



## Project Summary

# Ambient Acrylonitrile Levels Near Major Acrylonitrile Production and Use Facilities

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**This summary describes a study undertaken to determine the acrylonitrile (AN) levels near selected manufacturing plants that are either major users or producers of AN, and also to measure the difference, if any, in the concentration levels near the two types of facilities. Data gathering was done over a four-month period, and involved taking 24-h air samples on charcoal tubes for 10-12 consecutive days near the selected plant sites.**

**Results show that many factors affect the recorded AN levels, including meteorological conditions, distance of sampling site from plant, and certain geographical elements (such as bodies of water). Although study results point to higher AN concentration levels near user facilities than producers, the study did not provide an adequate data base from which to draw definite conclusions.**

***This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).***

### Introduction

This report describes a study in which data were gathered to verify the presence of ambient acrylonitrile (AN) in the vicinity of industrial plants that are major users or producers of AN. This study was also to determine the difference, if any, of AN concentration levels near user and producer facilities.

PEDCo Environmental, Inc., performed the field work, which involved taking 24-h

air samples on charcoal tubes for 10 to 12 consecutive days at sampling stations near the selected plants. Data gathering took place from June through September 1981 at the following facilities:

- Monsanto in Texas City, Texas
- Monsanto in Decatur, Alabama
- Borg-Warner in Washington, West Virginia
- Vistron (SOHIO) in Lima, Ohio

### Procedure

A preliminary one-day pilot test was conducted in the vicinity of each plant to evaluate the performance of two different size adsorbing tubes. Based on the pilot test results, 150-mg standard charcoal sorption tubes were used during this study.

After samples were taken, tubes were stored on dry ice before shipment to the two analysis laboratories (PEDCo, Cincinnati, Ohio and Research Triangle Institute [RTI], Research Triangle Park, North Carolina). Samples were shipped in insulated boxes containing an ice substitute chilled before shipment to the temperature of dry ice. Quality control and field samples between the two laboratories were shipped in insulated boxes containing dry ice. During the pilot test, samples were split evenly between RTI and PEDCo for analysis. During the actual data gathering test, PEDCo was the primary analysis laboratory, and a designated portion of replicate field samples was sent to RTI to determine interlaboratory method precision.

In evaluating the data presented in this report, the following factors must be considered:

- Location of sampling stations was influenced by the practicality of ob-

taining access permission to many areas, and by the presence of physical barriers, such as bodies of water, near plants to be tested.

- "Normal" plant operations were verified with Monsanto, Borg-Warner, and Vistron personnel during testing, but recording day-to-day events affecting potential AN emissions (such as production and use or process upsets) was beyond the scope of this project.
- Month-to-month and seasonal variations in AN levels are not accounted for.

The report presents details of the techniques used for sampling and for analysis by gas chromatography. Because of the small number of measurements involved, precision and accuracy assessments were not made during the pilot test. During the actual data gathering efforts the following precision and accuracy assessments were made:

- Charcoal tubes were spiked with AN. These tubes were prepared in quadruplicate and divided evenly between PEDCo and RTI for analysis.
- Samples were analyzed in duplicate to assess laboratory method precision.
- Collocated field samples were divided between PEDCo and RTI to determine interlaboratory method precision.
- Samples were analyzed by gas chromatography/mass spectrometry (GC/MS) to confirm the presence of AN.
- Sample flow rates were set and checked by a flow measurement device (proven linear and accurate to  $\pm 5$  percent throughout the flow measurement range used). Initial and final sample flow rates were recorded to correct sample volume error due to changes in sample flow rate over time.

In cases where wind speed and direction information was gathered, the following operation checks were made daily to ensure collection of accurate data:

- Check of wind zero accuracy
- Check of wind direction accuracy
- Data inspection to spot trends

## Results

Various levels of AN were found in the vicinity of each plant tested. Table 1 presents the results of the highest AN levels found in each sample day, the distance from the AN use or production areas at which the sample was collected, and the average values for each plant. This table indicates that the facilities that use AN (Monsanto--Decatur, AL and Borg-Warner--Washington, WV) generally are associated with higher ambient AN concentrations than the producer facilities (Monsanto--Texas City, TX and Vistron--Lima, OH). However, it is not clear from these limited data whether the higher fenceline levels found at the producer facilities were due to higher AN emissions or other factors, such as sampler proximity to the AN sources.

Listed below are the results of interlaboratory bias (IB) assessments based on analyses of charcoal tubes spiked with AN. IB assessments showed a greater probability of error at the Texas City Monsanto plants than at the other three plants. An analytical inconsistency was discovered following analysis of this plant's samples; but after remedial steps were taken these tests showed a marked improvement.

SITE	IB (%)
Texas City, TX	34.1
Decatur, AL	26.8
Washington, WV	7.4
Lima, OH	6.0

(Based on pooling all data, the overall IB was 10.6%.)

Table 2 presents the results of additional precision and accuracy assessments. Interlaboratory total method precision, based on dividing collocated field samples between analysis laboratories, is the assessment showing the "worst case" precision error encountered. The precision estimates obtained using interlaboratory analysis of collocated field samples showed a variation coefficient of 14.6 percent at levels above 10 ppb. Below 10 ppb, precision data showed a variation coefficient of 22.8 percent. (Since this type of precision error showed different characteristics above and below 10 ppb, different computation methods were used.) Other precision assessments presented in Table 2 indicate that collocated field samples analyzed by only one laboratory (intra-laboratory total method precision) showed improved reproducibility, and that analytical precision (repeat analyses of desorbed samples) was not a significant source of error in either of the analysis laboratories. Breakthrough determinations demonstrated that AN was efficiently collected by the charcoal sampling tubes, as approximately 90 percent of the AN found was contained in the first sections of charcoal.

## Conclusions and Recommendations

Confirmation GC/MS analyses of selected samples (samples showing AN by GC/FID analysis) showed positive identification of AN in all cases which indicates that interfering compounds were not causing erroneous measurement of AN.

Dispersion modeling consideration, typically used to support monitoring activities as well as the regulatory decision-making process, indicate a decrease of pollutant concentration with distance from the AN use or production area. This decrease can be substantial in distance ranges of, for example, 0.1 to 2.0 km, and may be

**Table 1.** Highest AN Values on Each Sample Day  
Values are in parts per billion (ppb)

	Sample day												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	
Monsanto TX (prod) distance (km)	11. 0.5	24. 0.3	5.4 0.7	4.7 0.5	8.1 0.5	15. 0.5	13. 0.3	6.6 0.3	5.2 0.5	5.2 0.3	-	-	9.8 0.44
Monsanto AL (use) distance (km)	20. 0.2	36. 0.2	57. 0.2	15. 0.2	10. 0.2	11. 0.1	50. 0.2	37. 0.2	52. 0.2	130. 0.2	97. 0.2	14. 0.2	44.1 0.2
Borg-Warner WV (use) distance (km)	8.1 1.0	20. 0.8	83. 0.5	29 <sup>a</sup> 0.5	11. 1.0	17. 0.5	33. 0.5	30. 0.5	55. 0.5	11. 0.5	-	-	29.7 0.6
Vistron (SOHIO) OH (prod) distance (km)	TR <sup>b</sup> 2.0	TR <sup>b</sup> 2.0	4.0 2.0	4.1 2.0	TR <sup>b</sup> 0.8	8.4 0.8	6.1 0.8	6.0 0.8	TR <sup>b</sup> 1.0	TR <sup>b</sup> 0.6	-	-	>4.1 1.3

<sup>a</sup>Property enclosed by Borg-Warner fenceline on all sides.

<sup>b</sup>TR is less than 2.5 ppb; assumed to be 2.5 for averaging.

**Table 2.** Summary of Quality Assurance Precision and Breakthrough Tests

	Total method precision		Analytical Precision		Breakthrough	
	Interlaboratory	Intralaboratory	RTI	PEDCo	RTI	PEDCo
Below 10 ppb, %	22.8	8.9	N/A <sup>a</sup>	N/A <sup>a</sup>	N/A <sup>a</sup>	N/A <sup>a</sup>
Above 10 ppb, %	14.6	6.5	N/A <sup>a</sup>	N/A <sup>a</sup>	N/A <sup>a</sup>	N/A <sup>a</sup>
Combined, %	N/A <sup>b</sup>	N/A <sup>b</sup>	2.2	1.9	10.5	12.3

<sup>a</sup>Data below and above 100 ppb were combined since different measured levels appeared to have little effect on results.

<sup>b</sup>Data could not be combined due to different characteristics at different ranges.

partially responsible for the lower AN levels found near the producer facilities.

A more detailed sensitivity analysis is necessary to investigate and identify those factors contributing to maximum concentrations at each plant. The results at hand suggest that AN concentrations near user facilities are higher than near producers, but do not necessarily provide an adequate data base from which to draw definite conclusions.

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*The complete report, entitled "Ambient Acrylonitrile Levels Near Major Acrylonitrile Production and Use Facilities," (Order No. PB 83-196 154; Cost: \$16.00, subject to change) will be available only from:*

*National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
Telephone: 703-487-4650*

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