

**Solutia Inc.**  
**Anniston, AL**

**RFI/CS Air Monitoring  
Report**

**ENSR International**  
**July 2004**



**Document Number 06105-017-200**

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**APPENDIX A: Solutia RFI/CS Work Plan: Solutia Response to ADEM Memorandum dated November 22, 2003**

**APPENDIX B: Monthly, Quarterly and Annual Windroses**

**APPENDIX C: (Provided in CD format only)**

**Part 1 – Monthly Meteorological Monitoring Reports**

**Part 2 – Monthly Ambient Monitoring Reports**

**APPENDIX D: Session-Specific Depictions of Wind Data and PCB Concentrations**

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## **1.0 INTRODUCTION**

### **1.1 Program Overview**

Solutia Inc. (Solutia) retained ENSR International (ENSR) to conduct an ambient PCBs monitoring program in the vicinity of the Solutia facility located in Anniston, AL. The overall objective of the air monitoring program was to (a) evaluate the air pathway in the area surrounding Solutia's Anniston, AL facility and (b) assist in identifying PCB source areas not yet characterized near the facility, if any, using an air pathway analysis approach. The Alabama Department of Environmental Management (ADEM) approved the specifications of the program which were outlined in the RFI/CS Air Monitoring Work Plan (Revision 2.0) dated October 2002 (ENSR Document No. 06105-006-500-10-R2) (Work Plan). Additional clarifications regarding program specifications were provided to ADEM on March 28, 2003 in response to post-approval comments (see Appendix A). The program involved monthly monitoring of ambient PCBs and continuous collection of meteorological monitoring data over the course of a one- year period from April 2003 through March 2004. This report presents results associated with the above-mentioned program.

### **1.2 Summary of Results**

The program included collection of over 200 individual samples at eight sites over a twelve-month period. Key results from the program show:

- Ambient PCBs levels measured during the program were well below the published NIOSH standard of 1,000 ng/m<sup>3</sup> and OSHA standard of 1,000,000 ng/m<sup>3</sup> (published as standards to assess worker exposure). Average ambient PCBs levels at eight sites varied from 2.3 to 27.1 ng/m<sup>3</sup>; the maximum concentration measured during the program was 145 ng/m<sup>3</sup>.
- The South and West Landfills do not appear to be a source of PCBs. Program data indicate that neither airborne particulate suspension nor evaporation are active mechanisms for moving PCBs from source to air pathway at the South and West Landfills.
- An evaluation of ambient PCB results and meteorological monitoring data indicate that potential PCB source areas exist both on and off the plant property.

Evaluation and interpretation of results in support of program objectives is provided in Section 4.0 of this report.

## **2.0 METEOROLOGICAL MONITORING**

### **2.1 Overview**

Meteorological monitoring occurred continuously for the 12-month program (i.e., April 2003 through March 2004). A description of the site location, parameters monitored and operational and QA/QC procedures are described in the sections that follow.

### **2.2 Met Station Site Location**

The meteorological monitoring station was situated at the 6-Near East site for the duration of the program, as identified in the site schematics provided in Figures 3-1 and 3-2. The location for the meteorological monitoring site was selected to provide representative onsite meteorological data, considering the following criteria:

- meteorological conditions similar to those in potential source areas;
- site exposure in terms of spacing from obstructions to air flow;
- site accessibility, including proximity to a maintained roadway, site preparation/grading requirements, and amenability of property owners; and
- proximity to existing power and telephone lines.

Section 2.1.1 of the October 2002 Work Plan provides additional detail related to site selection for the meteorological monitoring station.

### **2.3 Meteorological Monitoring Parameters**

The meteorological parameters measured, the heights of measurement, and the ranges of measurements are shown in Table 2-1. Appendix A of the October 2002 Work Plan provides additional details concerning the meteorological monitoring instrumentation. In addition to the parameters that are directly measured, the standard deviation of the wind direction (sigma theta) was automatically calculated. The measurement system also provided two methods of estimating atmospheric stability class that are recommended by U.S. EPA: 1) the solar radiation/delta temperature method and 2) the Sigma Theta method. Method 1 characterizes stability during daylight hours according to the measured wind speed at 10 meters and the strength of the solar radiation. During the night the stability class is determined by the wind speed and the temperature difference between the 2-meter and 10-meter levels. Method 2, used as a back-up to Method 1, determines stability class based on wind speed, sigma theta, and whether it is day or night.

**Table 2-1 Meteorological Parameters**

| Parameter                   | Measurement Height (meters) | Range                      | Sensor Accuracy | Starting Threshold |
|-----------------------------|-----------------------------|----------------------------|-----------------|--------------------|
| Wind Speed                  | 10                          | 0-100 mph                  | ±0.15 mph       | 1.12 mph           |
| Wind Direction/ Sigma Theta | 10                          | 0-360°                     | ±2°             | 1.12 mph at 10°    |
| Temperature                 | 2                           | -22 to 122°F               | ±0.27°F         | N/A                |
| Delta Temperature           | 2 to 10                     | -5 to 15°F                 | ±0.18°F         | N/A                |
| Solar Radiation             | 2                           | 0-1500 watt/m <sup>2</sup> | ±2%             | N/A                |
| Dewpoint Temperature        | 2                           | -22 to 104°F               | ±1.8°F          | N/A                |
| Precipitation               | 2                           | 0-10 inches                | ±1%             | N/A                |

## 2.4 Instrumentation Operation and QA/QC

The basic averaging time of the recorded and stored data for the meteorological parameters listed above in Table 2-1 was one hour. For the one-year monitoring program, the Odessa data logger sampled all enabled channels once every ten seconds, except the wind direction channel, which was sampled once a second. Every five minutes an average value was computed for each parameter based on the once per second or once per 10-second samples. At the end of each hourly period, five-minute average values for each parameter were used to form the 1-hour average values. On the hour, a report was printed summarizing the 5-minute values for the previous hour and the current 1-hour values for each parameter. At midnight a report was printed summarizing the hourly values for the previous day and the current 24-hour values.

Quality assurance of the meteorological data followed the EPA Quality Assurance Handbook for Air Pollution Measurement Systems (Vol. IV): **Measurement Systems**. Semi-annual audits and calibrations of the meteorological data collection systems were performed.

The following tables present the results of the periodic meteorological system calibrations during the year.

### 2.4.1 System Calibration Results (Startup Calibration)

On February 25-28, 2003 an initial (system start up) meteorological calibration was performed on all sensor instrumentation. The following table summarizes the results of the calibration.

**Table 2-2 Initial System Calibration Results**

| Level (Meters) | Parameter             | Range                   | Translator Card Indication                        | Recorder Indication                               | Odessa Computer Indication                        |
|----------------|-----------------------|-------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| 10             | Wind Speed            | 0-100 mph               | Within specs.<br>(spec. $\pm 5$ mph)              | Within specs.<br>(spec. $\pm 5$ mph)              | Within specs.<br>(spec. $\pm 5$ mph)              |
| 10             | Wind Direction        | 0-360°                  | Within specs.<br>(spec. $\pm 20^\circ$ )          | Within specs.<br>(spec. $\pm 20^\circ$ )          | Within specs.<br>(spec. $\pm 20^\circ$ )          |
| 2              | Temperature           | -22 to 122°F            | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) |
| 2 to 10        | Delta Temperature     | -5 to 15°F              | Within specs.<br>(spec. $\pm 0.54^\circ$ )        | Within specs.<br>(spec. $\pm 0.54^\circ$ )        | Within specs.<br>(spec. $\pm 0.54^\circ$ )        |
| 2              | Dew point Temperature | -22 to 104°F            | Within specs.<br>(spec. $\pm 7.2^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 7.2^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 7.2^\circ\text{F}$ ) |
| 2              | Solar Radiation       | 0-1500 W/M <sup>2</sup> | Within specs.<br>(spec. $\pm 10\%$ )              | Within specs.<br>(spec. $\pm 10\%$ )              | Within specs.<br>(spec. $\pm 10\%$ )              |
| 2              | Precipitation         | 0-10 inch               | N/A                                               | N/A                                               | Within specs.<br>(spec. $\pm 10\%$ )              |

#### 2.4.2 System Calibration Results (Six-month Calibration)

On August 13-14, 2003 a semi-annual meteorological calibration was performed on all sensor instrumentation. The following table summarizes the results of the calibration.

**Table 2-3 Semi-Annual System Calibration Results**

| Level (Meters)                                                                                                                           | Parameter               | Range                   | Translator Card Indication                        | Recorder Indication                               | Odessa Computer Indication                        |
|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| 10                                                                                                                                       | Wind Speed              | 0-100 mph               | Within specs.<br>(spec. $\pm 5$ mph)              | Within specs.<br>(spec. $\pm 5$ mph)              | Within specs.<br>(spec. $\pm 5$ mph)              |
| 10                                                                                                                                       | Wind Direction          | 0-360°                  | Within specs.<br>(spec. $\pm 20^\circ$ )          | Within specs.<br>(spec. $\pm 20^\circ$ )          | Within specs.<br>(spec. $\pm 20^\circ$ )          |
| 2                                                                                                                                        | Temperature             | -22 to 122°F            | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) |
| 2 to 10                                                                                                                                  | Delta Temperature       | -5 to 15°F              | Within specs.<br>(spec. $\pm 0.54^\circ$ )        | Within specs.<br>(spec. $\pm 0.54^\circ$ )        | Within specs.<br>(spec. $\pm 0.54^\circ$ )        |
| 2                                                                                                                                        | Dew point Temperature * | -22 to 104°F            | -8.1°F<br>(spec. $\pm 7.2^\circ\text{F}$ )        | -8.1°F<br>(spec. $\pm 7.2^\circ\text{F}$ )        | -8.1°F<br>(spec. $\pm 7.2^\circ\text{F}$ )        |
| 2                                                                                                                                        | Solar Radiation         | 0-1500 W/M <sup>2</sup> | Within specs.<br>(spec. $\pm 10\%$ )              | Within specs.<br>(spec. $\pm 10\%$ )              | Within specs.<br>(spec. $\pm 10\%$ )              |
| 2                                                                                                                                        | Precipitation           | 0-10 inch               | N/A                                               | N/A                                               | Within specs.<br>(spec. $\pm 10\%$ )              |
| * Note: The dewpoint temperature system was subsequently rotated and left operating within system tolerance ( $\pm 7.2^\circ\text{F}$ ). |                         |                         |                                                   |                                                   |                                                   |

### 2.4.3 System Calibration Results (Final)

On April 5-6, 2004 a final (system shut-down) meteorological calibration was performed on all sensor instrumentation. The following table summarizes the results of the calibration.

**Table 2-4 Final System Calibration Results**

| Level<br>(Meters) | Parameter                | Range                   | Translator Card<br>Indication                     | Recorder<br>Indication                            | Odessa Computer<br>Indication                     |
|-------------------|--------------------------|-------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| 10                | Wind Speed               | 0-100 mph               | Within specs.<br>(spec. $\pm 5$ mph)              | Within specs.<br>(spec. $\pm 5$ mph)              | Within specs.<br>(spec. $\pm 5$ mph)              |
| 10                | Wind<br>Direction        | 0-360°                  | Within specs.<br>(spec. $\pm 20^\circ$ )          | Within specs.<br>(spec. $\pm 20^\circ$ )          | Within specs.<br>(spec. $\pm 20^\circ$ )          |
| 2                 | Temperature              | -22 to 122°F            | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 5.4^\circ\text{F}$ ) |
| 2 to 10           | Delta<br>Temperature     | -5 to 15°F              | Within specs.<br>(spec. $\pm 0.54^\circ$ )        | Within specs.<br>(spec. $\pm 0.54^\circ$ )        | Within specs.<br>(spec. $\pm 0.54^\circ$ )        |
| 2                 | Dew point<br>Temperature | -22 to 104°F            | Within specs.<br>(spec. $\pm 7.2^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 7.2^\circ\text{F}$ ) | Within specs.<br>(spec. $\pm 7.2^\circ\text{F}$ ) |
| 2                 | Solar<br>Radiation       | 0-1500 W/M <sup>2</sup> | Within specs.<br>(spec. $\pm 10\%$ )              | Within specs.<br>(spec. $\pm 10\%$ )              | Within specs.<br>(spec. $\pm 10\%$ )              |
| 2                 | Precipitation            | 0-10 inch               | N/A                                               | N/A                                               | Within specs.<br>(spec. $\pm 10\%$ )              |

Data validation, an after-the-fact review of in-field collected data, is the process by which data are determined to be of acceptable or unacceptable quality, based on a set of predefined criteria. These criteria depend upon the type(s) of data involved and the purpose for which they are collected. The data validation process, which occurred at several steps along the path of data flow, included visual, mathematical, and graphical evaluations of the data. Station operators and ENSR staff personnel performing data reduction and processing performed checks continuously. Although the data validation process is continuous, final data validation can only occur at the time of a final calibration of each analyzer so that all of the validation criteria can be considered. ENSR staff reviewed all monitored data to determine validity during periods between the routine calibration checks.

The validation of continuous meteorological data was governed by **ENSR SOP 4000, Data Validation**. For data to be considered valid, they must be accurate and precise within prescribed limits, represent factual conditions, be obtained from calibrated, well-functioning instruments free from interference or obstructions, *and be thoroughly documented as to traceability to recognized primary standards.*

The validation process began in the field with the Solutia site engineer's assessment of data during each site visit. Charts were scanned for anomalous results and any faulty instrument performance.

Events affecting validity were documented. Concurrently with the field assessment, the data were checked daily by an ENSR professional meteorologist via a real-time data summary report. At the end of the month, all site documentation and strip charts were sent to the ENSR project meteorologist for quality control review. Erroneous values were edited based on the field information. An ENSR data analyst performed checks of data acquisition system data versus strip chart data. These data checks include checking all values annotated as suspect by the field engineer and usually one to two values a day.

Periods of data labeled "suspect" by the Solutia field engineer were deemed valid or invalid by the ENSR data validation meteorologist. Changes to the validation categories were initialed and reasons were documented. All instrument calibrations were subsequently analyzed to confirm that initial calibration results were within acceptable data validation limits, as documented in **ENSR SOP 4000 – Data Validation**.

## **2.5 Meteorological Data Capture**

The following tables present the valid data capture statistics for each monitored parameter for each month of the 12-month period (April 2003 through March 2004). Also included are explanations of significant missing data periods (i.e., less than 95% data recovery per month) that occurred throughout the report period for all parameters. In addition, as a corrective action measure, three emergency repair trips were conducted during the program to address the equipment issues identified in Table 2-7.

**Table 2-5 Parameter Definitions**

| <b>Monthly Summary Code</b> | <b>Definition</b>                      |
|-----------------------------|----------------------------------------|
| WSP                         | Wind speed (10-meter)                  |
| WDR                         | Wind direction (10-meter)              |
| SIGMA                       | Sigma theta (10-meter)                 |
| TMP                         | Temperature (2-meter)                  |
| DT                          | Temperature difference (2 to 10-meter) |
| DEWP                        | Dewpoint temperature (2-meter)         |
| RAD                         | Solar radiation (2-meter)              |
| RAIN                        | Precipitation (2-meter)                |

**Table 2-6 Data Capture Summary**

(April 2003 to March 2004)

| Solutia Meteorological Tower |                     |                     |                       |                     |                    |                      |                     |                      |
|------------------------------|---------------------|---------------------|-----------------------|---------------------|--------------------|----------------------|---------------------|----------------------|
| Month/<br>Year               | WSP<br>%<br>Capture | WDR<br>%<br>Capture | SIGMA<br>%<br>Capture | TMP<br>%<br>Capture | DT<br>%<br>Capture | DEWP<br>%<br>Capture | RAD<br>%<br>Capture | RAIN<br>%<br>Capture |
| April 2003                   | 94.6                | 99.9                | 99.4                  | 100.0               | 100.0              | 100.0                | 100.0               | 100.0                |
| May 2003                     | 59.8                | 99.3                | 99.2                  | 99.9                | 99.1               | 99.5                 | 99.9                | 99.7                 |
| June 2003                    | 99.9                | 99.9                | 99.7                  | 100.0               | 100.0              | 100.0                | 100.0               | 100.0                |
| July 2003                    | 100.0               | 100.0               | 99.5                  | 100.0               | 99.9               | 99.9                 | 100.0               | 100.0                |
| August 2003                  | 99.1                | 99.1                | 98.9                  | 99.2                | 99.2               | 99.5                 | 99.9                | 99.9                 |
| September 2003               | 99.9                | 99.9                | 99.9                  | 100.0               | 100.0              | 99.9                 | 100.0               | 100.0                |
| October 2003                 | 100.0               | 100.0               | 100.0                 | 100.0               | 100.0              | 99.7                 | 100.0               | 100.0                |
| November 2003                | 92.2                | 100.0               | 99.7                  | 100.0               | 100.0              | 99.3                 | 100.0               | 100.0                |
| December 2003                | 85.1                | 99.9                | 95.4                  | 92.7                | 98.4               | 100.0                | 100.0               | 100.0                |
| January 2004                 | 82.4                | 99.3                | 98.9                  | 96.8                | 100.0              | 99.9                 | 99.9                | 100.0                |
| February 2004                | 100.0               | 100.0               | 99.7                  | 100.0               | 99.6               | 99.4                 | 100.0               | 100.0                |
| March 2004                   | 100.0               | 100.0               | 99.7                  | 100.0               | 100.0              | 97.3                 | 100.0               | 100.0                |

**Table 2-7 Explanations of Significant Data Loss**

(April 2003 to March 2004)

| Solutia Meteorological Tower |                  |                   |                                             |                                    |
|------------------------------|------------------|-------------------|---------------------------------------------|------------------------------------|
| Parameter                    | Month/ Year      | % Data<br>Capture | Cause of Significant<br>Invalid Data        | Dates Affected                     |
| WSP                          | April 2003       | 94.6              | Intermittent electronic<br>shorting problem | April 27-29, 2003                  |
| WSP                          | May 2003         | 59.8              | Intermittent electronic<br>shorting problem | May 9-29, 2003                     |
| WSP                          | November<br>2003 | 92.2              | Circuit card<br>intermittently defective    | November 25-27, 30, 2003           |
| WSP                          | December<br>2003 | 85.1              | Circuit card<br>intermittently defective    | December 1-3, 8-10, 26-31,<br>2003 |
| TMP                          | December<br>2003 | 92.7              | Circuit card<br>intermittently defective    | December 16-17, 24-26, 31,<br>2003 |
| WSP                          | January<br>2004  | 82.4              | Circuit card<br>intermittently defective    | January 1-20, 2004                 |

## **2.6 Meteorological Data Summary**

Appendix B presents monthly, quarterly, annual and session-specific wind roses for the period of operation of the Solutia meteorological systems (April 2003 through March 2004). Monthly meteorological monitoring data reports are provided within Appendix C.

### 3.0 AMBIENT AIR MONITORING

Site selection, target parameters and measurement methodology are described for ambient air monitoring in the sections to follow.

#### 3.1 Monitoring Site Locations

Figure 3-1 and Figure 3-2 shows the monitoring site locations used for this program overlaid on a USGS map and aerial photograph of the network area, respectively. Site IDs presented in these figures correspond to the monitoring locations listed in Table 3-1. For air sampling, eight sites were utilized as follows:

- Four sites (one in each of the four directional quadrants around the Solutia facility) to provide information about fence-line ambient PCB concentrations
- One site was positioned at a location previously used by EPA for ambient PCB monitoring
- Three additional sites were employed to facilitate collection of data representative of conditions upwind and downwind of the Solutia facility.

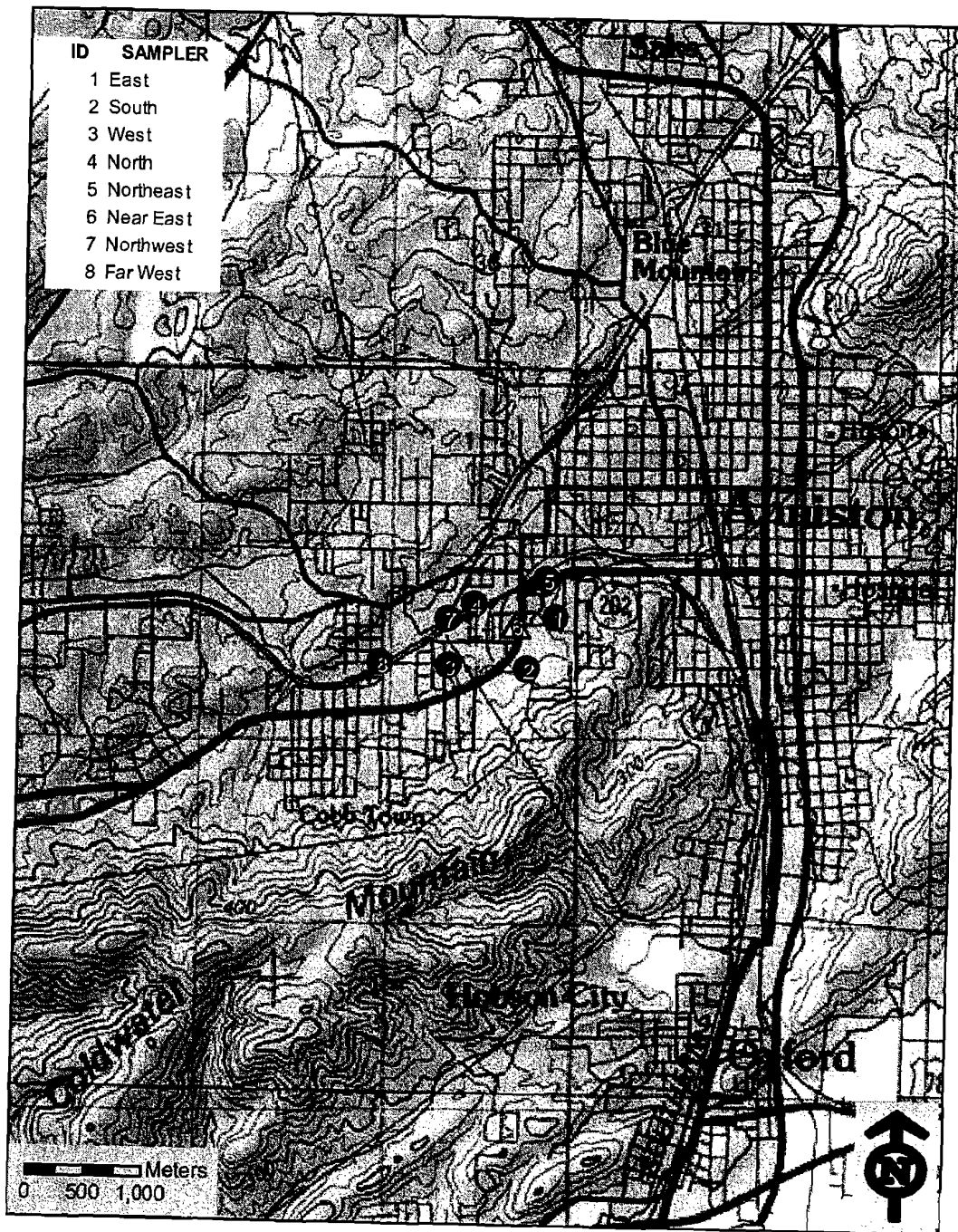
Section 2.2.1 of the October 2002 Work Plan provides additional detail related to site selection and site descriptions.

Target parameters for the ambient air monitoring program included the mono through deca PCB congener class sums. Results for the mono through deca values were added together to give total PCBs. Table 3-2 lists the PCB target parameters.

#### 3.2 Sampling Schedule and Sample Types

Ambient monitoring activity for this program commenced April 15, 2003 and continued through March 24, 2004. During this nominal 12-month period, ENSR conducted 24 sampling sessions at a frequency of two sessions per month. The two monthly sampling sessions were conducted over two sequential 24-hour periods. Five types of samples were collected during the program, as outlined below:

- 24-hour continuous samples; filter and PUF analyzed together. A majority of the samples collected were of this type.



**ENSR**

*Figure 3-1*  
Solutia-Alabama  
Sampler Locations

**Legend**

**Locations**

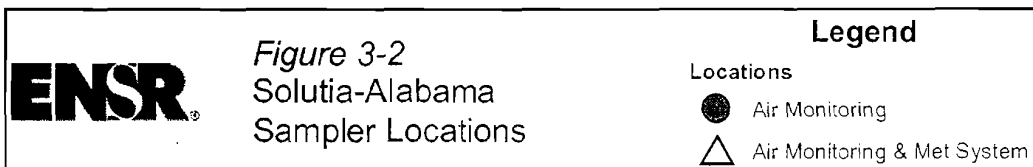


Air Monitoring



Air Monitoring & Met System

J:\Water\ProjectFiles\Other\Solutia ArcMap\Fig3-1.mxd



J:\Water\ProjectFiles\Other\Solutia ArcMap\Fig3-2.mxd

**Table 3-1 Sample Collection Summary**

| Site ID | Sampler Name | Sample Type           | Purpose / Rationale                                                              | Samples Collected | Samples Analyzed |
|---------|--------------|-----------------------|----------------------------------------------------------------------------------|-------------------|------------------|
| 1       | East         | Ambient air           | Brackets quadrant east of site                                                   | 24                | 24               |
|         | East-Colo    | Collocated            | QA/QC                                                                            | 12                | 12               |
| 2       | South        | Ambient air           | Brackets quadrant south of site                                                  | 24                | 24               |
| 3       | West         | Ambient air           | Brackets quadrant west of site                                                   | 24                | 24               |
| 4       | North        | Ambient air           | Brackets quadrant north of site                                                  | 24                | 24               |
| 5       | Northeast    | Ambient air           | Collocated with previous EPA amplers                                             | 24                | 23 (a)           |
| 6       | Near East    | Ambient air-filter    | Facilitate upwind/downwind analysis and provide particle/vapor partitioning data | 16                | 16               |
|         |              | Ambient air-PUF       |                                                                                  | 16                | 16               |
|         |              | Ambient air-combined  |                                                                                  | 8                 | 8                |
| 7       | Northwest    | Ambient air           | Facilitate upwind/downwind analysis and provide nocturnal/diurnal data           | 12                | 12               |
|         |              | Ambient air-nocturnal |                                                                                  | 12                | 12               |
|         |              | Ambient air-diurnal   |                                                                                  | 12                | 12               |
| 8       | Far West     | Ambient air           | Facilitate upwind/downwind analysis                                              | 24                | 24               |
| NA      | NA           | Field Blank           | QA/QC                                                                            | 15                | 15               |
| TOTAL   |              |                       |                                                                                  | 247               | 246              |

(a) Sampler operation at 5-Northeast site abbreviated (10 hours) due to power interruption on February 25, 2004; sample invalidated and not analyzed.

**Table 3-2 PCBs – Detection Limit Goals**

| PCB Congener Class                                                                                                                                                                                                                                            | Anticipated Lower Limits of Detection |                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------------------------------------|
|                                                                                                                                                                                                                                                               | ng/sample                             | ng/m <sup>3</sup> @ 300 m <sup>3</sup> Total Volume* |
| Mono                                                                                                                                                                                                                                                          | 20                                    | 0.07                                                 |
| Di                                                                                                                                                                                                                                                            | 20                                    | 0.07                                                 |
| Tri                                                                                                                                                                                                                                                           | 20                                    | 0.07                                                 |
| Tetra                                                                                                                                                                                                                                                         | 20                                    | 0.07                                                 |
| Penta                                                                                                                                                                                                                                                         | 20                                    | 0.07                                                 |
| Hexa                                                                                                                                                                                                                                                          | 20                                    | 0.07                                                 |
| Hepta                                                                                                                                                                                                                                                         | 20                                    | 0.07                                                 |
| Octa                                                                                                                                                                                                                                                          | 20                                    | 0.07                                                 |
| Nona                                                                                                                                                                                                                                                          | 20                                    | 0.07                                                 |
| Deca                                                                                                                                                                                                                                                          | 20                                    | 0.07                                                 |
| <b>Total PCBs</b>                                                                                                                                                                                                                                             | <b>200</b>                            | <b>0.7</b>                                           |
| * For samples submitted as separate filter/sorbent analyses, detection limits (ng/m <sup>3</sup> ) increased by a factor of two for the combined reporting of both sample fractions as well as for nocturnal/diurnal samples collected over a 12-hour period. |                                       |                                                      |

- 24-hour continuous samples; filter and PUF analyzed separately. The Work Plan called for the separate analysis of filter and PUF media to provide a basis for assessing PCB partitioning. These analyses were conducted for samples collected at the Near East site for eight of the twelve monitoring sessions in accordance with Work Plan requirements.
- Nocturnal/diurnal samples. The Work Plan called for collection of nocturnal and diurnal samples to assess day/night variation. These analyses were conducted on samples collected at the Northwest site for six of the twelve monitoring sessions in accordance with Work Plan requirements.
- Field blanks. Field blanks were collected each month used as a QA/QC measure to assess the potential for sample contamination. No PCBs were detected in any of the field blanks.
- Collocated samples. Collocated samples were collected once each month at the East site to assess precision of the combined sampling and analysis regime. Collocated samples showed good agreement with an average percent difference of less than 5%.

With the exception of the sampler designated for day/night evaluation, all samplers were operated for two sequential nominal 24-hour sampling sessions per month over a 12-month period. The sampler assigned for day/night evaluation operated over two distinct periods per 24-hour session

(approximately 15 hours for day sampling; approximately 9 hours for night sampling). Table 3-1 shows the number and types of samples collected and analyzed at each site.

### **3.3 Sampling Collection Procedures**

Sample collection procedures for the ambient measurement of PCBs were based upon the Work Plan (ENSR, October 2002) and the protocol outlined in EPA Method TO-4A, "Determination of Pesticides and Polychlorinated Biphenyls in Ambient Air Using High Volume PUF Sampling Followed by Gas Chromatographic/Multi-Detector Detection" as described in this Air Monitoring Plan. After sample collection using a PS-1 sampler outfitted with filter and PUF/XAD media, valid samples were analyzed by gas chromatography/mass spectrometry (GC/MS) for the mono through deca PCB congener class totals based upon the procedures described in EPA Method TO-4A. The GC/MS approach outlined in EPA Method TO-4A is consistent with the analytical methodology employed for ambient PCB samples previously collected at the facility.

#### **3.3.1 Sampler Description**

General Metal Works Polyurethane Foam (PUF) PS-1 samplers were utilized for collection of the PCBs (mono through deca congener class totals) as listed in Table 3-2. The PS-1 samplers were fitted with glass fiber filters and PUF/XAD sorbent traps to collect both particulate-associated and vapor-phase PCBs. The sampling module contains two chambers. The upper chamber supports the particulate filter medium (10.16 cm diameter glass fiber filter) and the second chamber accommodates a glass sampling cartridge containing a section of polyurethane foam (PUF) and XAD resin.

#### **3.3.2 Sampler Calibration and Operation**

The PS-1 samplers were fully calibrated in the field prior to and at the conclusion of each 24-hour sampling session. Field data sheets and sampler calibration information is provided in Appendix C.

Samplers operated for a nominal 24-hour sampling periods at a flow rate of approximately 210 lpm. These sampling conditions provided an approximate air volume equal to or exceeding 300 m<sup>3</sup> and offered data consistent with the sensitivity goals stated in Table 3-2 for each of the PCB congener classes. The day/night sampler operated during two discrete sampling durations within each 24 sampling session (approximately 15 hours for day sampling; approximately 9 hours for night sampling), providing approximate sample volumes of 190 and 115 m<sup>3</sup>, respectively. For samples submitted for separate filter/sorbent analyses, detection limits (ng/m<sup>3</sup>) increased by a factor of two for the combined reporting of both sample fractions, as well as for nocturnal/diurnal samples collected over an approximate 15 hour and 9 hour period. Sample collection flow rates were determined using the average of the initial and final magnehelic readings corrected to standard temperature and pressure (25° C, 760 mm Hg).

### **3.3.3 Sample Handling and Shipping Procedures**

All sample filters and cartridges were prepared and packaged for field use at the laboratory prior to shipment to the monitoring sites as described in the Work Plan, as modified by Solutia's response to ADEM post-approval comments dated March 28, 2003 (see Appendix A). After sampling, the filters and cartridges were packaged back in their original containers, wrapped in bubble wrap or soft paper, and packed "snugly" in coolers with ice packs for shipment to the laboratory sample bank. Sample control, including chain-of-custody and documentation procedures were followed as described in the Work Plan.

### **3.4 Laboratory Analytical Methods**

Valid samples were analyzed by gas chromatography/mass spectrometry (GC/MS) for the mono through deca PCB congener classes based upon the procedures described in EPA Method TO-4A. The GC/MS approach outlined in EPA Method TO-4A is consistent with the analytical methodology employed for ambient PCB samples previously collected at the facility. Detection limits of 20 ng/sample per congener class are anticipated, producing an overall method detection limit of about 0.7 ng/m<sup>3</sup> (assuming 300 m<sup>3</sup> sample volume) for total PCBs.

The PCB data sets from the program were evaluated based upon the following parameters:

- Recoveries of isotopically labeled PCB congeners spiked into samples prior to extraction. Acceptance limits for recoveries have been established as 50% to 125%. All samples met these acceptance limits.
- Results for the analyses of field and method blanks. No target analytes were detected in any of the field blanks or method blanks collected and analyzed during the program.
- Results of laboratory control spikes (spikes of sample collection media retained at the laboratory during the program). Acceptance limits for laboratory control spikes are relative percent difference of 40% and recovery limits between 50% and 125%. These limits were met for all samples.

Laboratory data reports for the program are provided within Appendix C.

### **3.5 Quality Assurance/Quality Control**

#### **3.5.1 Sample Validation**

A formal validation and selection procedure was implemented to select samples for analysis as described in Section 2.2.3.7 of the Work Plan. This procedure assesses sample integrity, sampler

operation and sample identification issues for each individual sample. Only those samples deemed valid based on application of the sample validation protocol were considered for analysis.

Table 3-3 presents the QA/QC log for the program. Of 279 samples collected during the program, one was invalidated due to a power interruption of significant length (the 5-Northeast sampler on February 25, 2004 operated for only 10 of 24 hours).

**Table 3-3 QA/QC Log**

| Sampling Date | Session No. | Comment                                                                                                                        |
|---------------|-------------|--------------------------------------------------------------------------------------------------------------------------------|
| 15-Apr-03     | 106         | None                                                                                                                           |
| 15-Apr-03     | 107         | Sample from 6-Near East mistakenly operated as nocturnal sampler; results valid as nocturnal sample                            |
| 20-May-03     | 108         | None                                                                                                                           |
| 21-May-03     | 109         | None                                                                                                                           |
| 17-Jun-03     | 110         | None                                                                                                                           |
| 18-Jun-03     | 111         | None                                                                                                                           |
| 14-Jul-03     | 112         | None                                                                                                                           |
| 15-Jul-03     | 113         | None                                                                                                                           |
| 13-Aug-03     | 114         | None                                                                                                                           |
| 14-Aug-03     | 115         | None                                                                                                                           |
| 9-Sep-03      | 116         | Magnehelic guage fluctuations noted at 2-South sampler at sample recovery; average of variation used for flowrate calculations |
| 10-Sep-03     | 117         | None                                                                                                                           |
| 21-Oct-03     | 118         | None                                                                                                                           |
| 22-Oct-03     | 119         | None                                                                                                                           |
| 18-Nov-03     | 120         | None                                                                                                                           |
| 19-Nov-03     | 121         | Sampler operation at 7-Northwest site abbreviated (22 hours) due to power interruption                                         |
| 9-Dec-03      | 122         | None                                                                                                                           |
| 10-Dec-03     | 123         | None                                                                                                                           |
| 13-Jan-04     | 124         | None                                                                                                                           |
| 14-Jan-04     | 125         | Sampler operation at 4-North site abbreviated (16.7 hours) due to power interruption                                           |
| 24-Feb-04     | 126         | None                                                                                                                           |
| 25-Feb-04     | 127         | Sampler operation at 5-Northeast site abbreviated (10 hours) due to power interruption; sample invalidated and not analyzed.   |
| 23-Mar-04     | 128         | None                                                                                                                           |
| 24-Mar-04     | 129         | None                                                                                                                           |

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### **3.5.2 Field Blanks and Method Blanks**

All field blank and method blank results were reported as "non detect" for each of the PCB congener class sums.

### **3.5.3 Collocated Samples**

Collocated samples collected once per month at the East site showed excellent agreement with an average percent difference of less than 5%.

## 4.0 PROGRAM RESULTS

### 4.1 Calculations and Results

A formal data reduction regime has been implemented to report the data set obtained from the monitoring program. Program data collected during the program consisted of two types, field data and laboratory analytical data. Field data includes information necessary for the calculation of sampler air volumes, which are then used to calculate ambient concentrations from the analytical results supplied by the laboratory.

For each sample, ambient PCB concentrations were calculated by dividing laboratory results (measured weight of target compound per sample) by sample volume (standard cubic meters) to give a mass per unit volume in ambient air (nanograms per cubic meter ( $\text{ng}/\text{m}^3$ )). Ambient concentrations were reported for each individual PCB congener class; total PCBs were reported on a per sample basis by summing the values reported for each of the ten congener classes. For those congener classes reported as non-detected, a value of zero was used to calculate total PCBs, as specified in the Work Plan.

Table 4-1 presents ambient PCB concentrations ( $\text{ng}/\text{m}^3$ ) from the program. Copies of monthly ambient PCB data reports inclusive of PCB congener class results are provided in Appendix C. Figure 4-1 graphically depicts the average and maximum total PCB concentration for each of the eight monitoring stations. Ambient PCB levels were measured as follows:

- Average ambient levels at the eight sites varied from 2.3 to 27.1  $\text{ng}/\text{m}^3$ .
- The maximum ambient total PCB concentration measured during the program was 145  $\text{ng}/\text{m}^3$  at the Near East site.
- The average and maximum PCB concentrations measured during the program were well below the NIOSH and OSHA standards for PCBs (published as standards to assess worker exposure) of 1,000  $\text{ng}/\text{m}^3$  and 1,000,000  $\text{ng}/\text{m}^3$ , respectively.

### 4.2 Data Evaluation and Interpretation

Total ambient PCB levels were evaluated in conjunction with meteorological monitoring data. Specifically, wind direction data facilitated evaluation of potential PCB source locations by comparing results from monitors situated predominantly upwind and downwind of the facility during a given sampling session. To support the upwind/downwind evaluation, only data from sampling periods showing consistent winds offered value. Of the 24 sampling sessions conducted during the program, 16 showed consistent winds. Table 4-2 identifies the 16 sessions with consistent winds and provides an assessment of possible PCB source areas for these sessions. Appendix D provides a graphical

**Table 4-1 Ambient PCB Results (ng/m<sup>3</sup>)**

| Monitoring Site ID and Name (e) |                    |         |      |      |      |      |      |      |               |       |       |                     |   |
|---------------------------------|--------------------|---------|------|------|------|------|------|------|---------------|-------|-------|---------------------|---|
| Sampling Date (c)               | Session Number (d) | 1       |      | 2    | 3    | 4    | 5    | 6    | 7             |       |       |                     | 8 |
|                                 |                    | Primary | East |      |      |      |      |      | Near East (b) | Night | Day   | Northwest 24-Hr (h) |   |
| 15-Apr-03                       | 106                | ND      | ND   | 0.3  | 0.6  | 12.9 | 8.5  | 14.3 | 3.4           | 7.2   | 5.5   | 10.9                |   |
| 16-Apr-03                       | 107 (f)            | ND      | a    | ND   | ND   | 9.4  | 3.1  | 0.9  | 0.2           | 6.1   | 3.1   | 0.4                 |   |
| 20-May-03                       | 108                | ND      | ND   | ND   | ND   | 13.8 | 2.9  | 4.8  | 3.2           | 1.6   | 2.4   | 0.1                 |   |
| 21-May-03                       | 109                | 1.8     | a    | 3.5  | 5    | 5    | 3.9  | 77.3 | 9.3           | 2.4   | 5.9   | 27.5                |   |
| 17-Jun-03                       | 110                | 1.5     | 1.6  | 1.2  | 3.4  | 17.4 | 17.1 | 33.2 | 9.4           | 11.8  | 10.8  | 16.1                |   |
| 18-Jun-03                       | 111                | 12.6    | a    | 9.1  | 9.4  | 36.9 | 30.7 | 85.9 | 68.2          | 14.7  | 41.4  | 12.8                |   |
| 14-Jul-03                       | 112                | 1.5     | 1.2  | 2.7  | 4.9  | 13.8 | 9.8  | 32.8 | 10.4          | 14.2  | 12.5  | 13.4                |   |
| 15-Jul-03                       | 113                | 6.6     | a    | 7.1  | 11.7 | 21.1 | 12.1 | 54.8 | 34.2          | 51.1  | 44.3  | 21.5                |   |
| 13-Aug-03                       | 114                | 0.5     | 0.3  | 0.4  | 1.8  | 33   | 10.9 | 17.1 | 8.9           | 9.1   | 9.0   | 6.1                 |   |
| 14-Aug-03                       | 115                | 3.4     | a    | 2.5  | 7.7  | 49.6 | 20   | 72.6 | 101.9         | 7.4   | 59.3  | 23.3                |   |
| 9-Sep-03                        | 116                | 0.4     | 0.4  | 1.9  | 6.8  | 19.1 | 6.8  | 15.6 | 18.9          | 9.8   | 14.3  | 13.6                |   |
| 10-Sep-03                       | 117                | ND      | a    | 0.2  | 2.7  | 12.9 | 6.5  | 10.7 | 2.8           | 15.5  | 8.2   | 26.6                |   |
| 21-Oct-03                       | 118                | 22.5    | 22.8 | 10.2 | 3.2  | 79.2 | 22.5 | 44.9 |               |       | 145.4 | 12.1                |   |
| 22-Oct-03                       | 119                | 9.9     | a    | 5.6  | 17.5 | 40.7 | 9.9  | 34.4 |               |       | 54.5  | 9.9                 |   |
| 18-Nov-03                       | 120                | ND      | ND   | 0.1  | 0.6  | 9.9  | 3.8  | 4.9  |               |       | 9.8   | 1.3                 |   |
| 19-Nov-03                       | 121                | 1.8     | a    | 0.2  | 0.5  | 21.5 | 16.9 | 11.9 |               |       | 32.1  | 1.1                 |   |
| 9-Dec-03                        | 122                | ND      | ND   | ND   | ND   | 3.9  | 4.4  | 3.3  |               |       | 3.0   | 0.2                 |   |
| 10-Dec-03                       | 123                | 1.1     | a    | 2.6  | 1.9  | 3.3  | 0.5  | 8.5  |               |       | 13.1  | ND                  |   |
| 13-Jan-04                       | 124                | 9.1     | 9    | 4.7  | 3.6  | 25.4 | 12.7 | 55.2 |               |       | 48.5  | 15.8                |   |
| 14-Jan-04                       | 125                | 3.9     | a    | 1.7  | 5.9  | 35.8 | 8.4  | 33.6 |               |       | 54.4  | 2.8                 |   |
| 24-Feb-04                       | 126                | ND      | ND   | 0.3  | 1.2  | 3.9  | 3.5  | 21.7 |               |       | 2.6   | 35.2                |   |
| 25-Feb-04                       | 127                | ND      | a    | ND   | ND   | 1.7  | g    | 8.4  |               |       | 0.4   | 0.2                 |   |
| 23-Mar-04                       | 128                | ND      | ND   | ND   | ND   | 2.5  | 1.8  | 2.0  |               |       | 1.8   | 1.7                 |   |
| 24-Mar-04                       | 129                | ND      | a    | ND   | ND   | 6.4  | 3.9  | 1.8  |               |       | 2.7   | 0.9                 |   |
| AVERAGE                         |                    | 3.2     | 2.9  | 2.3  | 3.7  | 20.0 | 9.6  | 27.1 | 22.6          | 12.6  | 24.4  | 10.6                |   |

**Table 4-1 Ambient PCB Results (ng/m<sup>3</sup>) (cont'd)**

**Table 4-1 Footnotes**

- a - Not sampled; collocated sample collected once per month per RFI/CS Air Monitoring Plan.
- b - Filter and PUF fractions were analyzed separately for samples collected April through September, February and March; results reported are combined for the two fractions (all filter analyses were reported as ND).
- c - Start date; samplers operated nominally for 24 hour period.
- d - Sampling session numbering scheme continued from regimen used for previous monitoring at the site.
- e - Site naming outlined in Table 2-4 of the RFI/CS Air Monitoring Plan (Revision 2.0), October 2002.
- f - 6-Near East location mistakenly operated as nocturnal sampler
- g - Power interruption led to sample invalidation; sample not analyzed.
- h - Time-weighted average of day/night results used to calculate "24-hour" value for samples collected April through September 2003 at the Northwest site.

Figure 4-1 Summary of Results

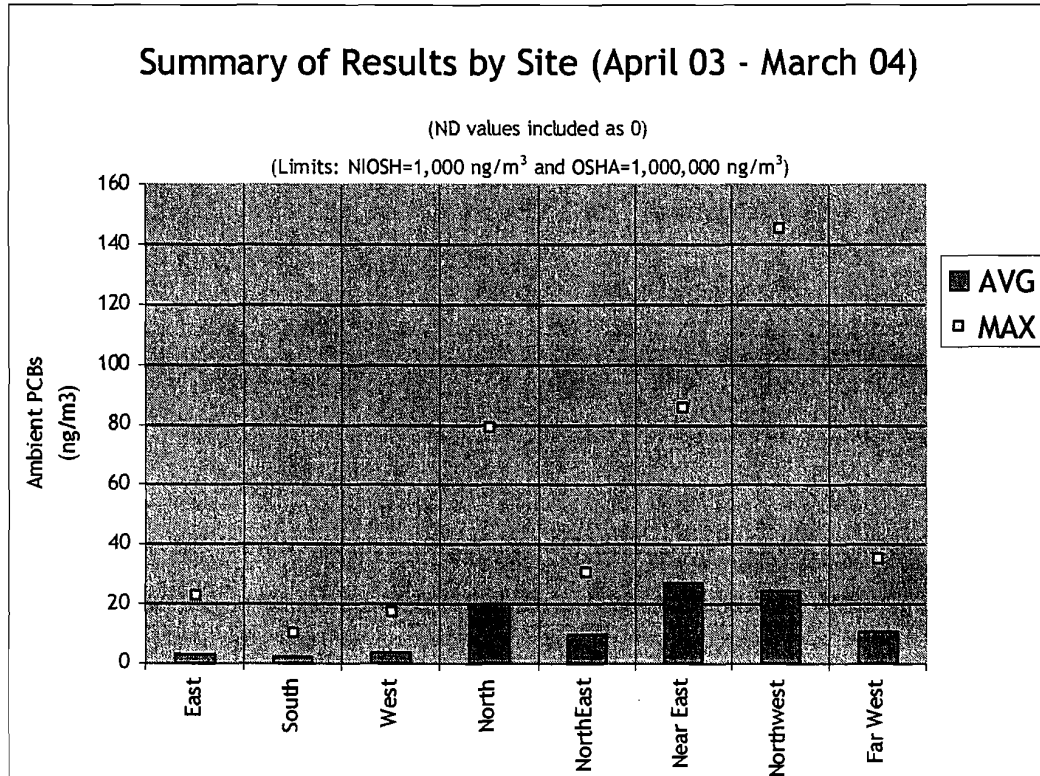


Table 4-2 Assessment of Potential PCB Source Locations

| Sampling Date  | Appendix D<br>Page Number<br>For Windrose | Total<br>Max PCB<br>(ng/m <sup>3</sup> ) | Max<br>Monitoring<br>Location | Predominant<br>Wind Direction | Potential PCB<br>Source Locations | Rationale                                                                            |
|----------------|-------------------------------------------|------------------------------------------|-------------------------------|-------------------------------|-----------------------------------|--------------------------------------------------------------------------------------|
| Apr 15/16 2003 | D-1                                       | 14.3                                     | Near East                     | Southeast                     | On- and off-site                  | Monitors both upwind and downwind of facility show similar PCB concentrations        |
| Apr 16/17 2003 | D-2                                       | 9.4                                      | North                         | South                         | On- and off-site                  | Monitors both upwind and downwind of facility show similar PCB concentrations        |
| May 20/21 2003 | D-3                                       | 13.8                                     | North                         | East-Southeast                | On- and off-site                  | Monitors both upwind and downwind of facility show similar PCB concentrations        |
| May 21/22 2003 | D-4                                       | 77.3                                     | Near East                     | North                         | Off-site, North of Plant          | Value at monitor upwind of facility is highest, suggesting off-plant source location |
| Jun 17/18 2003 | D-5                                       | 33.2                                     | Near East                     | Variable                      |                                   | No assessment possible due to variable winds                                         |
| Jun 18/19 2003 | D-6                                       | 85.9                                     | Near East                     | Variable                      |                                   | No assessment possible due to variable winds                                         |
| Jul 14/15 2003 | D-7                                       | 32.8                                     | Near East                     | Variable                      |                                   | No assessment possible due to variable winds                                         |
| Jul 15/16 2003 | D-8                                       | 85.3                                     | Northwest                     | Variable                      |                                   | No assessment possible due to variable winds                                         |
| Aug 13/14 2003 | D-9                                       | 33.0                                     | North                         | Northeast                     | Off-site, Northeast of Plant      | Value at monitor upwind of facility is highest, suggesting off-plant source location |
| Aug 14/15 2003 | D-10                                      | 109.3                                    | Northwest                     | Variable                      |                                   | No assessment possible due to variable winds                                         |
| Sep 9/10 2003  | D-11                                      | 28.7                                     | Northwest                     | Variable                      |                                   | No assessment possible due to variable winds                                         |
| Sep 10/11 2003 | D-12                                      | 26.6                                     | Far West                      | East-Southeast                | On-site                           | PCB concentrations tend to increase across the monitoring network                    |

Table 4-2 Assessment of Potential PCB Source Locations (cont'd.)

| Sampling Date                                        | Appendix D<br>Page Number<br>For Windrose | Total<br>Max PCB<br>(ng/m <sup>3</sup> ) | Max<br>Monitoring<br>Location | Predominant<br>Wind Direction | Potential PCB<br>Source Locations            | Rationale                                                                                     |
|------------------------------------------------------|-------------------------------------------|------------------------------------------|-------------------------------|-------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------------------|
| Oct 21/22 2003                                       | D-13                                      | 145.4                                    | Northwest                     | West                          | Off-site, West of Plant                      | Value at monitor upwind of facility is highest, suggesting off-plant source location          |
| Oct 22/23 2003                                       | D-14                                      | 54.5                                     | Northwest                     | Northwest                     | Off-site, Northwest of Plant                 | Value at monitor upwind of facility is highest, suggesting off-plant source location          |
| Nov 17/18 2003                                       | D-15                                      | 9.9                                      | North                         | South-Southeast               | On-site                                      | Two monitors downwind of site show highest levels                                             |
| Nov 18/19 2003                                       | D-16                                      | 32.1                                     | Northwest                     | Variable                      | No assessment possible due to variable winds |                                                                                               |
| Dec 9/10 2003                                        | (a)                                       | 4.4                                      | Northeast                     | Southeast                     | Off-site, East of Plant                      | Similar low levels measured at North, Northeast and Near East sites                           |
| Dec 10/11 2003                                       | D-17                                      | 13.1                                     | Northwest                     | West                          | Off-site, West of Plant                      | Value at monitor upwind of facility is highest, suggesting off-plant source location          |
| Jan 13/14 2004                                       | D-18                                      | 55.2                                     | Northeast                     | Variable                      | No assessment possible due to variable winds |                                                                                               |
| Jan 14/15 2004                                       | D-19                                      | 54.4                                     | Northwest                     | West-Southwest                | Off-site, West of Plant                      | Value at monitor upwind of facility is highest, suggesting off-plant source location          |
| Feb 24/25 2004                                       | D-20                                      | 35.2                                     | Far West                      | Northeast                     | On- and off-site                             | Max monitor downwind of both on-site and off-site areas; similar level seen at upwind monitor |
| Feb 25/26 2004                                       | D-21                                      | 8.4                                      | Near East                     | East                          | On- and off-site                             | Max monitor downwind of both on-site and off-site areas; similar level seen at upwind monitor |
| Mar 23/24 2004                                       | D-22                                      | 2.5                                      | North                         | Southeast                     | On- and off-site                             | Monitors both upwind and downwind of facility show similar PCB concentrations                 |
| Mar 24/25 2004                                       | D-23                                      | 6.4                                      | North                         | Southeast                     | On- and off-site                             | Monitors both upwind and downwind of facility show similar PCB concentrations                 |
| (a) Wind speed sensor failure; no windrose possible. |                                           |                                          |                               |                               |                                              |                                                                                               |

depiction of wind data and ambient PCB concentrations for each sampling session using a U.S.G.S map of the monitoring network area.

#### **4.2.1 Vapor / Particle Partitioning**

The mechanisms that transport PCBs from existing source areas to the air pathway include volatilization (evaporation) and airborne suspension of PCB-containing particles. These processes contribute respectively to the vapor phase and particulate-associated partitions of total ambient PCB levels. Therefore, understanding the vapor/particle partitioning can be helpful in assessing the types of potential sources that may be contributing to the ambient PCB burden. For instance, the presence of particulate-bound PCBs could indicate a PCB source from fugitive dust such as contaminated soil particles.

To assess the vapor/particle partitioning of PCBs, 16 samples collected at the Near East site were subjected to separate analysis of the filter and PUF/XAD media as described in the October 2002 Work Plan. The filter and PUF/XAD collect particulate-associated and vapor phase PCBs, respectively. As noted in Table 4-3, PCBs were not detected on the filter (particulate) in any of the samples even during different months and temperature ranges; all PCBs measured were found in the PUF/XAD (vapor phase) media.

The results from these analyses indicate that ambient PCBs appear almost exclusively in the vapor phase in the area surrounding the Solutia site. This vapor phase predominance indicates that the PCB transport mechanism from source area to air pathway is volatilization and not suspension of fugitive dust. Suspension of contaminated soil is therefore not a likely source mechanism of PCBs to the air pathway in the study area.

#### **4.2.2 Congener Profile Analysis**

Analysis of the mono through deca PCB profile can provide information on potential sources. The data for this study show that ambient PCB concentrations for the tri-substituted congener class and above increased with temperature. Higher ambient total PCB concentrations likely occur at higher temperatures because of PCB evaporation from soils. However, the evaporation is only correlated to the heavier congeners of PCBs (tri-substituted and above). High concentrations of heavy congener classes occur on hot days when evaporation is occurring and is found at all monitors in the area.

**Table 4-3 Particle / Vapor Results (a)**

| Session Number                                                                                                                                                                                                                                           | Sampling Date | Filter<br>Particulate-Associated<br>(ng/m <sup>3</sup> ) | PUF/XAD<br>Vapor Phase<br>(ng/m <sup>3</sup> ) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------------------------|------------------------------------------------|
| 106                                                                                                                                                                                                                                                      | 4/15/2003     | ND                                                       | 14.3                                           |
| 107                                                                                                                                                                                                                                                      | 4/16/2003     | ND                                                       | 0.9                                            |
| 108                                                                                                                                                                                                                                                      | 5/20/2003     | ND                                                       | 4.8                                            |
| 109                                                                                                                                                                                                                                                      | 5/21/2003     | ND                                                       | 77.3                                           |
| 110                                                                                                                                                                                                                                                      | 6/17/2003     | ND                                                       | 33.2                                           |
| 111                                                                                                                                                                                                                                                      | 6/18/2003     | ND                                                       | 85.9                                           |
| 112                                                                                                                                                                                                                                                      | 7/14/2003     | ND                                                       | 32.8                                           |
| 113                                                                                                                                                                                                                                                      | 7/18/2003     | ND                                                       | 54.8                                           |
| 114                                                                                                                                                                                                                                                      | 8/13/2003     | ND                                                       | 17.1                                           |
| 115                                                                                                                                                                                                                                                      | 8/14/2003     | ND                                                       | 72.6                                           |
| 116                                                                                                                                                                                                                                                      | 9/9/2003      | ND                                                       | 15.6                                           |
| 117                                                                                                                                                                                                                                                      | 9/10/2003     | ND                                                       | 10.7                                           |
| 126                                                                                                                                                                                                                                                      | 2/24/2004     | ND                                                       | 21.7                                           |
| 127                                                                                                                                                                                                                                                      | 2/25/2004     | ND                                                       | 8.4                                            |
| 128                                                                                                                                                                                                                                                      | 3/23/2004     | ND                                                       | 2.0                                            |
| 129                                                                                                                                                                                                                                                      | 3/24/2004     | ND                                                       | 1.8                                            |
| (a) Samples for separate particle/vapor analyses were collected at the Near East site April through September 2003 and February through March 2004 per the Work Plan.<br>ND - Not detected at the approximate detection limit of 0.7 ng/m <sup>3</sup> . |               |                                                          |                                                |

Ambient PCB concentrations of the mono- and di-substituted PCBs did not appear to vary with temperature. The lighter congeners (mono and di-substituted and sometimes tri-substituted) are not correlated with temperature and therefore likely do not arise from evaporation from soils. These lighter congeners are in the air year round. Thus, there appear to be two portions of the measured PCBs (mono and di-substituted; tri through deca-substituted) with two different source mechanisms. The light congener classes appear throughout the year and are not dependent on evaporation. They therefore come from sources that are not local to the plant site or monitoring area.

#### **4.2.3 Nocturnal / Diurnal Sampling**

The Work Plan called for separate collection and analysis of 12 nocturnal/diurnal sample pairs to assist with identifying potential PCB sources. Of the twelve nocturnal/diurnal sample pairs collected during the program, five showed higher PCB values at night and seven showed higher PCB values during the daytime. As such, evaluation of nocturnal/diurnal sampling results did not provide additional insight about potential PCB source areas.

#### **4.2.4 Identification of PCB Source Locations**

Program data summarized in Table 4-2 indicate influences from both on-site and off-site PCB source areas. As listed in Table 4-2, during six of sixteen sampling sessions with consistent wind direction (5/21/03, 8/13/03, 10/21/03, 10/22/03, 12/10/03 and 1/14/04), the highest total PCB concentration was measured at a monitor situated predominantly upwind of the facility. This suggests the presence of off-site PCB source influences.

In addition to off-site influences, the data also suggest influence from on-site PCB source areas. During one session (11/17/03), two monitors downwind of the facility showed the highest PCB concentrations. A second session (9/10/03) showed PCB concentrations increasing across the plant along the upwind/downwind vector. During seven additional sessions, as summarized in Table 4-2, both off-site and on-site source influences were noted.

#### **4.2.5 Evaluation of South and West End Landfills as Potential PCB Sources**

To evaluate the potential for the South and West Landfills to serve as sources of PCBs, program results from the 2-South and 3-West monitors were evaluated. These monitors are suitable for this evaluation because they are each located closest and adjacent to the landfills (see Figures 3-1 and 3-2 for a schematic of sampler locations in the study area). Also, because of general atmospheric mixing and the fact that a significant portion of the mixed air mass at the landfills would be expected to impinge at ground level at the 2-South and 3-West samplers (when these monitors are located downwind of the landfills), these monitors are properly situated to measure airborne PCBs from the South and West Landfills, if in fact these landfills served as a PCB source.

Neither the South nor West Landfills appear to be a source of PCBs because ambient PCB concentrations at the 2-South and 3-West sites were very low even when these locations were situated predominantly downwind of the South and West Landfills, respectively (e.g. winds from the S and SE vectors).

Table 4-4 shows ambient PCB concentrations measured at the 2-South and 3-West samplers during the program. Data are presented separately for the six sessions during which prevailing winds placed the 2-South and 3-West monitors mostly downwind of the respective landfills (4/15/03, 4/16/03, 11/17/03, 12/9/03, 3/23/04, 3/24/04). Appendix D provides a graphical depiction of wind data and ambient PCB concentrations for the six sampling periods listed above using a U.S.G.S map of the monitoring network area.

**Table 4-4 Landfill PCB Source Evaluation**

| Sampling Date                                                                                              | Appendix D Page Number For Windrose | Predominant Wind Direction | Total PCBs @ 2-South Site (ng/m <sup>3</sup> ) |      | Total PCBs @ 3-West Site (ng/m <sup>3</sup> ) |      | Total PCBs @ Max Site |           |
|------------------------------------------------------------------------------------------------------------|-------------------------------------|----------------------------|------------------------------------------------|------|-----------------------------------------------|------|-----------------------|-----------|
|                                                                                                            |                                     |                            | Downwind of South Landfill ?                   |      | Downwind of West Landfill ?                   |      | ng/m <sup>3</sup>     | Site      |
| Apr 15/16 2003                                                                                             | D-1                                 | Southeast                  | 0.3                                            |      | 0.6                                           |      | 14.3                  | Near East |
| Apr 16/17 2003                                                                                             | D-2                                 | South                      | ND                                             |      | ND                                            |      | 9.4                   | North     |
| May 20/21 2003                                                                                             | D-3                                 | East-Southeast             |                                                | ND   |                                               | ND   | 13.8                  | North     |
| May 21/22 2003                                                                                             | D-4                                 | North                      |                                                | 3.5  |                                               | 5.0  | 77.3                  | Near East |
| Jun 17/18 2003                                                                                             | D-5                                 | Variable                   |                                                | 1.2  |                                               | 3.4  | 33.2                  | Near East |
| Jun 18/19 2003                                                                                             | D-6                                 | Variable                   |                                                | 9.1  |                                               | 9.4  | 85.9                  | Near East |
| Jul 14/15 2003                                                                                             | D-7                                 | Variable                   |                                                | 2.7  |                                               | 4.9  | 32.8                  | Near East |
| Jul 15/16 2003                                                                                             | D-8                                 | Variable                   |                                                | 7.1  |                                               | 11.7 | 85.3                  | Northwest |
| Aug 13/14 2003                                                                                             | D-9                                 | Northeast                  |                                                | 0.4  |                                               | 1.8  | 33                    | North     |
| Aug 14/15 2003                                                                                             | D-10                                | Variable                   |                                                | 2.5  |                                               | 7.7  | 109.3                 | Northwest |
| Sep 9/10 2003                                                                                              | D-11                                | Variable                   |                                                | 1.9  |                                               | 6.8  | 28.7                  | Northwest |
| Sep 10/11 2003                                                                                             | D-12                                | East-Southeast             |                                                | 0.2  |                                               | 2.7  | 26.6                  | Far West  |
| Oct 21/22 2003                                                                                             | D-13                                | West                       |                                                | 10.2 |                                               | 3.2  | 145.4                 | Northwest |
| Oct 22/23 2003                                                                                             | D-14                                | Northwest                  |                                                | 5.6  |                                               | 17.5 | 54.5                  | Northwest |
| Nov 17/18 2003                                                                                             | D-15                                | South-Southeast            | 0.1                                            |      | 0.6                                           |      | 9.9                   | North     |
| Nov 18/19 2003                                                                                             | D-16                                | Variable                   |                                                | 0.2  |                                               | 0.5  | 32.1                  | Northwest |
| Dec 9/10 2003                                                                                              | (a)                                 | Southeast                  | ND                                             |      | ND                                            |      | 4.4                   | Northeast |
| Dec 10/11 2003                                                                                             | D-17                                | West                       |                                                | 2.6  |                                               | 1.9  | 13.1                  | Northwest |
| Jan 13/14 2004                                                                                             | D-18                                | Variable                   |                                                | 4.7  |                                               | 3.6  | 55.2                  | Northeast |
| Jan 14/15 2004                                                                                             | D-19                                | West-Southwest             |                                                | 1.7  |                                               | 5.9  | 54.4                  | Northwest |
| Feb 24/25 2004                                                                                             | D-20                                | Northeast                  |                                                | 0.3  |                                               | 1.2  | 21.7                  | Near East |
| Feb 25/26 2004                                                                                             | D-21                                | East                       |                                                | ND   |                                               | ND   | 8.4                   | Near East |
| Mar 23/24 2004                                                                                             | D-22                                | Southeast                  | ND                                             |      | ND                                            |      | 2.5                   | North     |
| Mar 24/25 2004                                                                                             | D-23                                | Southeast                  | ND                                             |      | ND                                            |      | 6.4                   | North     |
| AVERAGE                                                                                                    |                                     |                            | 0.1                                            | 3.0  | 0.2                                           | 4.8  | 39.9                  |           |
| (a) No windrose available for this sampling session due to wind speed sensor failure.<br>ND - Not detected |                                     |                            |                                                |      |                                               |      |                       |           |

If the landfills were a source of PCBs, higher PCBs levels should be noted when the 2-South and 3-West samplers are located downwind of the landfills compared to levels measured when they are not situated in a downwind position. As shown in Table 4-4, average PCB concentrations were actually about 30 times lower ( $0.1 \text{ ng/m}^3$  compared to  $3.0 \text{ ng/m}^3$ ) when the 2-South monitor was downwind of the South Landfill compared to the sampling periods during which it was not downwind. For the 3-West monitor, similar results were noted as listed in Table 4-4.

Also, four of the six sampling periods that placed the 2-South and 3-West monitors downwind of the landfills showed non-detection of PCBs. These low PCB concentrations measured at the 2-South and 3-West monitors and in particular at times during which these monitors were located predominantly downwind of the landfills indicates that neither airborne particulate suspension nor evaporation are active mechanisms for moving PCBs from source to air pathway at the South and West Landfills.

#### **4.3 Summary and Conclusions**

The following conclusions are supported by the evaluation of results from the ambient PCB monitoring program:

- The South and West Landfills are not indicated as a source of PCBs. Low PCB concentrations were measured overall at the 2-South and 3-West monitors and in particular at times during which these monitors were located predominantly downwind of the landfills. This indicates that neither airborne particulate suspension nor evaporation are active mechanisms for moving PCBs from source to air pathway at the South and West Landfills.
- The data indicate that potential PCB source areas exist both on and off the plant property. During multiple sampling sessions, monitors upwind of the facility measured the maximum PCB concentration. This is an indication of off-site PCB sources. Several sampling periods during which monitors downwind of the facility showed highest PCB concentrations reflect the presence of on-site PCB sources. Also, the absence of correlation between temperature and the levels of lighter, more volatile PCB congener classes (mono through tri substituted PCBs) indicate that the sources of this component of total PCBs are from outside the study area.