pre-calibrated flow controller to the canister
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge. A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form and sample form for each sample
- Completely open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge provided with the flow controller
- Photograph the canister and the area surrounding the canister
- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical). During monitoring, note the vacuum pressure on the gauge
- Stop sample collection after the scheduled duration of sample collected, but when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be analyzed, but the results will be flagged as potentially having a negative bias. In such cases, another sample may need to be collected
- Close the canister valve. Record the date and time that sample collection was stopped
- Remove the flow controller from the canister
- Connect a NIST-traceable vacuum gauge to the canister and record the final canister vacuum. Remove the vacuum gauge and attach the brass or plastic protective plug to the canister. As noted above, if there is no residual vacuum in the sample,

the sample will be analyzed, but the results will be flagged as potentially having a negative bias. In such cases, another sample may need to be collected

- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file
- Deliver or ship the samples to the laboratory within one business day of sample collection.

2.2.5 Outdoor (Ambient) Air Sample Collection

It is expected that one ambient air sample will be collected for each set of structures sampled in a general sample area (subject to sample schedule and owner/tenant approvals). Outdoor air samples will be collected by following the steps outlined below:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Select a location upwind of the building or other area that is being evaluated. If possible, select a location upwind of the structure(s).
- Record weather information as practicable (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and indoor temperature and humidity at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport or national weather service station).
- Use an evacuated Summa® (or equivalent) stainless-steel canister to collect the ambient air sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection (i.e., 24 hours). The sampling flow rate should always be less than 0.2 lpm. The canisters will be individually certified as clean by the laboratory.
- Place the canister at the sampling location. The sample should be collected from breathing height (e.g., 3 to 5 feet above ground); mount the canister on a stable platform such that the sample inlet will be at the proper height.
- Remove the protective plug (either brass or plastic) from canister. Connect a NIST-traceable vacuum gauge to the canister and record the initial canister vacuum.
- Remove the NIST-traceable vacuum gauge and connect the pre-calibrated flow controller to the canister. The flow controller inlet should be equipped with stainless steel tubing in the shape of a "button hook" that inverts the inlet downward. Attach a 35 mm polypropylene funnel or equivalent to the stainless tubing (near the canister inlet) to prohibit precipitation from entering the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge. A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form and sample form for each sample.
- Completely open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge provided with the flow controller.
- Photograph the canister and the area surrounding the canister.
- Document on a field form an outdoor plot sketch that indicates the building being sampled, streets, sampling location, location of potential outdoor air sources, north direction and paved areas. Also record pertinent observations such as odors, readings from field instrumentation, and significant activities in the vicinity that result in air emissions.

- Monitor the vacuum pressure in the canister routinely during sampling, when practical. During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be analyzed, but the results will be flagged as potentially having a negative bias. In such cases, another sample may need to be collected
- Close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister.
- Connect a NIST-traceable vacuum gauge to the canister and record the final canister vacuum. Remove the vacuum gauge and attach the brass or plastic protective plug to the canister. As noted above, if there is no residual vacuum in the sample, the sample will be analyzed, but the results will be flagged as potentially having a negative bias. In such cases, another sample may need to be collected
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection.

2.3 LABORATORY ANALYSIS AND DATA QA/QC

It is anticipated that sub-slab soil vapor, indoor air and outdoor air samples collected during each round of sampling during this pre-design assessment will be delivered by O'Brien & Gere personnel under chain of custody to ALS Environmental Laboratory Testing Services (ALS) located in Cincinnati, OH for analysis of eleven CVOCs (see Section 1.2) via USEPA Method TO-15 operated in select ion monitoring (SIM) mode. SIM analysis provides lower reporting limits than the routine TO-15 detection capabilities.

Sub-slab soil vapor samples will be collected in Summa® canisters batch-certified clean by ALS. Indoor air and outdoor air samples will be collected in Summa® canisters individually-certified clean by ALS. Sub-slab soil vapor, indoor air and outdoor air samples submitted for analysis will be processed on a standard laboratory turn-around time. The laboratory will be instructed to provide a Level 3 or Contract Laboratory Protocol (CLP)-like data package that will allow for future data validation efforts, if required.

2.4 DATA EVALUATION AND SCREENING

Upon receipt of final analytical results from the laboratory for all media sampled, O'Brien & Gere will tabulate the data and evaluate the results for each structure independently as follows pursuant to the technical approach described in Section 2 above and as illustrated in **Tables 2 and 3**.

- Classification of structures sampled into groups for decision-making purposes based on concentrations of COCs observed in sub-slab soil vapor and indoor air samples relative to their respective screening levels, as illustrated in Figure 4 and described further as follows:
 - » **Mitigation Warranted**
 - › COC concentrations greater than or equal to the screening level for PCE and/or TCE in indoor air **AND** also greater than or equal to the corresponding screening level for PCE and/or TCE in sub-slab soil vapor (complete VI pathway).
 - » **No Further Action Recommended**
 - › COC concentrations < 75% of the screening level for PCE and/or TCE in sub-slab soil vapor regardless of corresponding indoor air concentrations **UNLESS**, using a "multiple

lines of evidence approach,” site-specific factors (e.g., earthen floors, laid-up stone walls) suggest that SVI may otherwise be occurring, in which case additional monitoring may be warranted.

» **Additional Monitoring Warranted**

- › COC concentrations greater than the screening level for PCE and/or TCE in sub-slab soil vapor and corresponding indoor air concentrations between 25 and 99% of their respective indoor air screening levels (potential for VI pathway)
- › COC concentrations \geq 75% (but less than 100%) of the screening value for PCE and/or TCE in sub-slab soil vapor **AND** corresponding indoor air concentrations \geq 75% (but less than 100%) of indoor air screening levels (potentially complete VI pathway).

For structures identified as requiring mitigation, O'Brien & Gere will follow the steps outlined in the Design Mitigation Work Plan, submitted to Ohio EPA under separate cover. It is envisioned that this second phase of work would be performed concurrently with the additional monitoring that would be performed for those structures that have not been identified as requiring mitigation or cannot otherwise be removed from the program, according to the criteria above.

2.5 SUBSEQUENT SUB-SLAB SOIL VAPOR, INDOOR AND OUTDOOR AIR MONITORING

For structures exhibiting sub-slab soil vapor and indoor air analytical results (from the first set of samples) which place them in the “Additional Monitoring Warranted” category, O'Brien & Gere proposes to conduct another round of monitoring of sub-slab soil vapor, indoor air and outdoor air. The proposed additional monitoring, which will be performed in accordance with this Work Plan, will be conducted over the course of an additional two consecutive heating/cooling seasons.

Data collected during these proposed sampling events will be evaluated to identify whether SVI is occurring within these structures at a level of concern (as defined in the criteria above).

The proposed mitigation of residential structures will be conducted as a separate/second phase of work, and will be documented in accordance with the Design Mitigation Work Plan. Consistent with that document, structure-specific designs and specifications will be prepared for those structures requiring mitigation. These designs and specifications will be appended to the Design Mitigation Work Plan after review and approval by Ohio EPA and the property owner.

3. REPORTING

The results obtained during the two sampling events (heating season/summer season) will be documented in a Pre-Design Assessment Report that will be submitted to Unison and Ohio EPA within 120 days of the receipt of the last set of analytical data. The report will include, but is not limited to, the following:

- Map showing the sampling locations
- Tables summarizing the sub-slab soil vapor, indoor air, and outdoor air analytical results
- Discussion of the field activities, methods and results
- Identification of the residential structures that have proceeded to mitigation under the Design Mitigation Work Plan
- Discussion of the cumulative risk calculations performed for each residential structure that has not proceeded to mitigation under the Design Mitigation Work Plan
- Conclusions and recommendations.
- not inhibit GE's ability to communicate more

4. REFERENCES

1. *“Design Mitigation Work Plan”, prepared on behalf of Unison Industries, LLC, O’Brien & Gere Engineers, Inc., May 16, 2014 (as revised).*

3 “OSWER Final Guidance for Assessing and Mitigating the Vapor Intrusion Pathway From Sub-surface Sources to Indoor Air”, Draft, United States Environmental Protection Agency, April, 2013.
2. *“Sample Collection and Evaluation of Vapor Intrusion to Indoor Air – For Remedial Response and Voluntary Action Programs Guidance Document”, Ohio Environmental Protection Agency, May, 2010.*

TABLE OF CONTENTS

TABLE 1: [Illegible Table Title]

TABLE 2: [Illegible Table Title]

TABLE 3: [Illegible Table Title]

Table 1
Residential Properties With Structures for SVI Assessment

Map ID	Mailing Address	City
Area A		
1	2403 Dayton Xenia Rd	BEAVERCREEK OH 45434
BC#3	2441 Dayton Xenia Rd	BEAVERCREEK OH 45434
Area B		
2	2420 MAPLE ST	ALPHA OH 45301
3	2408 MAPLE DR	ALPHA OH 45301
4	2441 MAPLE ST	ALPHA OH 45301
5	PO BOX 9	ALPHA OH 45301
6	BOX 24	ALPHA OH 45301
7	2409 MAPLE ST	ALPHA OH 45301
8	2397 MAPLE ST	ALPHA OH 45301
10	2387 MAPLE ST	ALPHA OH 45301
11	2375 MAPLE ST PO BOX 76	ALPHA OH 45301
12	2390 PHIL HUBBLE DR	ALPHA OH 45301
13	PO BOX 64	ALPHA OH 45301
14	331 SUTTON RD	XENIA OH 45385
15	25 E SCHANTZ AVE	DAYTON OH 45409
16	742 ALPHA RD	ALPHA OH 45301
17	740 ALPHA RD	ALPHA OH 45301
19	738 ALPHA RD	ALPHA OH 45301
BC#13	PO BOX 32	ALPHA OH 45301
BC#15	410 MERRICK DR	BEAVERCREEK OH 45434
BC#17	2430 MAPLE DR	ALPHA OH 45301
BC#20	745 ALPHA RD	ALPHA OH 45301
BC#21	1113 CHRISTI CIR	BEAVERCREEK OH 45434
BC#26	2421 MAPLE DR	ALPHA OH 45301
Area C		
BC#5	472 Orchard Lane	ALPHA OH 45301
BC#6	PO Box 62	ALPHA OH 45301

**Table 2
Soil Vapor and Indoor Air Screening Matrix for
Tetrachloroethene (PCE)**

Sub-Slab Soil Vapor Concentration (ug/m ³)	Indoor Air Concentration PCE (ug/m ³)			
≥ 626	≥ 9.4	< 7.1	≥ 2.4, < 9.4	≥ 7.1, < 9.4
≥ 313, < 626	Mitigate immediately	Monitor*	Monitor	Monitor
< 313, ≥ 235	Mitigate	NFA	NFA	NFA
< 235	Monitor/Mitigate*	NFA	NFA	Monitor
	NFA/Monitor*	NFA	NFA	Monitor

Notes:

- Indoor air matrix values are based on United States Environmental Protection Agency Regional Screening Levels for Residential Indoor Air (based on a 10⁻⁶ Risk Level)
 - Residential soil vapor screening level calculated using a soil-vapor-to-indoor air attenuation factor of 0.03
- * A decision to categorize a structure as no further action recommended, continue monitoring or mitigate would be based on site-specific conditions using a multiple-lines-of-evidence approach as to whether vapor intrusion is the cause of elevated indoor air concentrations

ug./m³ = micrograms per cubic meter

PCE = tetrachloroethene

NFA = No further action

**Table 3
Soil Vapor and Indoor Air Screening Matrix for
Trichloroethene (TCE)**

Sub-Slab Vapor Concentration TCE (ug/m ³)	Indoor Air Concentration TCE (ug/m ³)			
	≥ 0.43	< 0.43	≥ 0.11, < 0.43	< 0.11
≥ 28	Mitigate immediately	Monitor*	Monitor	Monitor
≥ 14, < 28	Mitigate			NFA
< 14, ≥ 11	Monitor/Mitigate*		NFA	
< 11	NFA/Monitor*	NFA		Monitor

Notes:

- Indoor air matrix values are based on United States Environmental Protection Agency Regional Screening Levels for Residential Indoor Air (based on a 10⁻⁶ Risk Level)
- Residential soil vapor screening level calculated using a soil-vapor-to-indoor air attenuation factor of 0.03
- * A decision to categorize a structure as no further action recommended, continue monitoring or mitigate would be based on site-specific conditions using a multiple-lines-of-evidence approach as to whether vapor intrusion is the cause of elevated indoor air concentrations
ug /m³ = micrograms per cubic meter
TCE = trichloroethene
NFA = No further action

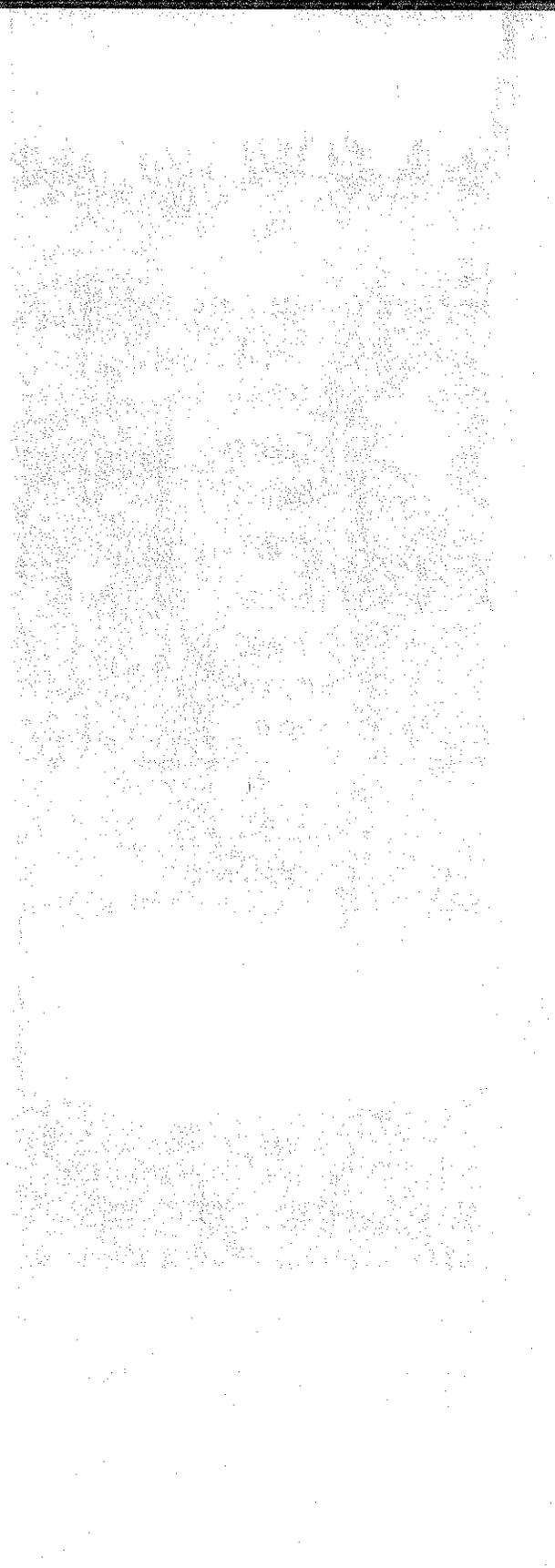
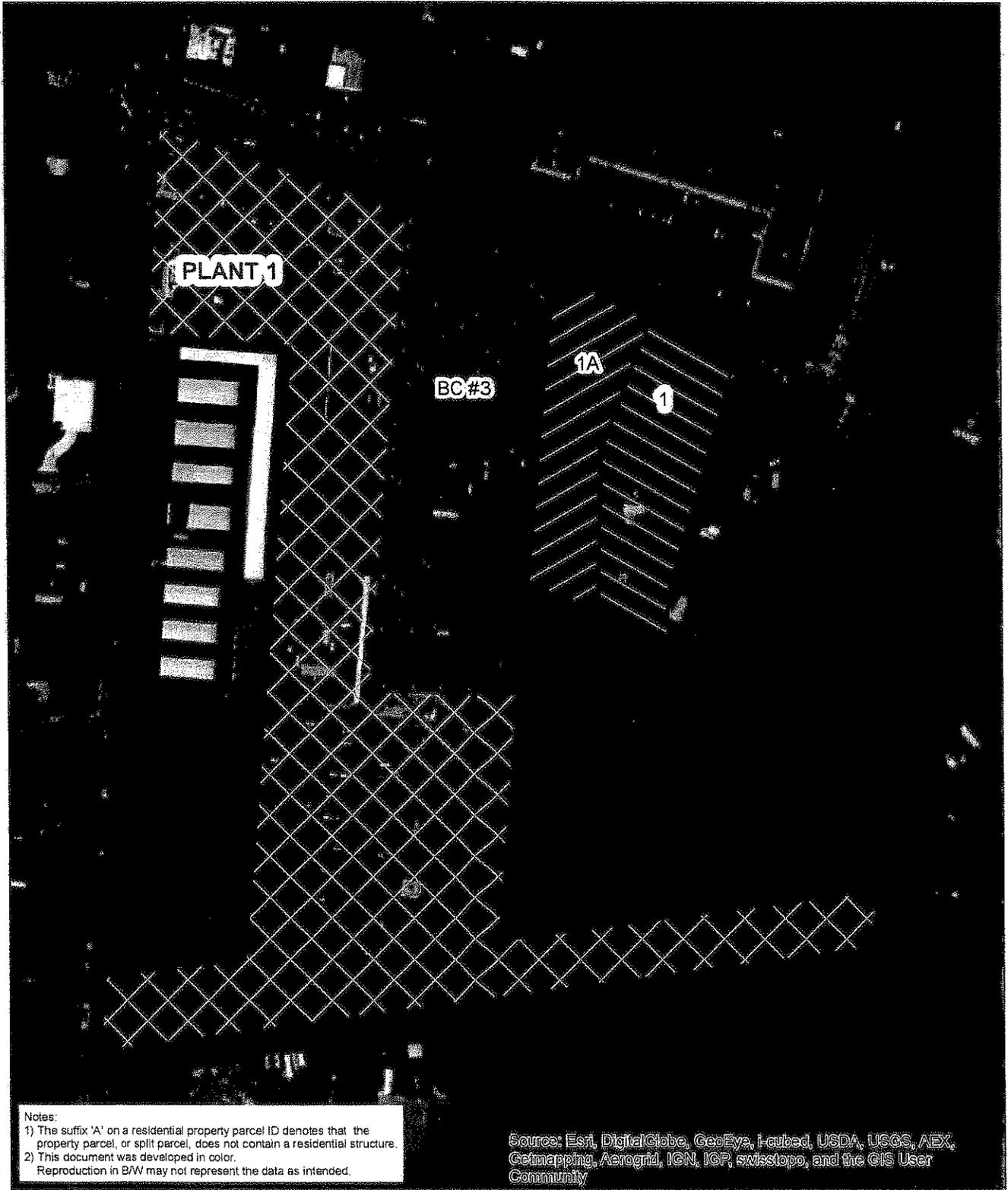


FIGURE 1

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PLOTDATE: 05/14/13 ON:ellium



Notes:
 1) The suffix 'A' on a residential property parcel ID denotes that the property parcel, or split parcel, does not contain a residential structure.
 2) This document was developed in color.
 Reproduction in B/W may not represent the data as intended.

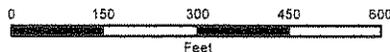
Source: Esri, DigitalGlobe, GeoEye, I-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

LEGEND

-  PLANT 1
-  RESIDENTIAL PROPERTY WITH STRUCTURES (POTENTIALLY IMPACTED PER BROWN AND CALDWELL)
-  RESIDENTIAL PROPERTY WITH STRUCTURES (NOT PREVIOUSLY IDENTIFIED)
-  RESIDENTIAL PROPERTY WITHOUT STRUCTURES (NOT PREVIOUSLY IDENTIFIED)

**FORMER ELANO CORPORATION SITES
 ALPHA, OHIO**

**SITE LAYOUT
 AREA A**

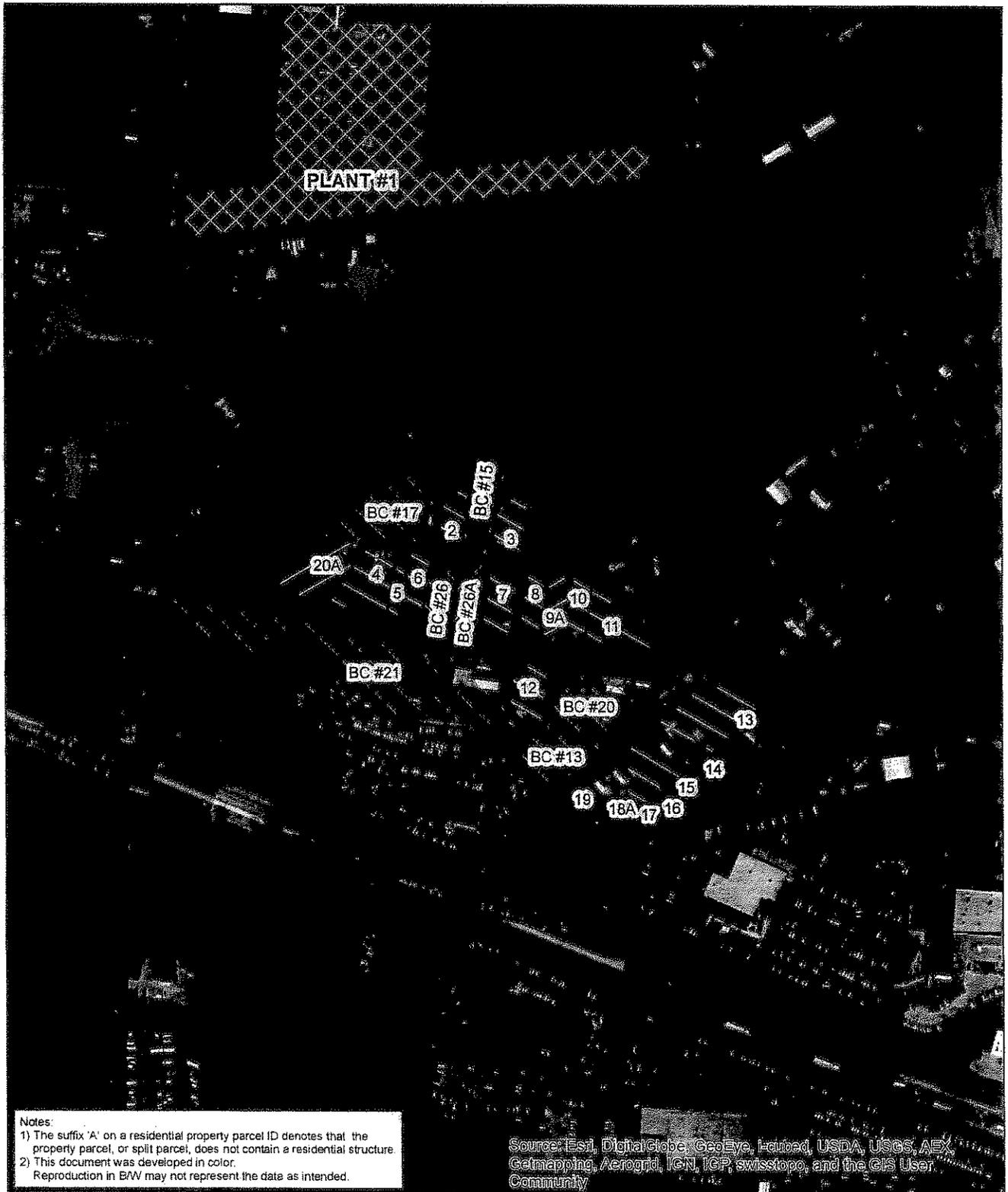


DECEMBER 2013



FIGURE 2

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Notes:
 1) The suffix 'A' on a residential property parcel ID denotes that the property parcel, or split parcel, does not contain a residential structure.
 2) This document was developed in color.
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Source: Esri, DigitalGlobe, GeoEye, Earthstar, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

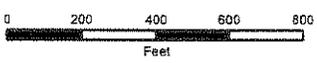
PLOT DATE: 05/14/13 ONHELIUM

LEGEND

-  PLANT 1
-  RESIDENTIAL PROPERTY WITH STRUCTURES (POTENTIALLY IMPACTED PER BROWN AND CALDWELL)
-  RESIDENTIAL PROPERTY WITHOUT STRUCTURES (POTENTIALLY IMPACTED PER BROWN AND CALDWELL)
-  RESIDENTIAL PROPERTY WITH STRUCTURES (NOT PREVIOUSLY IDENTIFIED)
-  RESIDENTIAL PROPERTY WITHOUT STRUCTURES (NOT PREVIOUSLY IDENTIFIED)

**FORMER ELANO CORPORATION SITES
 ALPHA, OHIO**

**SITE LAYOUT
 AREA B**



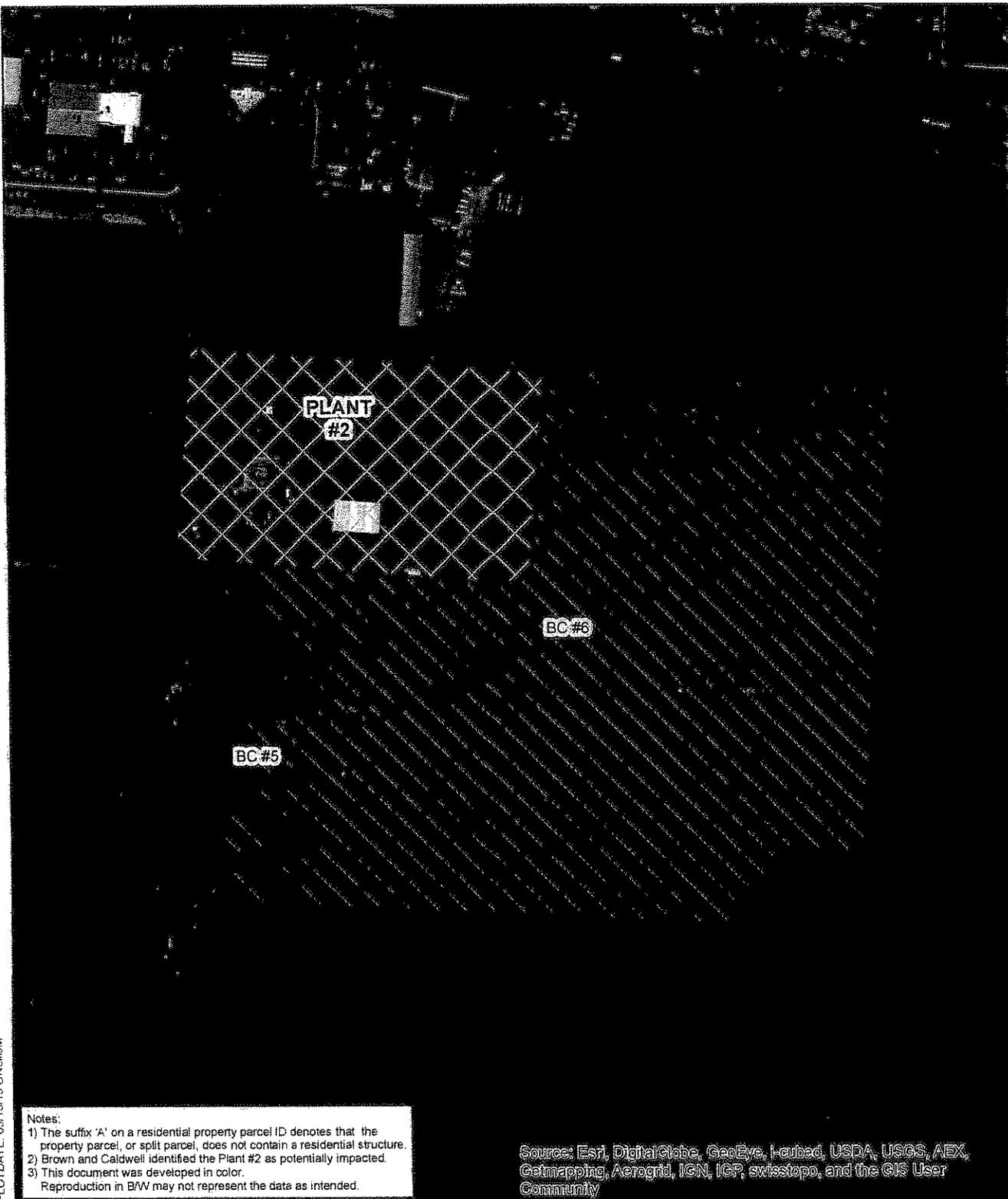
DECEMBER 2013



FIGURE 3

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PLOTDATE: 05/13/13 ON:ellim



Notes:
 1) The suffix 'A' on a residential property parcel ID denotes that the property parcel, or split parcel, does not contain a residential structure.
 2) Brown and Caldwell identified the Plant #2 as potentially impacted.
 3) This document was developed in color.
 Reproduction in B/W may not represent the data as intended.

Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

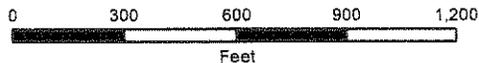
LEGEND

-  PLANT 2
-  RESIDENTIAL PROPERTY WITH STRUCTURES (POTENTIALLY IMPACTED PER BROWN AND CALDWELL)

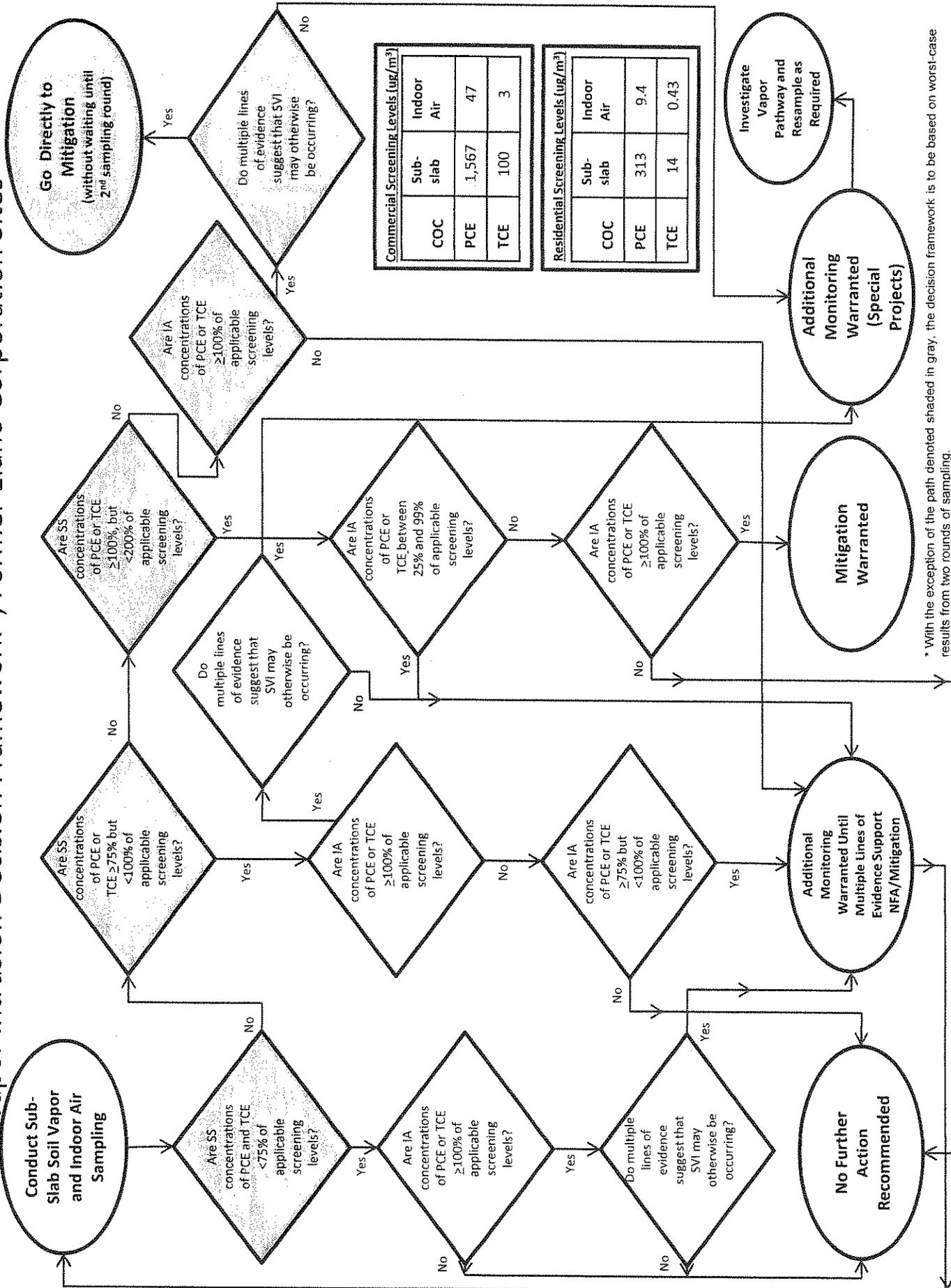
FORMER ELANO CORPORATION SITES
 ALPHA, OHIO

**SITE LAYOUT
 AREA C**

DECEMBER 2013



Vapor Intrusion Decision Framework*, Former Elano Corporation Sites



Commercial Screening Levels (ug/m³)

	Sub-slab	Indoor Air
COC	1,567	47
PCE	100	3
TCE		

Residential Screening Levels (ug/m³)

	Sub-slab	Indoor Air
COC	313	9.4
PCE	14	0.43
TCE		

* With the exception of the path denoted shaded in gray, the decision framework is to be based on worst-case results from two rounds of sampling.

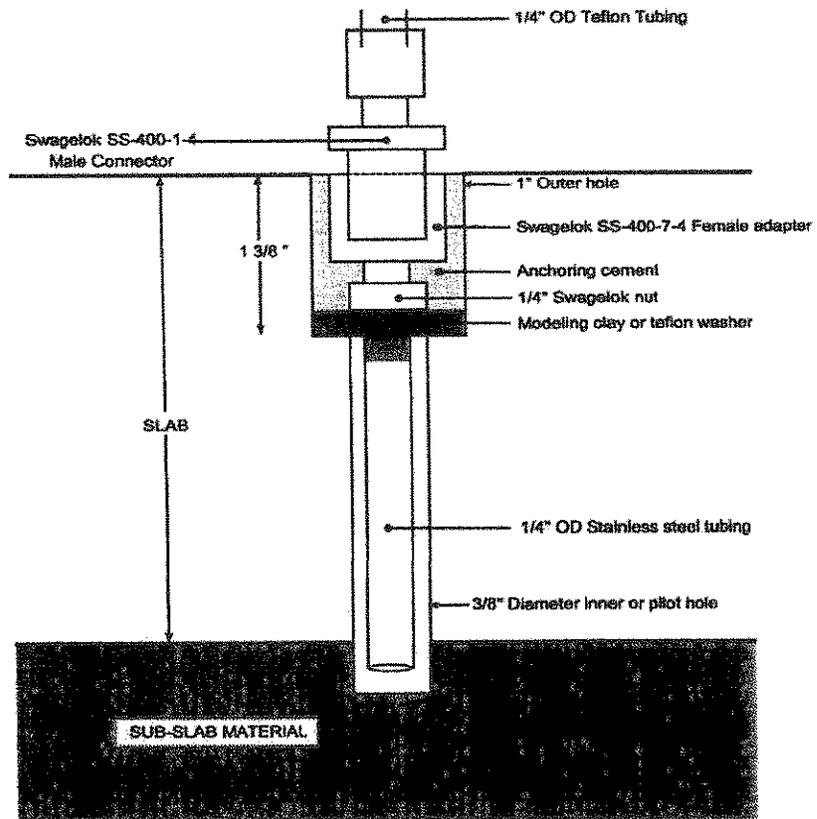


Figure 5: Example of a Sub-slab Soil Gas Probe

(adapted from May 2010 Guidance Document below)

Sample Collection and Evaluation of Vapor Intrusion to Indoor Air
 Guidance for Ohio EPA's Remedial Response and Voluntary Action Programs

*Standard Operating
Procedures*

SUB-SLAB/SOIL VAPOR TRACER GAS TEST PROCEDURES

This set of procedures outlines the general steps to complete tracer gas testing on sub-slab vapor samples and should accompany sub-slab vapor sample collection procedures.

TRACER GAS EVALUATION

A tracer gas evaluation provides a means to evaluate the integrity of the sub-slab vapor probe seal and assess the potential for introduction of ambient air into the sub-slab vapor sample. The following tracer gas testing procedure uses in-field tracer gas measurements and tracer gases (*e.g.*, helium) that can be measured by portable detectors.

- After the temporary probe has been installed, sealed and purged, place a chamber (such as a plastic container or bucket) over the sample location.
- Retain helium tracer gas around the sub-slab sample location by filling the chamber with helium gas.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting or equivalent (*e.g.*, pinch clamp) at the bottom to let the ambient air out while introducing tracer gas. A tracer gas detector will be attached to the valve fitting at the bottom of the chamber to verify the presence of the tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >50%.
- The chamber will have a gas-tight fitting or sealable penetration to allow the sub-slab vapor sample tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract soil vapor at a rate of no more than 0.2 lpm. Using the pump, draw a suitable volume of sub-slab soil gas into the Tedlar bag (the volume should be great enough to achieve a stable value on the helium detector).
- Use the tracer gas detector to measure the tracer gas concentration in the Tedlar Bag.
- Record the tracer gas concentrations in the chamber and in the sub-slab vapor sample.

If the evaluation indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement of the sample collection. A non-detectable level of tracer gas is preferred; however, if the evaluation indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated during the data validation process and in the sampling report.

Once acceptable tracer gas results are achieved and documented, connect the probe (tubing) to the flow controller and sample canister and proceed with sub-slab vapor sample collection procedures.

Note that methane can produce a false-positive reading on many helium analyzers. If methane is present in the sub-slab material, alternative forms of tracer gas testing should be considered (*e.g.*, liquid tracers or sulfur hexafluoride).

AMBIENT AIR SAMPLE COLLECTION PROCEDURES

This set of procedures outlines the general steps to collect ambient air samples. The project-specific work plan and Quality Assurance Project Plan (QAPP) should be consulted for proposed sample locations and sampling duration.

The following procedures will be followed for the collection of ambient air samples:

- ☒ Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- ☒ Select a location upwind of the building or other area that is being evaluated. If possible, select a location upwind and near the HVAC air intake for the building being sampled.
- ☒ Record weather information (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and indoor temperature and humidity at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- ☒ Use an evacuated Summa[®] passivated (or equivalent) stainless-steel canister to collect the ambient air sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be individually certified as clean by the laboratory.
- ☒ Place the canister at the sampling location. The sample should be collected from breathing height (e.g., 3 to 5 feet above ground); mount the canister on a stable platform such that the sample inlet will be at the proper height.
- ☒ Remove the protective plug (either brass or plastic) from canister. Connect a NIST traceable vacuum gauge to the canister and record the initial canister vacuum.
- ☒ Remove the NIST traceable vacuum gauge and connect the pre-calibrated flow controller to the canister. The flow controller inlet should be equipped with stainless steel tubing in the shape of a "button hook" that inverts the inlet downward. Attach a 35 mm polypropylene funnel or equivalent to the stainless tubing (near the canister inlet) to prohibit precipitation from entering the canister.
- ☒ Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge. A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling, refer to the project-specific QAPP for further direction. Record these numbers and values on the chain-of-custody form and sample form for each sample.
- ☒ Completely open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge provided with the flow controller.
- ☒ Photograph the canister and the area surrounding the canister.
- ☒ Document on a field form an outdoor plot sketch that indicates the building being sampled, streets, sampling location, location of potential outdoor air sources, north direction and paved areas. Also record pertinent observations such as odors, readings from field instrumentation, and significant activities in the vicinity that result in air emissions.

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AMBIENT AIR SAMPLE COLLECTION PROCEDURES – CONT'D

- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical). During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, refer to the project specific QAPP for further direction.
- Close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister.
- Connect a NIST traceable vacuum gauge to the canister and record the final canister vacuum. Remove the vacuum gauge and attach the brass or plastic protective plug to the canister.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping) when applicable.

INDOOR AIR SAMPLE COLLECTION PROCEDURES

This set of procedures outlines the general steps to collect indoor air samples. The project-specific work plan and Quality Assurance Project Plan (QAPP) should be consulted for proposed sampling locations and other indoor air sampling requirements (inventory, etc.).

Indoor air samples will be collected by following the steps outlined below:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Record weather information (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and indoor temperature and humidity at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Identify sampling location(s) on a floor plan that also identifies locations of HVAC equipment, chemical storage areas, garages, doorways, stairways, sumps, drains, utility perforations, north direction, and separate footing sections
- Use an evacuated Summa® passivated (or equivalent) stainless-steel canister to collect the indoor air sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be individually certified as clean by the laboratory.
- Place the canister at the sampling location. The sample should be collected from breathing height (e.g., 3 to 5 feet above ground). Either place the canister on a stable platform or attach a length of inert tubing to the flow controller inlet and support it such that the sample inlet will be at the proper height.
- Remove the protective plug (either brass or plastic) from canister. Connect a NIST traceable vacuum gauge to the canister and record the initial canister vacuum.
- Remove the NIST traceable vacuum gauge and connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge. A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling, refer to the project-specific QAPP for further direction. Record these numbers and values on the chain-of-custody form and sample form for each sample.
- Completely open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge provided with the flow controller.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical). During monitoring, note the vacuum pressure on the gauge.
- Complete the building survey and chemical survey form.

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INDOOR AIR SAMPLE COLLECTION PROCEDURES – CONT'D.

- Stop sample collection after the scheduled duration of sample collected, but when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, refer to the project specific QAPP for further direction.
- Close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister.
- Connect a NIST traceable vacuum gauge to the canister and record the final canister vacuum. Remove the vacuum gauge and attach the brass or plastic protective plug to the canister.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping) when applicable.

SOIL VAPOR INTRUSION ASSESSMENT – WORK PLAN

SUB-SLAB VAPOR SAMPLE COLLECTION PROCEDURES

This set of procedures outlines the general steps to collect sub-slab vapor samples. The project-specific work plan and Quality Assurance Project Plan (QAPP) should be consulted for proposed sample locations, sample depths, and sampling duration.

SUB-SLAB VAPOR PROBE INSTALLATION

Temporary sampling probes will be installed using the following procedures:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (*e.g.*, using markers, fueling vehicles, *etc.*).
- If appropriate, record weather information (temperature, barometric pressure, rainfall, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (*e.g.*, a local airport).
- Identify sampling location(s) on a floor plan that also identifies any slab breeches (*e.g.*, utility penetrations, sumps, drains, and cracks) and locations of HVAC equipment.
- Insert a section of food-grade (inert) Teflon® or other appropriate tubing through a 3/8-inch (approx.) hole drilled through the slab. If necessary, advance the drill bit 2 to 3 inches into the sub-slab material to create an open cavity.
- Install the tubing inlet to the specified sampling depth below the slab, not to exceed 2 inches.
- Seal the annular space between the hole and tubing using 100% beeswax or another inert, non-shrinking sealing compound such as permagum®.

SUB-SLAB VAPOR SAMPLE COLLECTION

Sub-slab vapor samples will be collected by following the steps outlined below.

- Purge the tubing using a vacuum pump or gas-tight syringe (~60 cc). Calculate the volume of air (volume = $\pi r^2 h$) in the tubing and purge one to three tubing volumes prior to sample collection at a rate no greater than 0.2 liter per minute (lpm).
- Use an evacuated Summa® passivated (or equivalent) canister to collect the sub-slab vapor sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be batch or individually certified as clean by the laboratory.
- Remove the protective brass or plastic plug from canister. Connect a NIST traceable vacuum gauge to the canister and record the initial canister vacuum.
- Remove the NIST traceable vacuum gauge and connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge. A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling, refer to the project-specific QAPP for further direction. Record these numbers and values on the chain-of-custody form and sample form for each sample.
- Connect the tubing from the sub-slab vapor sampling probe to the flow controller using a nut and ferrule set.

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SUB-SLAB VAPOR SAMPLE COLLECTION PROCEDURES – CONT'D

- Completely open the valve on the canister. Record the time that the valve is opened (beginning of sampling) and the canister pressure on the vacuum gauge provided with the flow controller.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical).
- Complete the appropriate building survey and chemical survey form.
- Stop sample collection after the scheduled duration of sample collected, but when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, refer to the project specific QAPP for further direction.
- Close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister.
- Connect a NIST traceable vacuum gauge to the canister and record the final canister vacuum. Remove the vacuum gauge and attach the brass or plastic protective plug to the canister.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping) when applicable.
- For temporary probes, remove and discard the probe (tubing). Seal the slab hole with polyurethane caulk, concrete or equal.

Field Forms



Multiple Vapor Intrusion Sampling Form

Project # _____	Date _____
Project Name _____	Collector _____
<u>Structure Location</u> _____	<u>Sample Locations</u> _____
PID/FID meter ID _____	_____
Sample Duration (Intended) _____	_____

<u>Indoor Air Sample</u>	<u>Sub-structure Sample</u>	Circle Sample Type: <u>Indoor Air</u>
		<u>SS-DUP</u> <u>Ambient</u> <u>IA-DUP</u>
Sample ID _____	Sample ID _____	Sample ID _____
Canister ID _____	Canister ID _____	Canister ID _____
Flow Controller ID _____	Flow Controller ID _____	Flow Controller ID _____
Date/Time start _____	Date/Time start _____	Date/Time start _____
Date/Time end _____	Date/Time end _____	Date/Time end _____
Gauge prior to start _____	Gauge prior to start _____	Gauge prior to start _____
Start pressure _____	Start pressure _____	Start pressure _____
End pressure _____	End pressure _____	End pressure _____
Complete all that apply:	Complete all that apply:	Complete all that apply:
Air temperature (°F) _____	Air temperature (°F) _____	Air temperature (°F) _____
PID/FID reading _____	PID/FID reading _____	PID/FID reading _____
in. tubing used _____	in. tubing used _____	in. tubing used _____
Tubing purged? _____	Tubing purged? _____	Tubing purged? _____
	Chamber tracer gas concentration: _____	
	Tracer gas concentration during purging: _____	
<u>For indoor location:</u>	<u>For indoor location:</u>	<u>For outdoor location:</u>
Noticeable odor _____	Noticeable odor _____	Noticeable odor _____
Intake height above floor (in) _____	Floor slab depth _____	Distance to road (ft) _____
Floor surface type _____	Intake depth below floor (in) _____	Direction to closest building (degrees) _____
Room _____	Floor surface type _____	Distance to closest building (ft) _____
Story/level _____	Room _____	Intake height above ground level (in) _____
	Story/level _____	

Building Survey and Chemical Inventory Form Completed? _____

Photographs Taken? _____

Comments: _____

Analytical method required _____

Laboratory used _____



Indoor Air Quality Building Survey

Date:
Collector:
Affiliation: O'Brien & Gere

Access Contact:
Phone:
Best time to contact:
Owner [] Renter [] Other []
Address:
Tax ID:
Access Agreement Signed?:

Date built
Yrs. of residence
No. of occupants
Building type: Residential [] Commercial []
School [] Church [] Industrial [] Other []

Check all that apply:

Ranch [] Cape [] 3-Family []
Raised Ranch [] Colonial [] Mobile Home []
2-Family [] Duplex [] Other (specify)
Apartments [] Condominium []

Above grade building construction

Wood frame [] Brick []
Poured concrete [] Concrete block []
Stone [] Other []

Foundation construction

Fieldstone [] Poured concrete []
Solid top concrete block [] Open top concrete block []
Slab on grade [] Other []

Is the owner aware of any additions made to the original design of the structure? (please specify)

[]

Utilities

Sewer: Public [] Private [] Other []
Water: Public [] Private [] Other []
Spring [] Well []
Hot water heater type: Gas [] Oil [] Electric [] Other []

Heating, ventilation, and air conditioning systems

Primary heat type: Hot air [] Hot water [] Steam radiator [] Electric [] Other []
Fuel type (heat): Natural gas [] Fuel oil [] Electric [] Wood [] Other []
Secondary heat type: Kerosene [] Wood stove [] Electric [] Propane [] Other []

Ventilation types: Attic fan [] Kitchen hood [] Bathroom fan [] Other []
Whole house fan [] Air filtration [] Induced fireplace [] Other []
Air conditioning: Window units [] Furnance unit [] Electric [] Other []



Indoor Air Quality Building Survey

Date:
Collector:
Affiliation: O'Brien & Gere

Basement type

None, Full, Half, Slab on grade, Vented crawlspace, Unvented crawlspace, Other

If slab on grade, is there a garage with occupied space above?

Basement depth below grade (feet)

Front, Rear, Side 1, Side 2

Basement characteristics

General: No. of rooms, Bathroom, Basement use; Floor: Earth, Concrete, Tile, Carpet, Other; Walls: Finished, Unfinished, Painted, Sheetrock, Other; Paneling, Tile, Insulated, Uninsulated

Check if present:

Fireplace, Sump pump, Floor drains, Interior walls, Elevator, Ash cleanout, Water damage, Jacuzzi/hot tub, French drain, Floor cracks, Wall cracks, Other

Does the basement have a moisture problem?
Does the basement ever flood? (specify frequency)
Is there water in the sump or drains?
Is there evidence of possible mold?
Does the basement have a radon system installed?
Has there been recent purchases of furnishings (carpets, rugs, linoleum, tile, or furniture) or remodeling (new construction, roofing, or floor stripping)? (please specify)

Chemical usage, exposure and storage

Identify occupant hobbies:

Painting, Stained glass, Jewelry making, Electronics, Woodworking, Furniture refinishing, Model making, Auto repair, Other

Where in the structure are these hobbies conducted?
Does the occupants' job require chemical exposure?
If so, where are the occupants clothes cleaned?
Has the structure been fumigated in the last year?
If so, is fumigation regularly performed? (how often)
Are pesticides frequently applied to lawn or garden?
If so, are they stored on the property?
Are dry-cleaned clothes kept in vicinity of sampling?
Is there smoking in the building?
Have cleaning products been used recently? (when & type)
Has painting/staining been done recently? (when & where)

