

SCANNED

Immediate Response Action Completion Report
General Chemical Corporation
91 Leland Street
Framingham, MA 01702
RTN #3-19174
VERTEX Proj. No: 4109

VERTEX

Prepared By:

VERTEX Engineering Services, Inc.
400 Libbey Parkway
Weymouth, Massachusetts 02189

July 8, 2002

Prepared For:

Mr. Roy Schwartz
Manager of Regulatory Compliance
General Chemical Corporation
133-138 Leland Street
Framingham, MA 01702

Submitted To:

Mr. Jefferey Chorman
Executive Office of Environmental Affairs
Massachusetts Department of
Environmental Protection
One Winter Street
Boston, Massachusetts 02108

Bell, Lauren (DEP)

SCANNED

From: Chormann, Jeffrey (DEP)
Sent: Monday, August 05, 2002 3:08 PM
To: Bell, Lauren (DEP)
Subject: RE: General Chemical, RTN 3-19174

After checking on this it appears that we did not require an LSP final opinion. The completion report is all we required. We agree with the conclusion of Vertex that the IRA can be closed out. If you need anything in writing from us to do that please let me know. Thanks

-----Original Message-----

From: Bell, Lauren (DEP)
Sent: Monday, August 05, 2002 1:59 PM
To: Chormann, Jeffrey (DEP)
Subject: RE: General Chemical, RTN 3-19174

For Intra Agency Policy Deliberations Only

Any word on this? I was out last week.

~~~~~  
 Lauren Bell lauren.bell@state.ma.us 978.661.7704

Bureau of Waste Site Cleanup  
 MA Department of Environmental Protection  
 Northeast Regional Office

Check out the DEP website at:  
<http://Mass.Gov/dep>

And the Searchable Sites Database at:  
<http://Mass.Gov/dep/bwsc/sites/report.htm>

-----Original Message-----

**From:** Chormann, Jeffrey (DEP)  
**Sent:** Wednesday, July 24, 2002 8:29 AM  
**To:** Bell, Lauren (DEP)  
**Cc:** Fine, Ralph (DEP); Carrigan, John (DEP)  
**Subject:** RE: General Chemical, RTN 3-19174

If I read this correctly we told them they do not need to submit LSP signed status reports under 40.0425. Since we were overseeing the work we didn't see the need for it. It does not appear that we exempted them from submitting a IRA completion statement w/LSP opinion under 40.0427(5). Generally we do not exempt our adequately regulated sites, who must perform an IRA, from this requirement since it closes the loop. Although it appears the "Department" has the authority to waive the submittal under 40.011 (2) I don't believe we did in this case. Although we always could have I suppose. I will check with my staff to see what our intent was this is the case and get back to you with a answer so we can get this straightened out. Part of the confusion may stem from the fact that GCC just switched consultants from GZA to Vertex.

John/Ralph: Do you recall any conversations with GZA or GCC about this? Ralph, can you find the letter referenced in our files. Thanks Jeff

-----Original Message-----

**From:** Bell, Lauren (DEP)  
**Sent:** Tuesday, July 23, 2002 6:23 PM  
**To:** Chormann, Jeffrey (DEP)  
**Subject:** General Chemical, RTN 3-19174

8/14/2002

**For Intra Agency Policy Deliberations Only**

BWSC-NERO received an IRA completion statement for this RTN from Vertex Engineering. I called Russell Fitzpatrick and told him that to get credit in BWSC's database, they should submit form 105. Sean Healey called back and stated there was an agreement with EOEa and they didn't have to send forms. I asked him to fax the information that verifies his statement. He sent a letter from DEP, signed by you, that states, "Since the Immediate Response Action is being performed under 310 CMR 40.0113, the LSP Opinion under 310 CMR 40.0425(3)(f) is not required..." I referenced these citations, the second of which is specific to IRA status reports, not completion statements. I'm confused; it seems like this means they still need the form (at least to be credited), but just no LSP Opinion. I realize the site is adequately regulated, and that they haven't sent any IRA forms since their plan was submitted on 2/29/00, but in this case does the completion statement need to be accompanied by a form? Thanks for any guidance.

---

Lauren Bell   lauren.bell@state.ma.us   978.661.7704

Bureau of Waste Site Cleanup  
MA Department of Environmental Protection  
Northeast Regional Office

Check out the DEP website at:  
<http://Mass.Gov/dep>

And the Searchable Sites Database at:  
<http://Mass.Gov/dep/bwsc/sites/report.htm>

8/14/2002



Massachusetts Office Address:  
400 Libbey Parkway  
Weymouth, MA 02189  
Phone: 781-952-6000  
Fax: 781-335-3543

**VERTEX** Engineering Services, Inc.

**FAX TRANSMITTAL**

To: **Lauren Belle**

Fax: **978-661-7615**

From: **Sean Healey**

Date: **7/12/02**

Re:

Pages:

CC:

☒ Urgent

☒ For Review

☐ Please Comment

☐ Please Reply

☐ Please Recycle

**Lauren**

**Enclosed is Letter from Executive Office.**

**Please call with any questions.**

**Sean**

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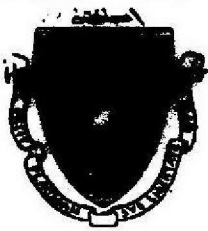
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COMMONWEALTH OF MASSACHUSETTS

EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

DEPARTMENT OF ENVIRONMENTAL PROTECTION

ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

ARGEO PAUL CELLUCCI  
Governor

JANE SWIFT  
Lieutenant Governor

BOB DURAND  
Secretary

LAUREN A. LISS  
Commissioner

CERTIFIED MAIL: P 134 892 108

March 9, 2000

Mr. Roy H. Swartz  
General Chemical Corporation  
P.O. Box 608  
Framingham, MA 01702

Release Tracking Number 3-19174

Re: General Chemical Corporation - Immediate Response Action Plan: Approval with Conditions.

Dear Mr. Swartz:

The Massachusetts Department of Environmental Protection, Bureau of Waste Prevention, Business Compliance Division (Department) has received the Immediate Response Action Plan dated February 16, 2000 (the IRA Plan) for General Chemical Corporation's (GCC) facility located at 133-135 Leland Street, Framingham, Massachusetts. The IRA Plan was prepared and submitted on behalf of GCC by GZA GeoEnvironmental, Inc. of Newton Upper Falls, Massachusetts. The Department, as provided by Section (B)(6)(f) of the facility's Hazardous Waste License, approves the IRA Plan with the following modifications:

- 1) The maintenance of an effective negative pressure within the extraction space (e.g., beneath the false floor) requires that this space be effectively isolated and sealed from the remainder of the structure, including the crawl space above. An effective seal also is necessary to minimize the potential for the venting system to cause back drafts in the combustion units in the home (furnace etc.).

GZA proposes to accomplish this by placing a polyethylene liner above the floor studs beneath the final plywood flooring. The IRA Plan does not provide details on how the polyethylene liner will be installed and sealed to the foundation walls or to structures that may penetrate the liner (piping, tank supports, foundation cracks, seams in the plywood floor, etc.). GCC shall seal the polyethylene liner as

This information is available in alternate format by calling our ADA Coordinator at (617) 574-6872.

DEP on the World Wide Web: <http://www.state.ma.us/dep>

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needed to create an effective seal between the extraction space and overlying crawl space. Any sealing and caulking materials used should not contain volatile organic compounds (VOCs).

- 2) Figure No. 2 of the IRA Plan shows an oil tank within the existing crawl space. GZA has indicated that the false floor will extend beneath the oil tank. However, the IRA Plan does not describe whether this will be accomplished by lifting the tank and placing it on the false floor or by constructing the floor around the existing tank without relocating it. Should the tank be lifted and placed on the false floor GCC shall assure that the floor is sufficiently reinforced to support the weight of the tank. If the floor is constructed around the existing base of the tank GCC shall take measures to seal the floor and polyethylene liner in the area of the tank as required by paragraph 1 above.
- 3) The IRA Plan provides for testing and monitoring to ensure the venting system is operating properly and not adversely impacting the home. One of the principle concerns is the potential for the occurrence of flue-gas "back drafting" as a result of the venting system operation. Therefore, in addition to the testing proposed in the IRA Plan GCC shall:
  - a) Install a carbon monoxide detector alarm within the living area;
  - b) Provide a quantitative<sup>1</sup> assessment of the venting system's impact on the air pressure/flow in the crawl space and living area of the home and of the venting system's impact (e.g., back drafting) on the operation of the furnace and water heater (if present);
  - c) Reevaluate the operation and impact of the venting system, in accordance with the IRA Plan and the provisions of this approval, within one week of the date of startup (excluding TO-14 sampling) and thereafter during each indoor air sampling round;
  - d) Conduct the initial TO-14 sampling to assess the venting system's effectiveness within two weeks of the system's startup and as proposed in the IRA Plan quarterly thereafter; and
  - e) Inspect the blowers, vents and crawl space monthly and determine that the equipment is functioning properly and maintaining the desired venting conditions.
- 4) GCC shall equip the venting systems with clearly identified and readily accessible emergency shutdown switches for use in the event the systems suffer mechanical or other problems.
- 5) GCC shall provide the Department with a Final Installation Report within forty-five (45) days of the date of conducting the initial TO-14 indoor air sampling after the system startup. The report shall detail the system installation and operation including but not necessarily limited to the following:
  - a) a plan or sketch outlining the locations of all system components and vacuum monitoring points;

<sup>1</sup> Quantitative assessment includes such methods as the use of manometers or magnehelic gauges to measure pressure differentials within the structure and combustion units and smoke testing.

- b) a brief account of field operations associated with the system installation and startup;
  - c) pre-startup air pressure and flow data;
  - d) post-startup data (e.g., smoke/pressure test data, flow rate readings) from the system;
  - e) a description of the backdraft evaluation and documentation that a backdraft situation is not occurring;
  - f) post-startup indoor air testing data (TO-14, carbon monoxide etc.);
  - g) the sound evaluation; and
  - h) an estimate of the potential yearly VOC emissions from the venting system.
- 6) GCC shall within sixty (60) days of the date of receipt of this approval provide the Department with an initial Implementation Status Report (ISR) containing the information required by 310 CMR 40.0425(3). Following submission of the first status report, additional ISRs shall be submitted to the Department every six months. Since the Immediate Response Action is being performed under 310 CMR 40.0113 the LSP Opinion under 310 CMR 40.0425(3)(f) is not required. and
- 7) Within seventy-two (72) hours of completing the startup testing GCC shall notify the Department's Boston Office and the residents if any significant problems (back drafting, noise etc.) are encountered that require a major redesign of the venting system. The initial notice may be either in writing or verbally and shall describe the problem and its significance. Within five (5) days of this initial notice GCC shall submit a written notice to the Department and the residents that includes a description of the problem, the steps GCC proposes to resolve it, and a schedule.

This Decision is issued pursuant to the authorities of M.G.L. c. 21C and 310 CMR 30.000, the Massachusetts Hazardous Waste Regulations and M.G.L. c. 21E and section 310 CMR 40.0113 of the Massachusetts Contingency Plan. This approval does not relieve GCC of its responsibility to comply with all other applicable State, Federal, and local statutes, regulations, and requirements.

Should you have any questions regarding this letter, please contact Mr. Ralph Fine at (617) 292-5866.

Sincerely,

  
Ralph Fine, LPG, Geologist

  
John A. Carrigan, CPG, EAIV

  
Verney B. Chormanh, Chief  
Assessment and Business Reporting Branch

**VERTEX<sup>SM</sup>**  
**Engineering Services, Inc.**

Massachusetts Office  
400 Libbey Parkway  
Weymouth, MA 02189  
Office (781) 952-6000  
Fax (781) 335-3543  
e.mail: vertex@vertexeng.com

July 8, 2002

Mr. Jefferey Chorman  
Executive Office of Environmental  
Massachusetts Department of  
Environmental Protection  
One Winter Street  
Boston, Massachusetts 02108

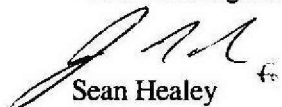
RE: **Immediate Response Action Completion Report**  
**General Chemical Corporation**  
**91 Leland Street**  
Framingham, MA 01702  
RTN # 3-19174


To Whom It May Concern:


VERTEX Engineering Services, Inc. (VERTEX) has been retained by General Chemical Corporation (GCC) to prepare an Immediate Response Action (IRA) Completion Report for the above referenced site. This document serves as an IRA Completion Report and is submitted to you in accordance with 310 CMR 40.0410. Please do not hesitate to contact us should you have any questions or comments. Thank you.

Sincerely,

VERTEX Engineering Services, Inc.

  
Sean Healey  
Project Manager

  
Russell Fitzpatrick, L.S.P., R.E.A.  
Vice President

  
Jaron Frieden  
Division Manager

Cc: Roy H. Schwartz, GCC  
Michael S. Persico, GCC (w/o attachment)  
Matt Hoagland, EPA Region I (w/o attachment)  
George P. King, Jr., City of Framingham (w/o attachment)  
Patricia Donahue and Nihar Mohanty, DEP/BWSC-NERO  
Reference Department, Framingham Public Library  
Dr. Mark C. Smith, Framingham School Administration (w/o attachment)

Susan Ruch and Al Nardone DEP-OGC  
Paul Hyman, AIG Technical Services  
Gary Basileco, Sithe New England  
Leon Latille, MWRA  
Robert T. Cooper, City of Framingham  
Gustav E. Pearson (w/o attachment)

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## FIGURES

Figure 1: Site Locus

Figure 2: Site Schematic

## APPENDICES

Appendix A: *Evaluation of Critical Exposure Pathways*  
91 and 91A Leland Street, Framingham, Massachusetts, GZA,  
November 2, 2001

## **1.0 GENERAL SITE AND SURROUNDING AREA DESCRIPTION**

The site is an unoccupied abandoned single story residential building located at 91 Leland Street in Framingham Massachusetts. The building contains a basement that has been partially filled with soil, leaving a crawl space of approximately four to five feet in height between the soil floor and the first floor joists overhead. The site parcel is zoned residential. The site is currently owned by GCC.

The site is bordered to the north by a residential property. A Boston Edison access road borders the site to the east, beyond which is undeveloped land and the GCC facility. Undeveloped land borders the site to the south. Wetlands border the site to the west. The site can be identified on the USGS Topographic map for the Framingham, Massachusetts Quadrangle. Please refer to Figure 1 – Site Locus.

## **2.0 RELEASE HISTORY**

GZA GeoEnvironmental, Inc. submitted an IRA Plan for the subject site to the MADEP in February 2000. As indicated within GZA's IRA Plan, concentrations of Volatile Organic Compounds (VOCs) were detected within groundwater samples collected from monitoring wells installed on the 19 Leland Street property. Due to the fact that VOC impacted groundwater was identified at concentrations greater than 5 mg/l of Total VOCs within 30 feet of the then occupied structure at 91 Leland Street (the site building), GZA concluded that a 72 hour reporting condition existed at the site and a Critical Exposure Pathway (CEP) may have existed within respect to potential vapor phase emissions to indoor air within the site building, warranting an IRA.

GZA's IRA Plan consisted of the installation of a false floor in the basement of the site building, the extraction of vapors beneath the floor and the discharge of the vapors to the outside of the site building. GZA also conducted ongoing air monitoring activities within the site building as part of ongoing monitoring.



### 3.0 VENTING SYSTEM IMPLEMENTATION AND MONITORING DATA

GZA has submitted the following reports to the MADEP:

- Final Installation Report, January 11, 2001
- IRA/IRS Status Reports, May, October and December 2000 and July 2001

These reports detail the venting system installation and on-going air monitoring activities conducted within the site building.

GZA also submitted a report entitled *Evaluation of Critical Exposure Pathways at 91 and 91A Leland Street* on November 11, 2001. This report summarizes the results of Venting System Operational Data, Air Monitoring Data as well as a Risk Evaluation. This report is attached as Appendix A.

As indicated within GZA's November 2, 2001 Report, an evaluation of the potential for a Critical Exposure Pathway (CEP) to have existed at the 91 Leland Street building (the site) was completed. This evaluation entailed ten (10) indoor and outdoor sampling events. As indicated within the report, GZA concluded that a CEP did not exist within the site building due to the fact that indoor air sampling data demonstrated that the measured contaminant of concern (COC) levels within the site building do not constitute either an Imminent Hazard or a Substantial Hazard and that indoor air sampling data indicated that the organic compounds detected were the result of confounding sources (sources other than groundwater). Therefore, GZA concluded a CEP did not exist.

#### **4.0 IRA ACTIVITIES SINCE LAST STATUS REPORT**

Residents of the 91 Leland Street property moved from the site building on May 10, 2002. The crawl space venting system was shut down at that time and the building secured. GCC currently owns the 91 Leland Street property and has no plans to utilize the building. The building will remain unoccupied and secured.

The site building is no longer occupied and is secured. As such, the potential Critical Exposure Pathway within respect to potential vapor phase emissions to indoor air within an occupied site building does not exist and there is no necessity to continue the IRA, as such the IRA is considered complete.

## **5.0 MANAGEMENT OF REMEDIATION WASTE**

No remediation waste has been generated to date at the site.

## **6.0 EVALUATION FOR IMMEDIATE RESPONSE ACTION**

Pursuant to 310 CMR §40.0412, Immediate Response Actions (IRAs) are required at the following sites:

- where a release or threat of release of oil and/or hazardous material has occurred which requires notification to the MADEP under the "Two Hour" notification provisions of 310 CMR §40.0311 or §40.0312;
- where a release or threat of release of oil and/or hazardous material has occurred which requires notification to the MADEP under the "72 Hour" notification provisions of 310 CMR §40.0313 or §40.0314;
- where a condition of Substantial Release Migration has been identified; and
- any other site where the MADEP determines that immediate or accelerated response actions are necessary to prevent, eliminate, or minimize damage to health, safety, public welfare or the environment.

Site conditions do not meet the requirements of a "Two Hour" condition.

Although previous site conditions initially triggered an IRA due to 72-hr. notification, current site conditions do not meet the requirements of an IRA.

The site building has been vacated and is not longer occupied and will not be occupied. Pursuant to 310 CMR §40.0412, VERTEX has determined that site conditions have been stabilized and that Imminent Hazards and Critical Exposure Pathways have been assessed, eliminated or controlled.

Based on the above, the IRA for 91 Leland Street is considered complete.

## **7.0 LISCENSED SITE PROFESSIONAL OPINION**

Per the requirements of DEP's March 9, 2000 letter (Item 6) an LSP Opinion is not required for this submittal; as such, a MADEP IRA Transmittal form is not included within this report. This letter and this report and the work described herein are subject to the limitations contained within this report.

## **8.0 CONCLUSIONS**

VERTEX offers the following conclusions:

The IRA for 91 Leland Street is considered complete due to the fact that the site building is no longer occupied and therefore there is no imminent hazards to health, safety, public welfare and the environment as described by 310 CMR 40.0321.

## 9.0 QUALIFICATIONS

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with customary principles and practices in the fields of environmental science and engineering. This warranty is in lieu of all other warranties either expressed or implied. VERTEX is not responsible for the independent conclusions, opinions or recommendations made by others based on the record review, site inspection, field exploration, and laboratory test data presented in this report.

It must be recognized that environmental activities are inherently limited in the sense that conclusions are drawn and recommendations developed from information obtained from limited research and site investigation. The passage of time may result in a change in the environmental characteristics at this site and surrounding properties. This report does not warrant against future operations or conditions, nor does this warrant operations or conditions present of a type or at a location not investigated.

The conclusions presented in this report are professional opinions based solely upon visual observations and supplemental testing of soil and/or groundwater at the site. Our interpretation of the available historical information and documents reviewed, as described in this report, were also considered in the conclusions. VERTEX relied upon but did not attempt to independently verify the validity or accuracy of the findings and conclusions noted in the documentation reviewed.

This report is intended for the sole use of GCC. The scope of services performed in execution of this investigation may not be appropriate to satisfy the needs of other users, and any use or re-use of this document or the findings, conclusions, or recommendations is at the risk of said user.



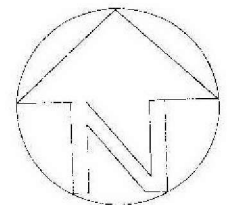
It should be noted that twenty percent (20%) of submittals with supporting documentation are audited by the Massachusetts Department of Environmental Protection ("the MADEP"). The MADEP may conduct Random Audits or Targeted Audits for up to five (5) years following the submission of an IRA Completion Statement. Under certain circumstances, as provided in 310 CMR 40.1110(3), there are no time constraints for Targeted Audits.

Due to the inherent flexibility in interpreting the applicable regulations, the Audits are often subjective and dependent on the opinion of the auditor. As a result, the auditor could require additional assessment of the site and/or remedial action. Based on these considerations, VERTEX is not and will not be responsible for costs or other possible ramifications of additional work required by the MADEP. GCC and any other parties with financial or other interests in the subject property are urged to consider these facts.

## FIGURES



USGS 7.5 x 7.5 minute Topographic Map, 1997  
 Framingham, Massachusetts  
 Contour Interval: 20 Feet



## SITE LOCUS MAP

91 Leland Street  
 Framingham, MA

SCALE: Not to Scale

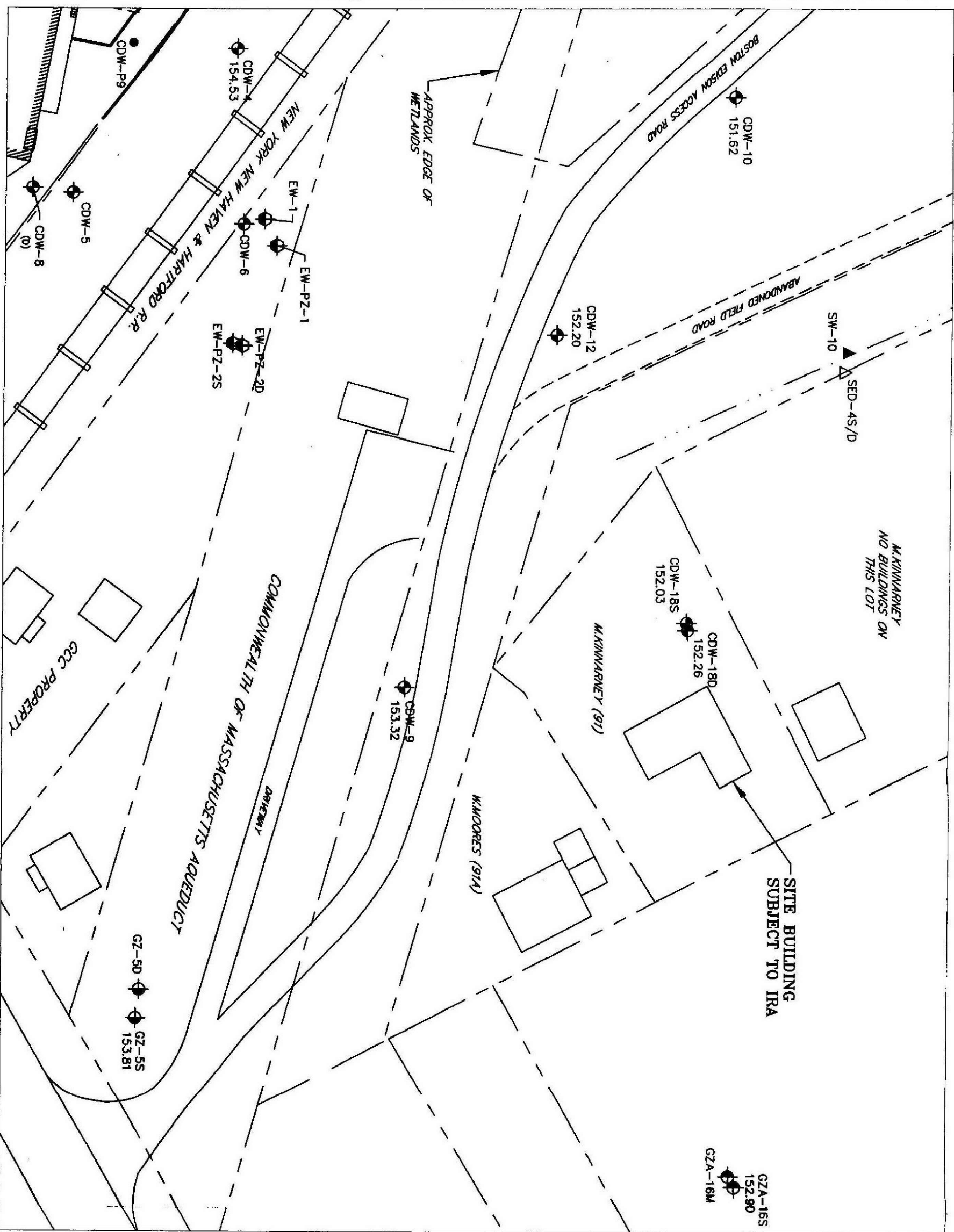
July 1, 2002

VERTEX Proj. No. 4109

**VERTEX**

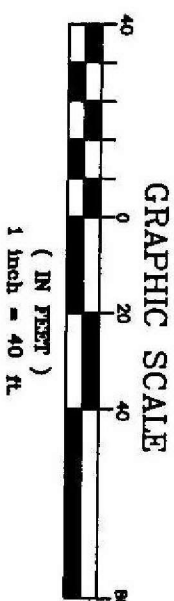
Engineering Services, Inc.

FIGURE NO. 1



# LEGEND

- MW-1 MONITORING WELLS LOCATION
- B-1 SOIL BORING LOCATION



**SITE SCHEMATIC**

General Chemical Company  
133-135 Leland Street  
Framingham, Massachusetts

SCALE : 1" = 40'

DATE: June 28, 2002


VERTEX PROJ. 4109

**VERTEX**

FIGURE NO. 2

## APPENDIX A

November 2, 2001  
File No. 15861.29-C, PC

 Mr. Jeffrey Chormann  
Executive Office of Environmental Affairs  
Department of Environmental Protection  
One Winter Street  
Boston, Massachusetts 02108

Re: General Chemical Corporation  
Evaluation of Critical Exposure Pathways  
91 and 91A Leland Street, Framingham, Massachusetts

Dear Mr. Chormann:

GZA GeoEnvironmental, Inc. (GZA) has prepared this letter on behalf of General Chemical Corporation (GCC) to request that the requirement for residential air sampling conducted as part of the Assessment Monitoring Program (AMP) be eliminated prior to the next AMP sampling round, which is tentatively scheduled<sup>1</sup> for November 2001. Additionally, GCC requests that permission be granted to shut down the crawl space venting system at 91 Leland Street. GCC requests these modifications due to substantial data demonstrating the absence of a Critical Exposure Pathway (CEP), as defined by the Massachusetts Contingency Plan (MCP), at the 91 Leland Street residence and the upcoming changes in occupancy of the 91A Leland Street residence. The rationale for these requests is provided in the following paragraphs.

## 91A LELAND STREET

A settlement was reached in October 2001 between the 91A Leland Street residents and GCC. Under this settlement, the residents will vacate the property no later than six months after executing the agreement. The property will remain unoccupied thereafter, removing human receptors from the residence. Without a human receptor, collection of indoor air samples and completion of quarterly Imminent Hazard and Substantial Hazard Evaluations are unnecessary<sup>2</sup>. Therefore, GCC requests that these requirements be eliminated for the 91A Leland Street residence.

<sup>1</sup> Pending execution of access agreement between Site and GCC.

<sup>2</sup> It is also noted that the ten rounds of air data collected indicate that the contaminants of concern found in this residence are primarily due to confounding sources, rather than as a result of migration from the groundwater. These data further demonstrate that a condition of No Significant Risk exists at this residence if the more technically appropriate PCE unit risk value is used (see discussion for 91 Leland Street, page 2).



## 91 LELAND STREET

The absence of a vapor migration pathway from groundwater to the indoor air of the 91 Leland Street residence has been demonstrated by data collected during ten AMP sampling rounds, four of which took place after start-up of the venting system, as well as ten monthly crawl space venting system monitoring rounds. The venting system was installed and became operational in November 2000 under an MCP Immediate Response Action (IRA) to mitigate a potential CEP from groundwater to indoor air at the residence. As described below, a CEP does not exist and operation of the venting system has no affect on indoor air quality.

### Crawl Space Venting System Operational Data

The lack of a complete VOC migration pathway from the groundwater to the indoor air is most clearly demonstrated through an understanding of venting system efficacy together with comparison of the indoor air data obtained before and after venting system installation. In summary, these data show that: 1) the venting system forms an effective barrier to VOC migration from the groundwater into the residence, and 2) given the preceding item 1 above, the lack of a reduction in interior VOC levels after venting system startup shows that measurable VOCs were not migrating up into the residence prior to system installation.

As documented in the System Installation Report and Implementation Status Reports/IRA Status Reports,<sup>3</sup> the system has been operating within nominal system parameters. Vacuum readings indicate that the venting system continues to maintain a negative pressure beneath the entire false floor in the channel between the two passive physical barriers (polymeric liners)<sup>4</sup>. This vacuum causes a downward advective flow direction from the crawl space into the false floor. As such, VOCs will not advect against the imposed airflow up into the crawl space from below the floor, even if imperfections were to exist in the passive physical barrier systems. In addition, the active venting system exchanges the air below the false floor at least once every six minutes. Therefore, if any VOCs are to penetrate the first polymeric membrane, they are swept from beneath the floor before they can diffuse upward through the second membrane (diffusion is also countered by the negative pressure maintained in the channel below the false floor). Given these design and operational features, it can be concluded that the system would be effective in preventing the hypothesized migration of VOCs from the groundwater into the crawl space.

However, if migration of VOCs from groundwater into the crawl space had been occurring prior to system installation, a reduction in VOC concentrations would be expected after the system was installed; this did not occur. Concentrations of constituents of concern (COCs) in the crawl space not only did not decrease after the venting system became operational, but, in some cases, increased. This behavior is most directly evident based on a comparison of samples taken just before and after system installation. In addition, concentrations of organic compounds on the first floor also showed an increase after venting system startup. Based on these data, it can be concluded that the presence of organic chemicals detected in the crawl space and the first floor,


<sup>3</sup> The first ISR/IRA Status Report was submitted on May 18, 2000. Each subsequent report was submitted as an attachment to the AMP reports (October 2000, December 2000 and July 2001).

<sup>4</sup> It is also noted that a concrete floor located beneath the two polymeric liners acts as a third physical barrier to VOC migration.



are not attributable to vapors migrating from the groundwater and must be attributable to confounding sources.<sup>5</sup> All of this demonstrates the absence of a measurable vapor migration pathway from groundwater to the indoor air of the 91 Leland Street residence, and thus the absence of a CEP.

#### First floor/crawl space comparison

 Six rounds of air samples were collected from the crawl space and first floor of the residence before venting system start-up on November 15, 2000. An additional round was conducted just after start up, followed by three additional quarterly AMP sampling rounds thereafter, through the most recent AMP round in July, 2001. The data (reported in the Basement Venting System Final Installation Report (GZA, 2001) and GZA's quarterly AMP Reports) have shown that concentrations of constituents of concern in air samples from the first floor of the residence have continued to generally exceed those detected in the crawl space, both prior to and after system installation<sup>6</sup>. DEP's Office of Research and Standards (ORS) suggested in 1999 that the detected contaminants may be from confounding sources other than the groundwater<sup>7</sup>. GZA's data, which are summarized for your convenience in the attached Figures 1 through 7 and Table 1, indicate that DEP's premise was correct. The elevated levels on the first floor relative to the crawl space of the residence are clearly attributed to confounding sources, and not vapor migration from the groundwater. If the origin of the VOCs was the groundwater, the crawl space concentrations should be generally higher than the first floor concentrations.

Finally, it is also noted that the average concentration measured for each COC falls below generally accepted residential background levels cited by GZA<sup>8</sup> and ORS<sup>9</sup>. This finding further supports the conclusion that the organic compounds found in the indoor air are from confounding sources such as typical household products and are not indicative of a Critical Exposure Pathway.

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<sup>5</sup> As indicated in GZA's AMP Reports, air quality technicians noted dry cleaning and various containers of household chemicals throughout the home, all of which are considered to be confounding sources.

<sup>6</sup> The site COCs all typically show higher concentrations on the first floor of the residence with the exception of PCE. PCE in crawl space air has consistently been slightly higher than on the first floor. However, as per the discussion above, PCE concentrations showed no change from pre-system startup to post-system operation.

<sup>7</sup> ORS, October 28, 1999, Review of Residential Indoor Air Sampling Results and an Imminent Hazard Evaluation of the General Chemical Corporation site in Framingham, Massachusetts.

<sup>8</sup> As discussed in the quarterly AMP reports, the measured COC concentrations were compared to background values developed by: 1) Wallace, L. A. The Total Exposure Assessment Methodology (TEAM) Study: Project Summary, EPA Research and Development. EPA/600/S6-87/002, September 1987. The value for the background air level measured represents the value found in Elizabeth-Bayonne, NJ residences; 2) Shah J, Singh, H. Distribution of Volatile Organic Chemicals in Outdoor and Indoor Air, A National VOCs Data Base. Environmental Science & Technology, Vol. 22, No. 12, 1988; and 3) Background Documentation for the Development of MCP Numerical Standards, indoor air background levels (Table 3.1), Massachusetts Department of Environmental Protection, 1994.

<sup>9</sup> ORS, October 28, 1999, Review of Residential Indoor Air Sampling Results and an Imminent Hazard Evaluation of the General Chemical Corporation site in Framingham, Massachusetts.

### Correlation Between Groundwater and Indoor Air Concentrations

Indoor air and groundwater samples from monitoring well CDW-18S (adjacent to 91 Leland Street) were collected concurrently during AMP sampling rounds. While the various COC concentrations in the groundwater show good correlation to each other over time, the temporal-varying concentrations found in the first floor air samples do not correlate to the temporal-varying concentrations observed in the groundwater (see Table 1 and Figures 1 through 7). It is further noted that many of the organic compounds found in the indoor air are not associated with the Site and have never been found in the groundwater. The groundwater monitoring rounds have therefore provided another set of data which supports the conclusion that the concentrations of chlorinated compounds measured in the indoor air at the residence are from sources other than the groundwater proximate to the house.

### Risk Evaluation

While a CEP is not risk based, it is important to note that over two years and ten rounds of indoor air sampling data demonstrate that the measured COC levels within the residence do not constitute either an Imminent Hazard or Substantial Hazard. The non-carcinogenic risk estimate calculated for residential receptors in this house is below the MADEP acceptable risk level of 1.0 for both subchronic and chronic indoor air exposures, under both the imminent hazard and substantial hazard scenarios. The carcinogenic risk estimates calculated for both the Imminent Hazard Evaluations (IHE) and Substantial Hazard Evaluations (SHE) at 91 Leland Street are also below the applicable DEP cancer risk limit of  $1 \times 10^{-5}$ . In addition, it is noted that PCE drives the risk evaluations and that the above findings were obtained using DEP's overly conservative unit risk factor for PCE<sup>10</sup>; this value increases the calculated risk by a factor of ten over that computed using the more up to date data. Therefore, if the more current and technically defensible value for PCE is used, the data also support a finding of No Significant Risk for indoor air exposure at this residence.

### **CONCLUSIONS**

In summary, the property at 91A Leland Street will be vacated within the next 6 months, removing the human receptor and negating the need for quarterly air sampling and IHE/SHEs. Additionally, based upon the data presented in the last four quarterly AMP Reports and reiterated herein, the IHE and SHE at 91 Leland Street are below action thresholds. Finally, the COCs measured in the residence are attributable to confounding sources and not to the presence of a measurable CEP from groundwater to indoor air. Therefore, with no CEP present, operation of the crawl space venting system is unnecessary. GCC therefore requests permission to eliminate air sampling at both residences, and to submit an IRA Closure Report for the venting system.

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<sup>10</sup> As described in GZA's October 2000 AMR, there are numerous concerns regarding the validity of DEP's unit risk value for PCE, especially with respect to the assumed metabolism percentage. GZA evaluated the published technical information relative to the unit risk values for PCE to assess which available value was based on the most up-to-date research and was derived using current scientific procedures. Based on our evaluation, GZA believes that the California EPA unit risk value contained the most technically accurate estimate of PCE metabolism in the liver.

On behalf of GCC, GZA welcomes the opportunity to discuss this with you further. Please do not hesitate to contact any of the undersigned at (781) 278-3700 if you have any additional questions or concerns.

Very truly yours,



GZA GEOENVIRONMENTAL, INC.

A handwritten signature in black ink, appearing to read 'Patricia A. Haederle'.

Patricia A. Haederle, C.P.G.  
Project Manager

A handwritten signature in black ink, appearing to read 'Albert J. Ricciardelli'.

Albert J. Ricciardelli, P.E.  
Consultant/Reviewer

A handwritten signature in black ink, appearing to read 'Matthew J. Barvenik'.

Matthew J. Barvenik, L.S.P.  
Senior Principal

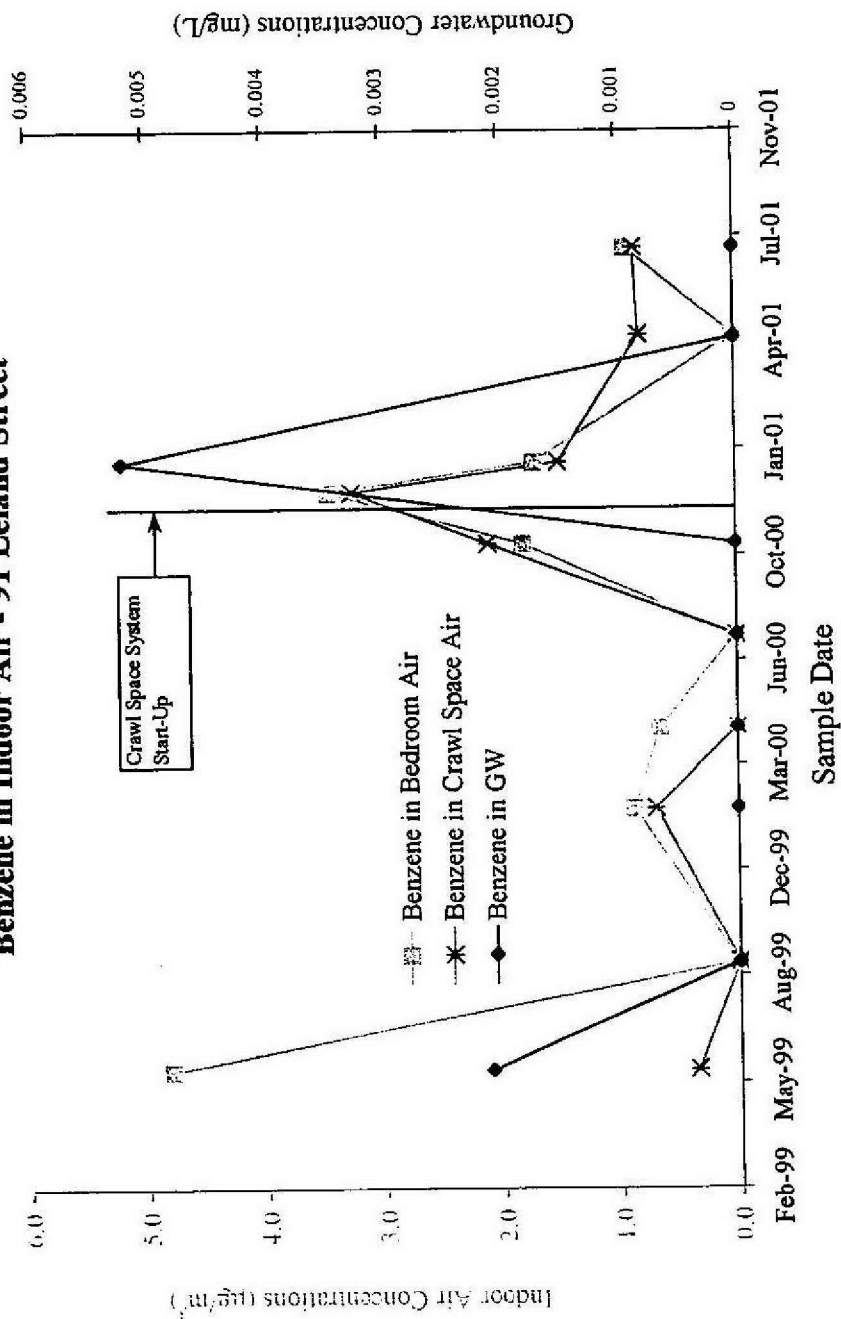
Attachments: Table 1  
Figures 1 through 7

cc: Roy H. Swartz and Michael S. Persico, GCC  
John Carrigan, DEP  
Ralph Fine, DEP  
Susan Ruch, DEP/OGC  
Patricia Donahue, DEP/BWSC-NERO  
Matt Hoagland, EPA-New England  
Michael P. Donegan, Donegan & Associates, Ltd.  
Thomas G. Fiore, Urbelis, Fieldsteel & Bailin  
Robert T. Cooper, Town of Framingham  
George P. King, Jr., Town of Framingham  
Gustav E. Pearson  
Leon Lataille, MWRA  
Paul Hyman, AIG Technical Services

# FIGURE 1 BENZENE CONCENTRATIONS AT 91 LELAND STREET

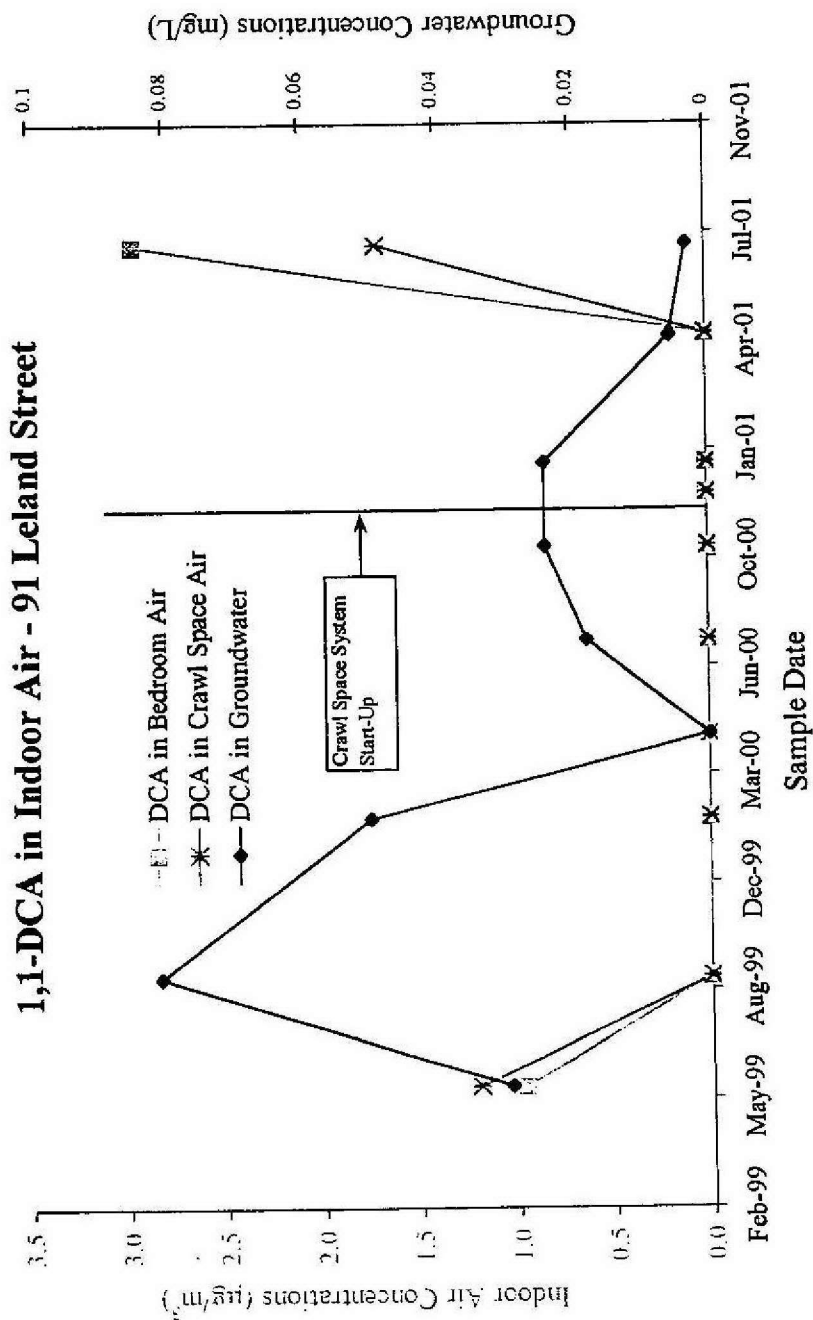
General Chemical Corporation  
Framingham, Massachusetts

## Benzene in Indoor Air - 91 Leland Street



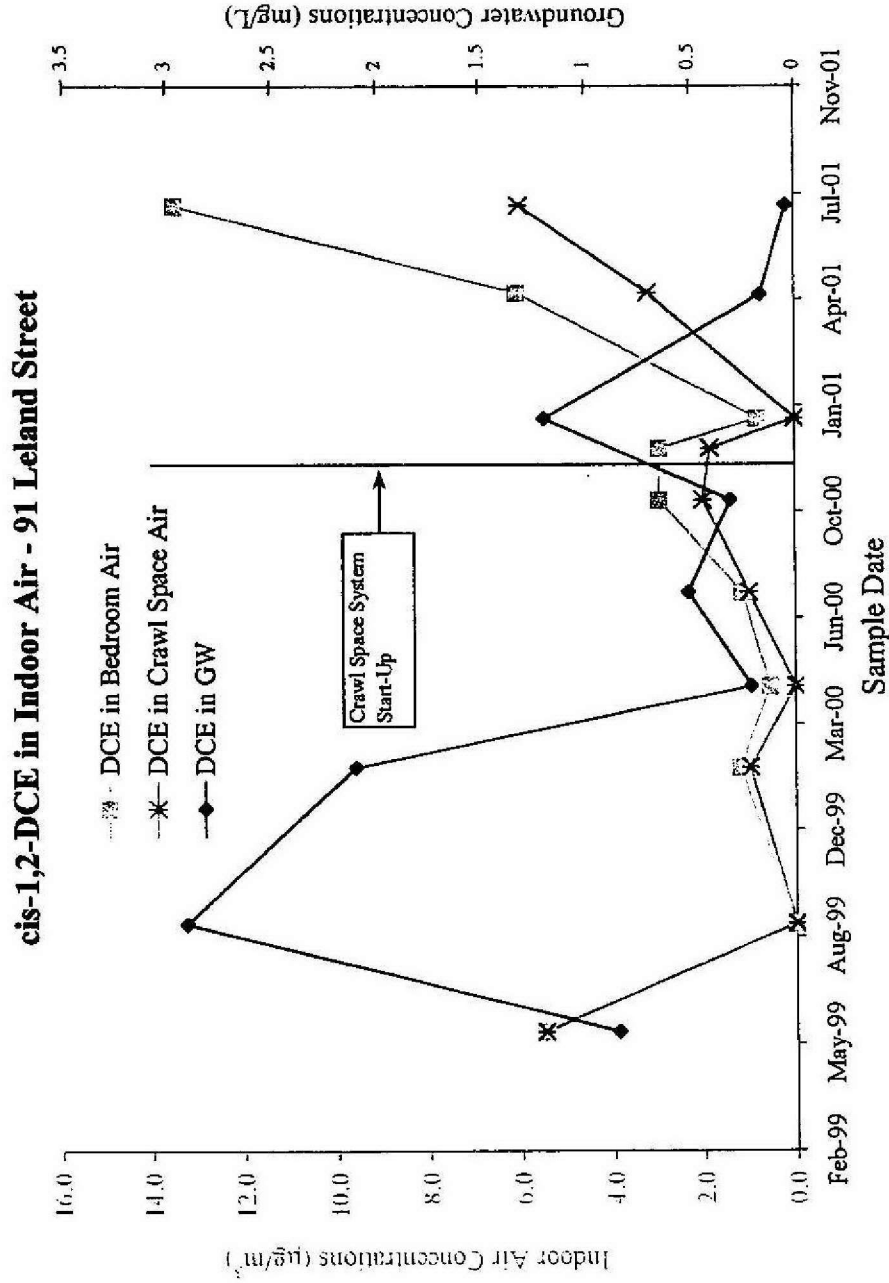
**Notes:**  
Constituents not detected above the sample quantitation limit were presented as zero values for both the groundwater and indoor air trends.

**FIGURE 2**  
**1,1-DICHLOROETHANE CONCENTRATIONS AT 91 LELAND STREET**  
General Chemical Corporation  
Framingham, Massachusetts



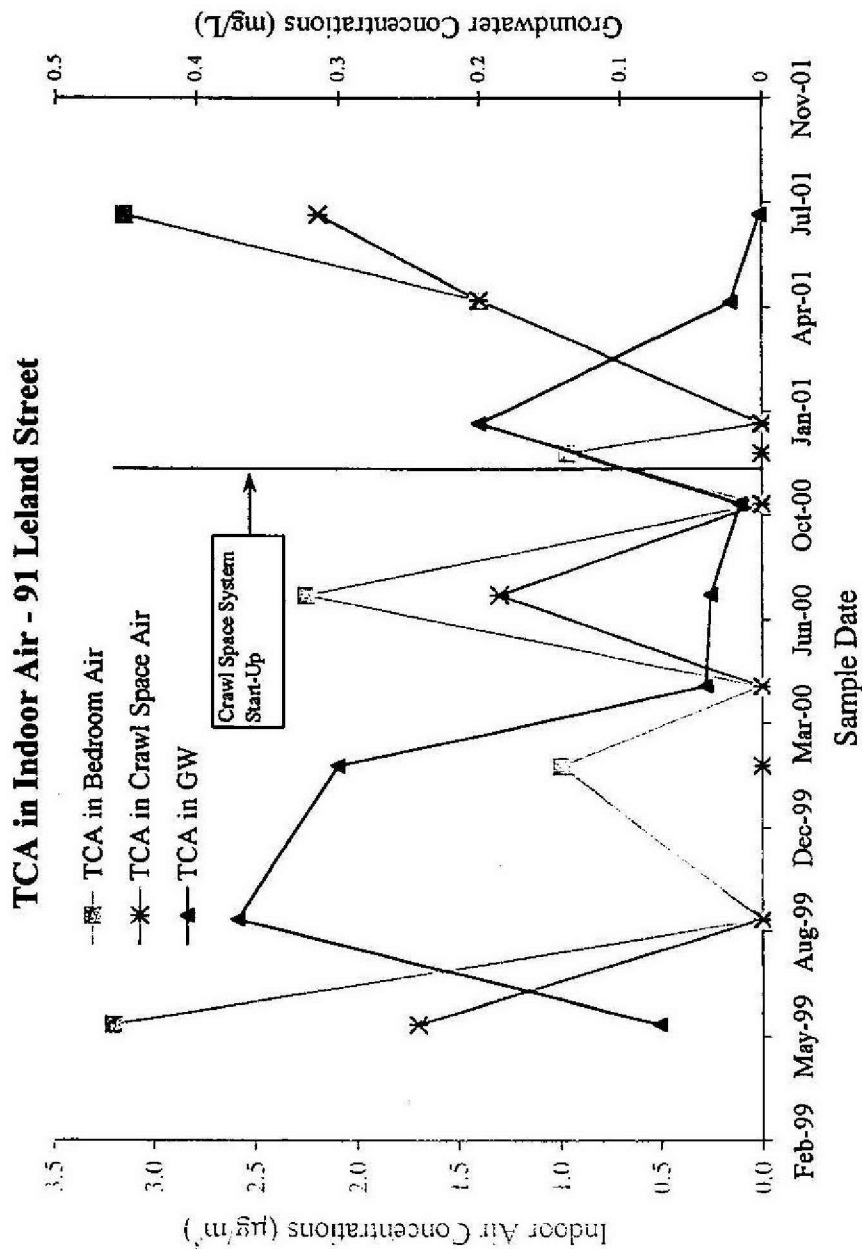
**Notes:**  
Constituents not detected above the sample quantitation limit were presented as zero values for both the groundwater and indoor air trends.

# **FIGURE 3** **CIS-1,2-DICHLOROETHENE CONCENTRATIONS AT 91 LELAND STREET** General Chemical Corporation Framingham, Massachusetts



**Notes:**  
 Constituents not detected above the sample quantitation limit were presented as zero values for both the groundwater and indoor air trends.

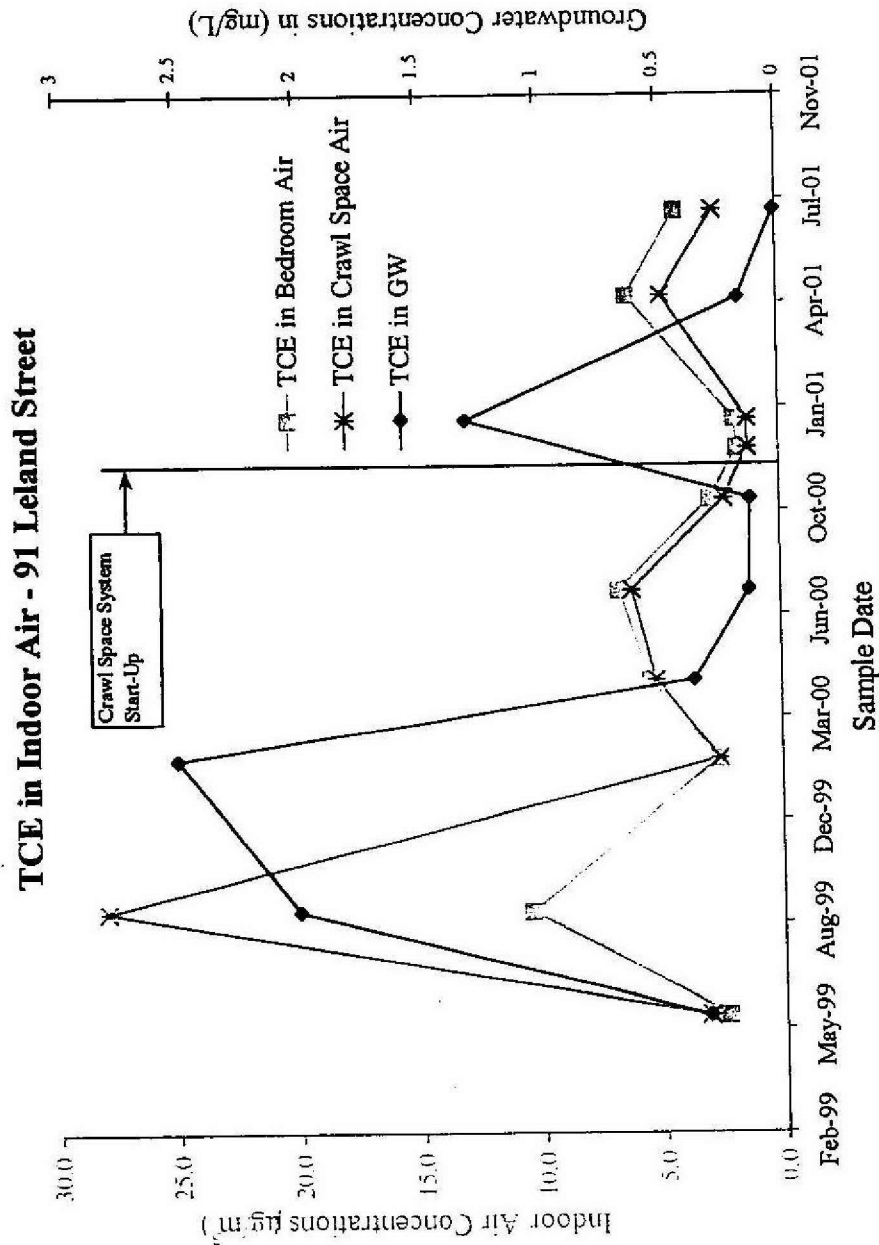
**FIGURE 4**  
**1,1,1-TRICHLOROETHANE CONCENTRATIONS AT 91 LELAND STREET**  
General Chemical Corporation  
Framingham, Massachusetts



**Notes:**  
Constituents not detected above the sample quantitation limit were presented as zero values for both the groundwater and indoor air trends.

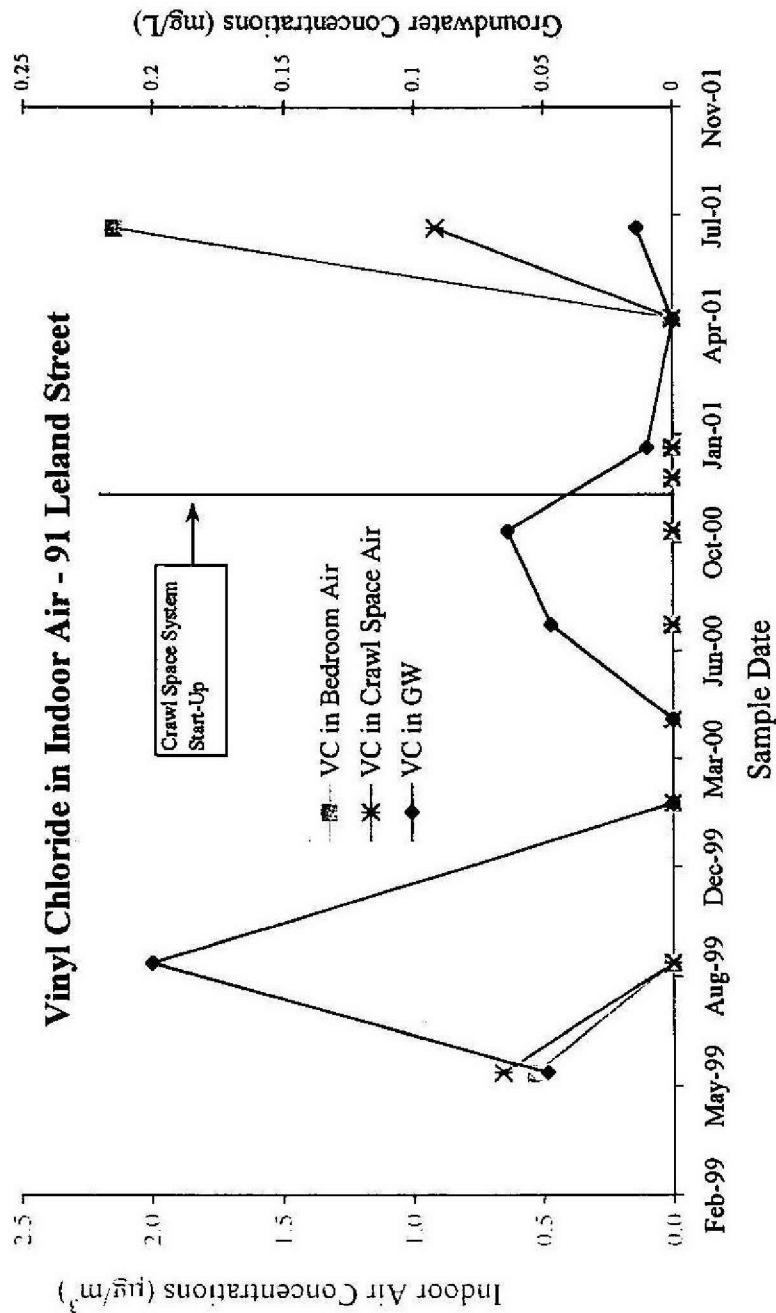


**FIGURE 5**  
**TRICHLOROETHENE CONCENTRATIONS AT 91 LELAND STREET**  
General Chemical Corporation  
Framingham, Massachusetts



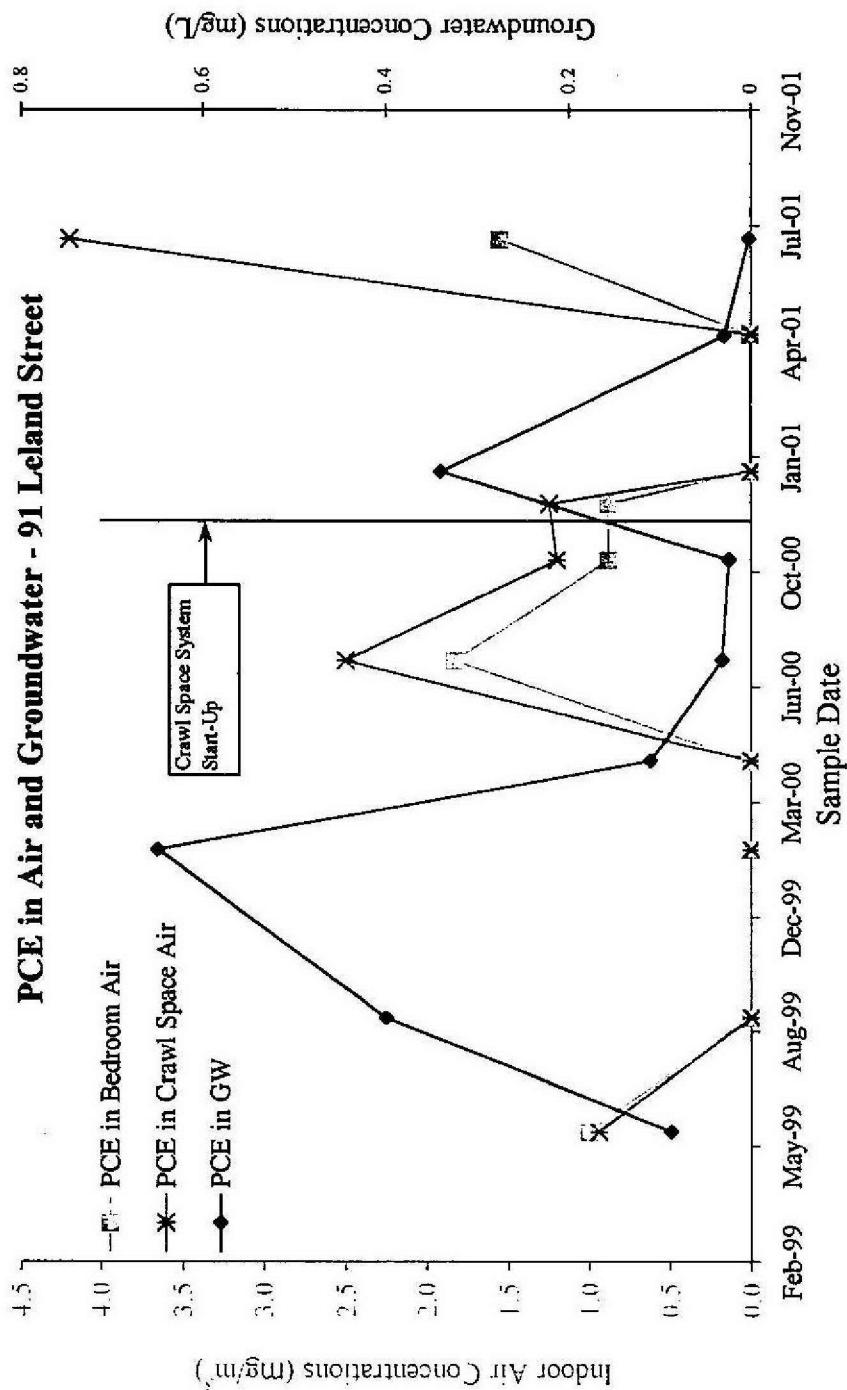
**Notes:**  
Constituents not detected above the sample quantitation limit were presented as zero values for both the groundwater and indoor air trends.

**FIGURE 6**  
**VINYL CHLORIDE CONCENTRATIONS AT 91 LELAND STREET**  
General Chemical Corporation  
Framingham, Massachusetts



**Notes:**  
Constituents not detected above the sample quantitation limit were presented as zero values for both the groundwater and indoor air trends.

**FIGURE 7**  
**TETRACHLOROETHENE CONCENTRATIONS AT 91 LELAND STREET**  
General Chemical Corporation  
Framingham, Massachusetts



**Notes:**  
Constituents not detected above the sample quantitation limit were presented as zero values for both the groundwater and indoor air trends.

TABLE 1  
Historic Indoor Air and Groundwater Data - 91 Leland Street  
General Chemical Corporation  
Framingham, Massachusetts

| Property<br>Medium<br>Sample ID:<br>Units | June 1, 1999<br>91 Leland Street |                         |                             |                                | September 9, 1999<br>91 Leland Street |                               |                                 |                             | February 3, 2000<br>91 Leland Street |                         |                               |                                 | April 20, 2000<br>91 Leland Street |                                |                         |                               | July 17, 2000<br>91 Leland Street |                             |                                |                         |                               |                                 |                             |      |
|-------------------------------------------|----------------------------------|-------------------------|-----------------------------|--------------------------------|---------------------------------------|-------------------------------|---------------------------------|-----------------------------|--------------------------------------|-------------------------|-------------------------------|---------------------------------|------------------------------------|--------------------------------|-------------------------|-------------------------------|-----------------------------------|-----------------------------|--------------------------------|-------------------------|-------------------------------|---------------------------------|-----------------------------|------|
|                                           | Groundwater<br>CDW-185<br>mg/l   | Air<br>Bedroom<br>µg/m³ | Air<br>Crawl Space<br>µg/m³ | Groundwater<br>CDW-185<br>mg/l | Air<br>Bedroom<br>µg/m³               | Air<br>Bedroom (dup)<br>µg/m³ | Air<br>Bedroom Average<br>µg/m³ | Air<br>Crawl Space<br>µg/m³ | Groundwater<br>CDW-185<br>mg/l       | Air<br>Bedroom<br>µg/m³ | Air<br>Bedroom (dup)<br>µg/m³ | Air<br>Bedroom Average<br>µg/m³ | Air<br>Crawl Space<br>µg/m³        | Groundwater<br>CDW-185<br>mg/l | Air<br>Bedroom<br>µg/m³ | Air<br>Bedroom (dup)<br>µg/m³ | Air<br>Bedroom Average<br>µg/m³   | Air<br>Crawl Space<br>µg/m³ | Groundwater<br>CDW-185<br>mg/l | Air<br>Bedroom<br>µg/m³ | Air<br>Bedroom (dup)<br>µg/m³ | Air<br>Bedroom Average<br>µg/m³ | Air<br>Crawl Space<br>µg/m³ |      |
| Acetone                                   | 0.0021                           | 4.8                     | 0.35                        | BMQ                            | 100                                   | 120                           | 110                             | 23                          | <1.3                                 | 17                      | 13                            | 15                              | 19                                 | <0.25                          | 12                      | 60                            | 65                                | <0.52                       | <0.13                          | 49                      | 40                            | 44.5                            | <1.1                        | 14   |
| Benzene                                   |                                  |                         |                             |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| Bromochloroethane                         |                                  |                         |                             |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| Bromonethane                              |                                  |                         |                             |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| Chlorobenzene                             |                                  |                         |                             |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| Chloroethane                              |                                  |                         |                             |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| Chloroform                                | BMQ                              | 1.5                     | <0.96                       | BMQ                            | 7.3                                   | 5                             | 6.15                            | 4.7                         | <0.05                                | <0.78                   | <0.85                         | <0.815                          | <0.81                              | <0.04                          | 1.2                     | 1.3                           | 1.2                               | <0.8                        | <0.005                         | 2.6                     | 2.5                           | 2.55                            | <0.83                       | 0.84 |
| Chloroethane                              |                                  | 1.4                     | <0.41                       |                                | 3.6                                   | 2.1                           | 2.325                           | 2                           | <0.2                                 | <0.33                   | <0.36                         | <0.345                          | <0.34                              | <0.04                          | 1.7                     | 1.1                           | 1.4                               | 1.2                         | <0.02                          | 1.8                     | 3.9                           | 2.85                            | 0.84                        |      |
| Carbon Disulfide                          |                                  |                         |                             |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| Carbon Tetrachloride                      |                                  | 0.68                    | <1.2                        |                                | <9.5                                  | <6.4                          | <7.95                           | <6.1                        | <0.05                                | <1                      | <1.1                          | <1.05                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <1                          | <0.005                         | <2.1                    | <2.2                          | <2.15                           | <1.1                        |      |
| Cyclohexane                               |                                  |                         |                             |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| 1,1-Dichloroethane                        | 0.0296                           | 0.96                    | 1.2                         | 0.081                          | <6.1                                  | <4.1                          | <5.1                            | <3.9                        | 0.05                                 | <0.65                   | <0.7                          | <0.675                          | <0.67                              | <0.01                          | <0.67                   | <0.67                         | <0.67                             | <0.66                       | 0.018                          | <1.4                    | <1.4                          | <1.4                            | <0.69                       |      |
| 1,1-Dichloroethane                        | 0.0378                           | <0.78                   | <0.78                       | 0.13                           | <6                                    | <4.1                          | <5.05                           | <3.8                        | 0.12                                 | <0.64                   | <0.66                         | <0.655                          | <0.66                              | 0.016                          | <0.66                   | <0.66                         | <0.66                             | <0.65                       | 0.013                          | <1.4                    | <1.4                          | <1.4                            | <0.68                       |      |
| 1,2-Dichloroethane                        | BMQ                              | <1.5                    | <1.5                        |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| 1,2-Dichloroethane                        |                                  | <0.92                   | <0.92                       |                                | <7                                    | <4.7                          | <5.85                           | <4.5                        | <0.05                                | <0.74                   | <0.8                          | <0.77                           | <0.77                              | <0.01                          | <0.77                   | <0.77                         | <0.77                             | <0.76                       | <0.005                         | <1.4                    | <1.4                          | <1.4                            | <0.69                       |      |
| 1,4-Dioxane                               |                                  |                         |                             |                                | <22                                   | 29                            | 20                              | 14                          |                                      | 3.4                     | <3.1                          | 2.45                            | 11                                 |                                | <3                      | 12                            | 4.25                              | 3.8                         | <0.01                          | 6.2                     | <6.4                          | <6.3                            | <3.1                        |      |
| Dichlorodifluoromethane                   |                                  | 3.8                     | 3.5                         | 2.9                            | 10                                    | 6.4                           | 8.2                             | <4.8                        | <0.1                                 | <0.79                   | <0.86                         | <0.825                          | <0.82                              | <0.02                          | 4.2                     | 4.3                           | 4.25                              | 3.8                         | <0.01                          | 11                      | 11                            | 11                              | 4.6                         |      |
| 1,2-Dichloropropane                       |                                  |                         |                             |                                |                                       |                               |                                 |                             |                                      |                         |                               |                                 |                                    |                                |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |
| 1,2-Dichloropropane                       |                                  | <0.9                    | <0.9                        |                                | <6.8                                  | <4.6                          | <5.7                            | <4.4                        | <0.05                                | <0.73                   | <0.79                         | <0.76                           | <0.76                              | <0.01                          | <0.76                   | <0.76                         | <0.76                             | <0.76                       | <0.005                         | <1.6                    | <1.6                          | <1.6                            | <0.78                       |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.01                          | <1                      | <1                            | <1                                | <0.98                       | <0.005                         | <2                      | <2.1                          | <2.05                           | <1                          |      |
| 1,2-Dichloropropane                       |                                  | <1.2                    | <1.2                        |                                | <9                                    | <6.1                          | <7.55                           | <5.8                        | <0.05                                | <0.96                   | <1                            | <0.98                           | <1                                 | <0.                            |                         |                               |                                   |                             |                                |                         |                               |                                 |                             |      |



