ATSDR's Assessments of ethylene oxide (EtO) in ambient air in Willowbrook, IL

Presented by

Michelle Colledge, PhD
Environmental Health Scientist, ATSDR R5

Mark Johnson, PhD
Regional Director, ATSDR R5

Public Meeting

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ATSDR
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Presentation Overview

- **Initial ATSDR Letter Health Consultation and Public Statement (Completed in August 2018)**

- **Follow-Up ATSDR Health Consultation (In development)**
  - Preliminary data summaries of Ambient Air Monitoring for EtO for Willowbrook, IL and other areas across the country
  - Conclusions about health risks are being evaluated

- **ATSDR's Next Steps**

ATSDR Letter Health Consultation (Aug 2018)

(Based on EPA's May 2018 air monitoring data)

ATSDR Conclusions for Residents & Off-Site Workers in Willowbrook

1. An elevated cancer risk was calculated assuming long-term exposure
2. Non-cancer health effects unlikely to result from EtO exposures

ATSDR Recommendations

1. Sterigenics take immediate action to reduce EtO emissions. (Completed)
2. U.S. EPA initiate long-term air monitoring to determine effectiveness of actions taken to reduce EtO emissions. (Completed)
3. Illinois Department of Public Health (IDPH) investigate whether there are elevated cancers in the Willowbrook community. (Completed)

Objectives of the Follow-Up ATSDR Health Consultation

(In development)

1. Incorporate newly-available ambient air dataset to estimate long term EtO exposures for residents and workers.

2. Identify spatial, temporal, and weather effects on EtO concentrations that impact exposures in Willowbrook.

3. Evaluate possible health risks associated with these exposures, particularly cancer.

4. Review studies of EtO concentrations found in different areas of the country and provide a comparison to Willowbrook.

Summary of EtO Ambient Air Data collected near Sterigenics, Willowbrook, IL

Data Sources Available for ATSDR Evaluation	ATSDR Health Consultation	Number of monitoring locations	Number of samples[a]
U.S. EPA *May 2018*	**Initial Health Consultation** (COMPLETED)	**26**	**39**
U.S. EPA Nov 2018 to Mar 2019 *Sterigenics Operational* *-Nov 13, 2018 to Feb 15, 2019* *Sterigenics Non-Operational* *-Feb 15, 2019 to Mar 31, 2019*	**Follow-Up Health Consultation** (ONGOING)	**8** **8**	**265** **139**
City of Willowbrook *Nov 2018 and Feb 2019*		**10[a]**	**31[b]**
City of Burr Ridge *Nov 2018*		**8**	**8**

[a] *Only valid samples are included here*

[b] *This data set included indoor and outdoor monitoring. However, the indoor monitoring data were extremely limited and could not be used to evaluate trends or to compare with outdoor site due to potential interference with indoor EtO sources. For this assessment, ATSDR only conducted statistical evaluation on the outdoor air data collected by the City of Willowbrook*

Preliminary Summary of U.S. EPA EtO Data

Nov 2018 to Mar 2019

Monitoring Station	Sterigenics Operational (µg/m³)			Sterigenics Non-Operational (µg/m³)		
	# of samples	Median	Range	# of samples	Median	Range
Village Hall	31	**0.95**	0.18 - 19.3	16	**0.13**	ND - 0.46
Village Hall STN 2	14	**1.78**	0.16 - 15.6	9	**0.11**	ND - 0.22
W. Neighborhood	30	**0.21**	0.06 - 5.35	15	**0.11**	ND - 0.30
Gower Elementary	29	**0.24**	0.1 - 1.38	14	**0.14**	ND - 0.39
Hinsdale South H.S.	29	**0.27**	0.13 - 3.29	15	**0.13**	ND - 0.28
Warehouse	29	**0.75**	0.13 - 26.4	17	**0.12**	ND - 0.18
Warehouse STN 2	15	**1.26**	0.25 - 14.3	8	**0.17**	ND - 0.24
Gower Middle	30	**0.23**	0.08 - 3.29	15	**0.09**	ND - 0.27
Water Tower	28	**0.26**	0.08 - 10.8	15	**0.09**	ND - 0.22
Willow Pond	30	**0.21**	0.09 - 3.71	15	**0.15**	ND - 0.32

Median for all stations (Operational): 0.21 – 1.78 µg/m³

Median for all stations (Non-Operational): 0.09 - 0.17 µg/m³

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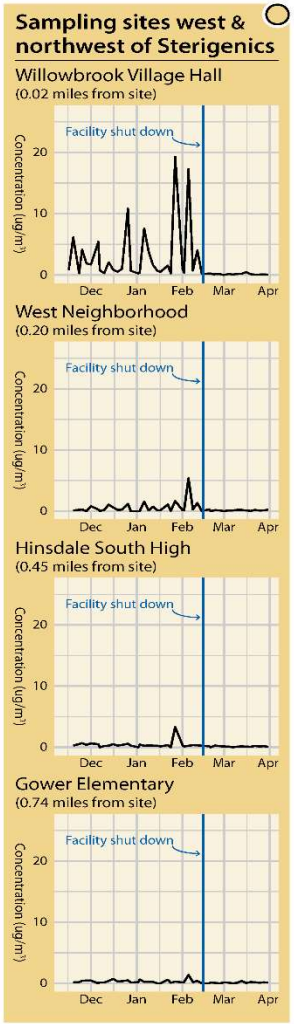
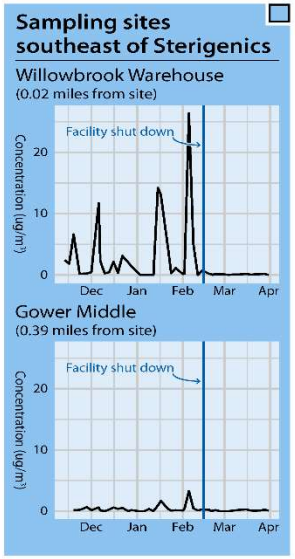
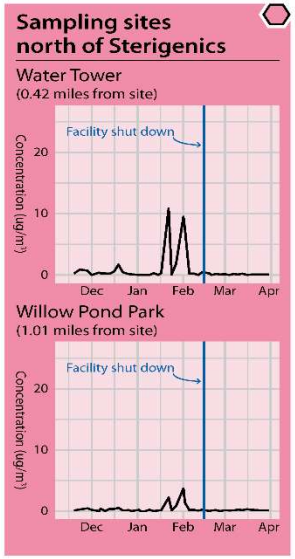
TIME AND SPATIAL TRENDS

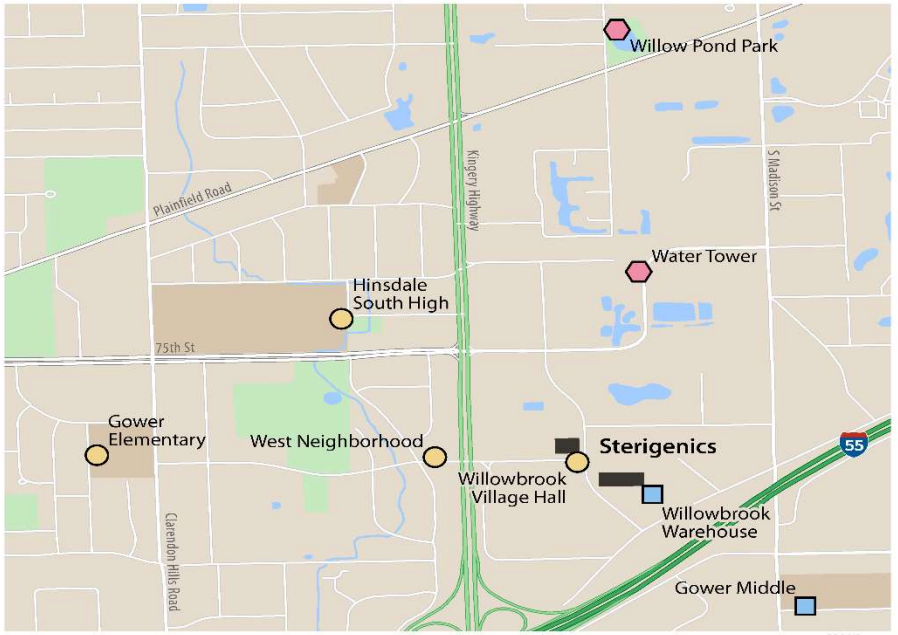
EtO concentration over time at EPA Air Sampling Sites







The line graphs here indicate ethylene oxide (EtO) concentration at the eight primary EPA serial sampling sites around the Sterigenics location. These eight sites collected 24-hour air samples starting at 10:00 a.m. on the days listed in the chart at the lower left of this page. The map shows the location of these sampling sites, as well as two duplicate sites at the Willowbrook Village Hall and the EPA's Willowbrook Warehouse. These two duplicate sites collected samples on roughly half the days that the primary sites did. The Sterigenics facility was shut down on February 15th by the State of Illinois.



Sampling Start Dates

Nov		Dec		Jan		Feb		Mar	
13	16	1	6	2	3	1	2	1	4
19	23	7	10	6	9	5	8	7	10
25	28	13	16	12	15	11	14	13	16
		19	22	17	22	19	20	19	22
		26	28	24	27	21	22*	25	28
						23*	26	31	

*Willowbrook Warehouse and Willowbrook Village Hall only

N W E S Feet 0 1,500

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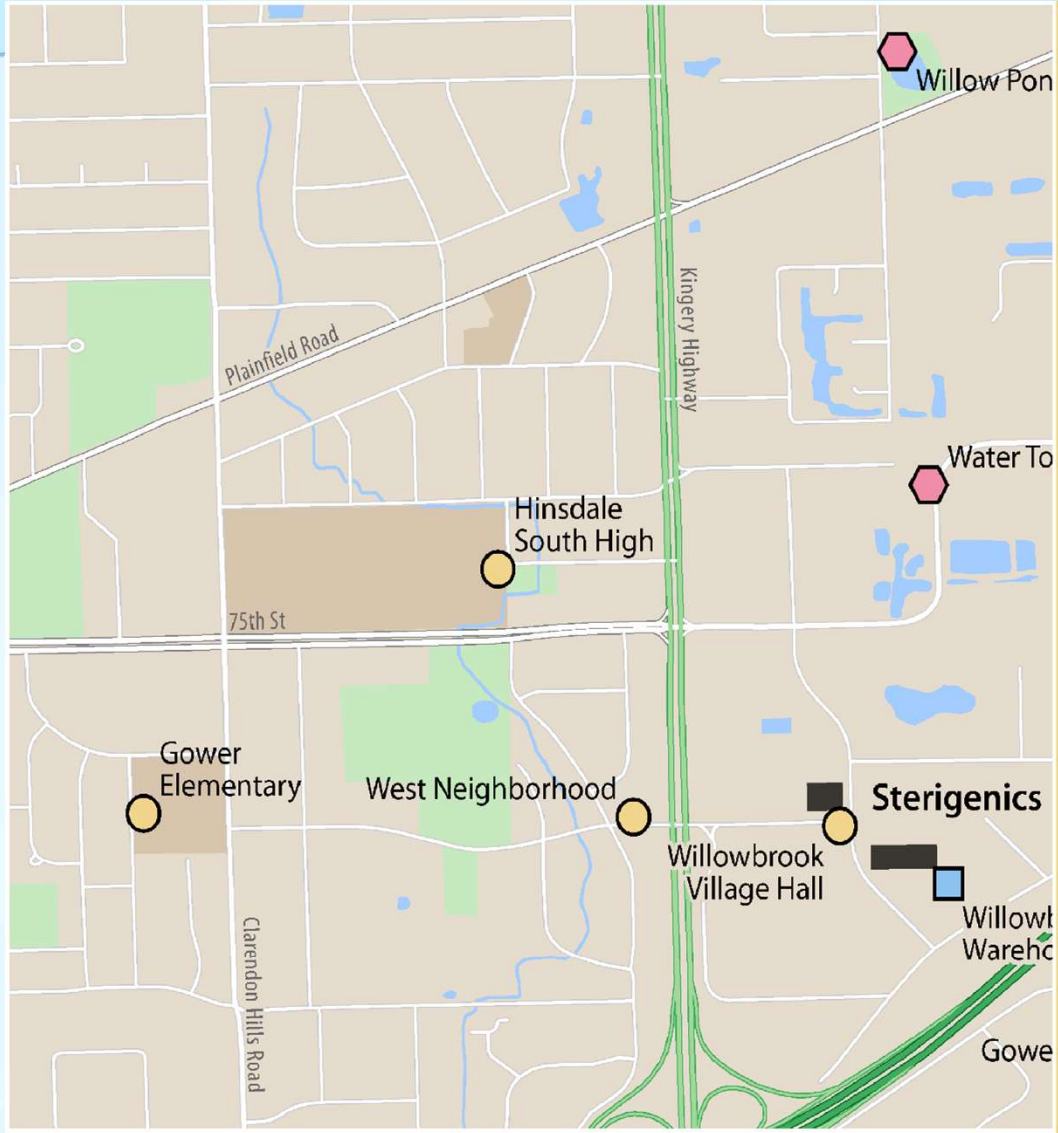
TIME AND SPATIAL TRENDS



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19	23	7	10	6	9	5	8	7	10
25	28	13	16	12	15	11	14	13	16
		19	22	17	22	19	20	19	22
		26	28	24	27	21	22*	25	28
						23*	26	31	

*Willowbrook Warehouse and Willowbrook Village Hall only

N E S W

Feet
0 1,500

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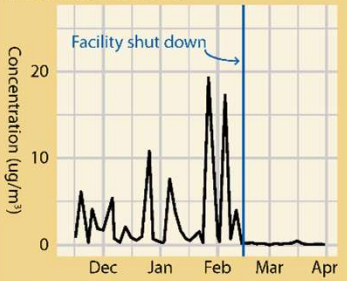
Sampling sites west & northwest of Sterigenics

Willowbrook Village Hall
(0.02 miles from site)



West Neighborhood
(0.20 miles from site)

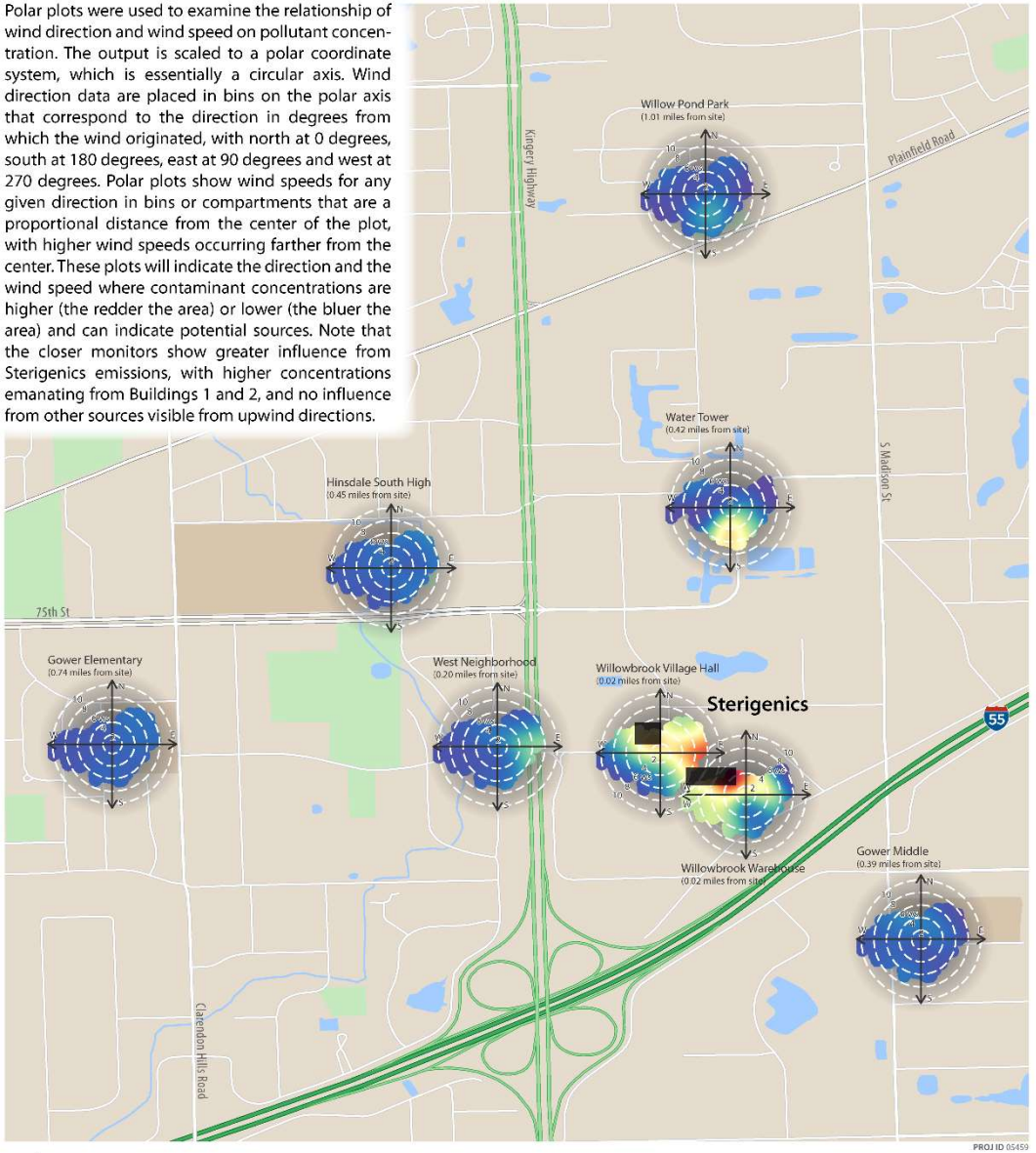
Hinsdale South High
(0.45 miles from site)

Gower Elementary
(0.74 miles from site)

SPATIAL TRENDS

Polar Plots of EtO concentration at EPA Air Sampling Sites

Polar plots were used to examine the relationship of wind direction and wind speed on pollutant concentration. The output is scaled to a polar coordinate system, which is essentially a circular axis. Wind direction data are placed in bins on the polar axis that correspond to the direction in degrees from which the wind originated, with north at 0 degrees, south at 180 degrees, east at 90 degrees and west at 270 degrees. Polar plots show wind speeds for any given direction in bins or compartments that are a proportional distance from the center of the plot, with higher wind speeds occurring farther from the center. These plots will indicate the direction and the wind speed where contaminant concentrations are higher (the redder the area) or lower (the bluer the area) and can indicate potential sources. Note that the closer monitors show greater influence from Sterigenics emissions, with higher concentrations emanating from Buildings 1 and 2, and no influence from other sources visible from upwind directions.



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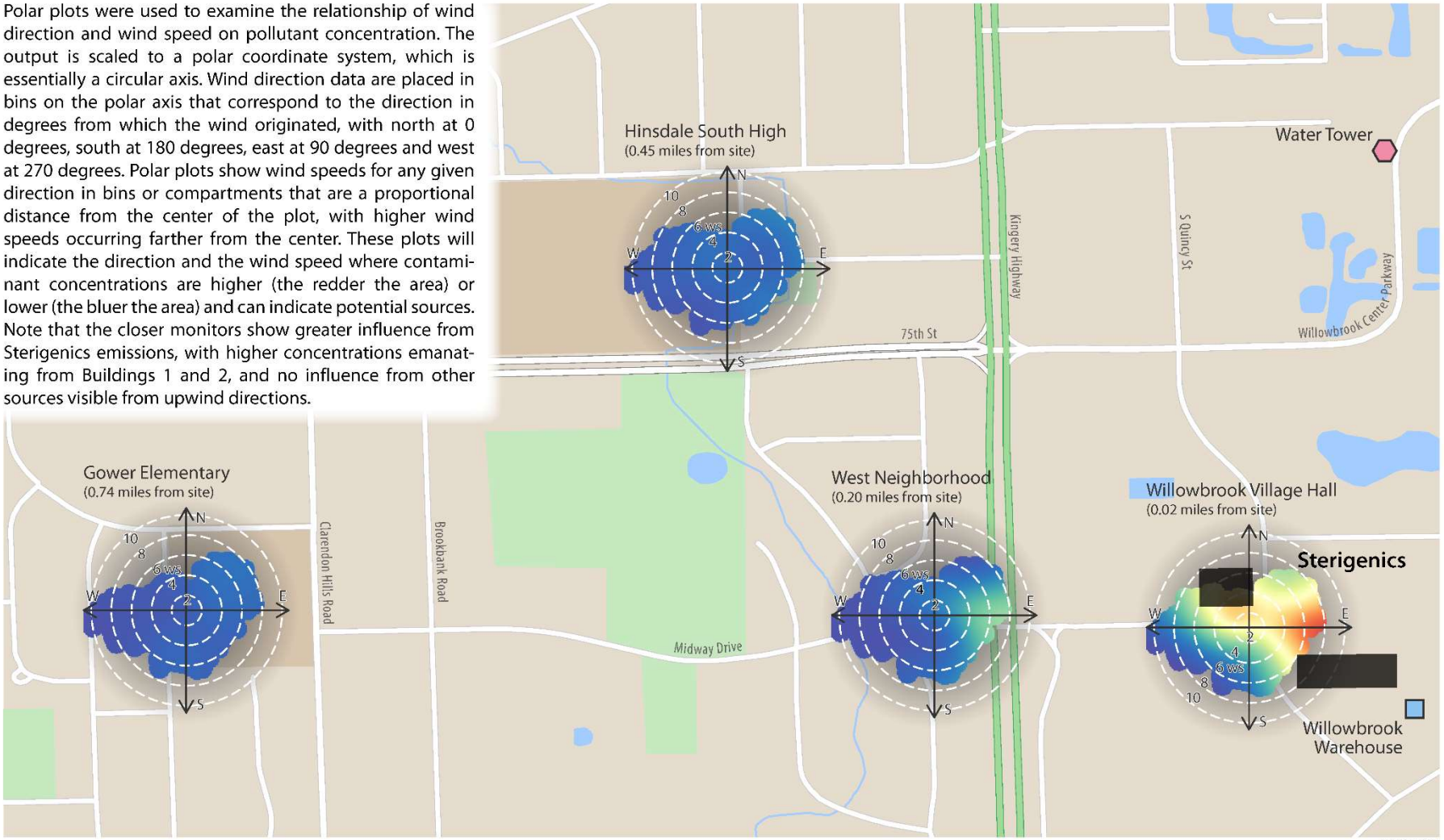
Polar Plots of EtO concentration at EPA Air Sampling Sites West and Northwest of Sterigenics Site

Polar plots were used to examine the relationship of wind direction and wind speed on pollutant concentration. The output is scaled to a polar coordinate system, which is essentially a circular axis. Wind direction data are placed in bins on the polar axis that correspond to the direction in degrees from which the wind originated, with north at 0 degrees, south at 180 degrees, east at 90 degrees and west at 270 degrees. Polar plots show wind speeds for any given direction in bins or compartments that are a proportional distance from the center of the plot, with higher wind speeds occurring farther from the center. These plots will indicate the direction and the wind speed where contaminant concentrations are higher (the redder the area) or lower (the bluer the area) and can indicate potential sources. Note that the closer monitors show greater influence from Sterigenics emissions, with higher concentrations emanating from Buildings 1 and 2, and no influence from other sources visible from upwind directions.



PROJ ID 05459

N
W E
S

Feet
0 1,000

Mean Concentration(ug/m^3)

1 2 3 4 5 6 7

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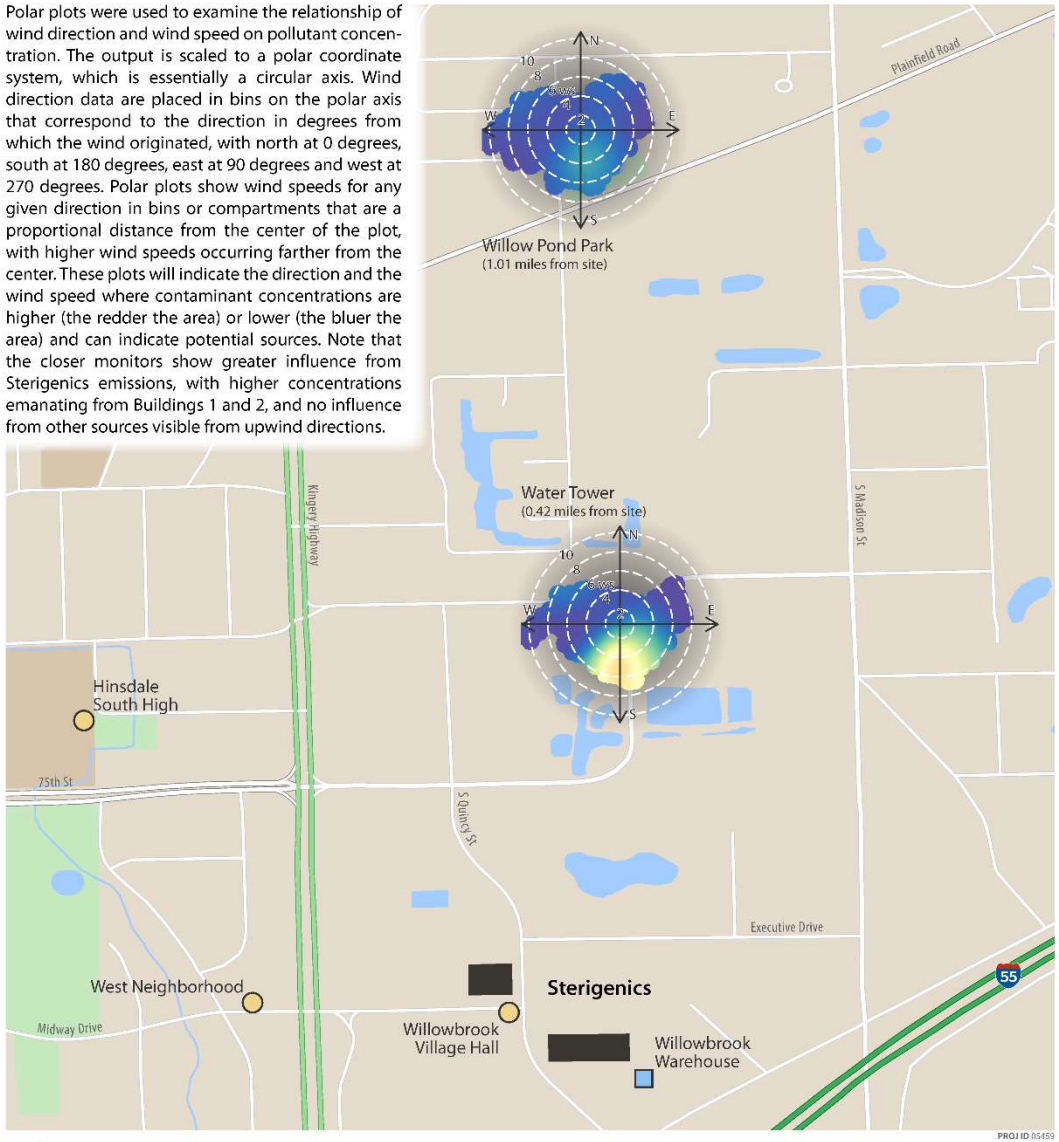
SPATIAL TRENDS

Polar Plots of EtO concentration at EPA Air Sampling Sites North of Sterigenics Site

Polar plots were used to examine the relationship of wind direction and wind speed on pollutant concentration. The output is scaled to a polar coordinate system, which is essentially a circular axis. Wind direction data are placed in bins on the polar axis that correspond to the direction in degrees from which the wind originated, with north at 0 degrees, south at 180 degrees, east at 90 degrees and west at 270 degrees. Polar plots show wind speeds for any given direction in bins or compartments that are a proportional distance from the center of the plot, with higher wind speeds occurring farther from the center. These plots will indicate the direction and the wind speed where contaminant concentrations are higher (the redder the area) or lower (the bluer the area) and can indicate potential sources. Note that the closer monitors show greater influence from Sterigenics emissions, with higher concentrations emanating from Buildings 1 and 2, and no influence from other sources visible from upwind directions.



Polar Plots of EtO concentration at EPA Air Sampling Sites Southeast of Sterigenics Site

Polar plots were used to examine the relationship of wind direction and wind speed on pollutant concentration. The output is scaled to a polar coordinate system, which is essentially a circular axis. Wind direction data are placed in bins on the polar axis that correspond to the direction in degrees from which the wind originated, with north at 0 degrees, south at 180 degrees, east at 90 degrees and west at 270 degrees. Polar plots show wind speeds for any given direction in bins or compartments that are a proportional distance from the center of the plot, with higher wind speeds occurring farther from the center. These plots will indicate the direction and the wind speed where contaminant concentrations are higher (the redder the area) or lower (the bluer the area) and can indicate potential sources. Note that the closer monitors show greater influence from Sterigenics emissions, with higher concentrations emanating from Buildings 1 and 2, and no influence from other sources visible from upwind directions.

N W E S

Feet 0 500

Mean Concentration(ug/m³)

1 2 3 4 5 6 7

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Comparison of Ambient EtO Concentrations with other areas without a known EtO source

Station	Number samples	Concentration (µg/m^3)
California (1989-1990)	55	**0.05 - 0.08[a] (range)**
Colorado (2018)	16[b]	**0.25[b] (mean)**
Illinois (Chicago area-2018)	69	**0.19 - 0.20 (median)**
Massachusetts (1999-2016)	1,433	**0.15 - 0.18 (median)**
Michigan (2018 and 2019)	9[c]	**0.12 - 0.37[c] (range)**
New Hampshire (2002-2008)	578	**0.22 - 0.27 (median)**
Rhode Island (1999-2010)	11,288	**0.14 - 0.20 (median)**
Willowbrook, IL (non-operational)	139	**0.09-0.17 (median)**
Willowbrook, IL (operational)	265	**0.21-1.78 (median)**

[a] Only offsite samples for Phase 2 are represented here, and the range of detections at the background locations are presented because only one sample was collected at each site.

[b] The arithmetic mean was reported as an average background concentration in this report; nine samples were reported as half the detection limit of 0.082 ug/m^3 because they were below detection limits. Data are too limited to determine whether this average is a representative estimate of long-term exposures.

[c] Only "outlying" distant sample locations for Phase 2 are presented here.

ATSDR'S Next Steps

- Complete risk review, health conclusions, and recommendations
- Incorporate summary of finding of IDPH Cancer Incidence Review
- Release follow-up Health Consultation this summer
- Continue to work with stakeholders

THANK YOU!

The ATSDR Sterigenics EtO Assessment team:
Michelle Colledge, PhD and Mark Johnson, PhD, ATSDR/Region 5
James Durant, MS, ATSDR/Science Support Branch
Dennis Helsel, PhD, Practical Stats, under contract with ATSDR/CDC
Andrew Berens, MS, GRASP/CDC
David Rickless, MS, GRASP/CDC
Mark Hartnett, MA, GRASP/CDC

For more information please contact Agency for Toxic Substances and Disease Registry

4770 Buford Highway NE, Chamblee, GA 30341
Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
Web: http://www.atsdr.cdc.gov

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