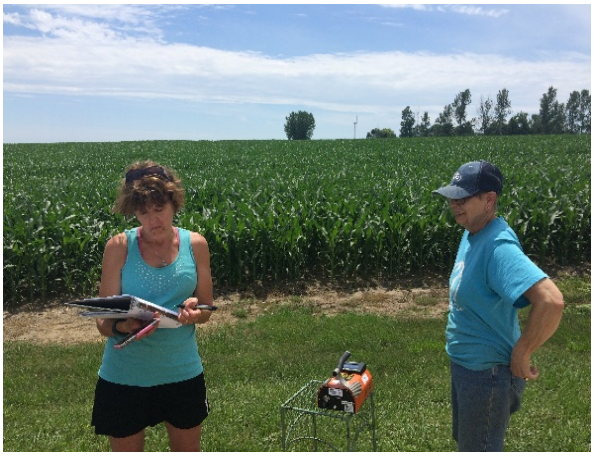
A Community at Risk:

A Report on Citizens' Hydrogen Sulfide Monitoring at Kohlnhofer Factory Hog Farms in Goodhue County, Minn.



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LAND STEWARDSHIP PROJECT

Pictured on the front cover (clockwise from left):

- Zumbrota Township farmers Frederick Fredrickson and Dale Post monitor for hydrogen sulfide.
- Zumbrota Township resident Sharon Pagel and farmer Marilyn Fredrickson record hydrogen sulfide levels.
- Kohlnhofer finishing barns in Goodhue County.
- The Jerome Hydrogen Sulfide Analyzer shows a high reading outside a Kohlnhofer hog facility.

Citizen Hydrogen Sulfide Monitoring Team

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Marilyn Fredrickson, Dairy Farmer, Zumbrota Township
Dale Post, Farmer, Zumbrota Township
Mary Post, Zumbrota Township
Kristi Rosenquist, Zumbrota Township
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Sharon Pagel, Zumbrota Township
Andrea Lodermeier, Zumbrota Township
Kathy Bramble, Zumbrota Township
Beth Slocum, Farmer, Welch
Winston Kaehler, Red Wing
Linda Walbruch, Mantorville
Marilyn Johnson, Minneapolis
Katie Doody, Policy Organizer, Land Stewardship Project

Citizens' Monitoring Shows High Levels of Hydrogen Sulfide at Kohlnhofer Hog Operations

OUR STUDY: As neighbors to a proposed Kohlnhofer 4,700-hog factory farm in Goodhue County's Zumbrota Township in southeastern Minnesota, we have concerns about the impacts this project will have on our air quality, water quality, property values and family farms. To analyze the impact the Kohlnhofers' existing hog facilities are having on air quality in Goodhue County, we monitored for hydrogen sulfide (H_2S) emissions at the property boundaries of Kohlnhofer hog operations. Using a Jerome J605 Hydrogen Sulfide Analyzer and following a scientific protocol, a team of 15 citizens conducted 47 monitoring sessions over a 35-day period.

Citizens set out to find:

1) Are hydrogen sulfide emissions levels exceeding **health risk values** designed by the Minnesota Department of Health (MDH)?
2) Are Kohlnhofer hog operations violating **state ambient air quality standards** set by the Minnesota Pollution Control Agency (MPCA)?

Our data shows:

1) Hydrogen sulfide emissions from Kohlnhofer hog facilities are likely exceeding health risk values set by the Minnesota Department of Health.

2) Two facilities (Jeff Finishing and Holst I Finishing) may be violating state ambient air quality standards set by the MPCA.

HYDROGEN SULFIDE & FACTORY FARMS: Hydrogen sulfide (H_2S) is a toxic gas emitted when large amounts of liquid animal waste are collected in one place. H_2S has proven negative health impacts, such as nausea, headaches, vomiting and severe diarrhea. Prolonged exposure has been associated with neurologic symptoms, which may be more serious in children.[i] Exposure to extremely high levels of H_2S levels is life threatening.[ii] [iii]

HEALTH RISK VALUE: According to the Minnesota Department of Health, **H_2S becomes a health risk when levels exceed 7 ppb**[iv] (parts per billion) over a 13-week average (Minn. R. 4717.8150).

- Our study shows **122 readings over 7 ppb** at four operations, with readings up to 56.48 ppb.

STATE HYDROGEN SULFIDE STANDARDS: Minnesota state law mandates ambient air quality standards for feedlots, which creates legal limits for H_2S emissions at the property boundary. This limit is significantly higher than the health risk value, and all operations should stay well below the legal limit. The MPCA mandates that feedlots cannot exceed **30 ppb** of H_2S emissions over a 30-minute period more than two times per week, or **50 ppb** of H_2S emissions over a 30-minute period more than two times per year (Minn. R. 7009.0080).

- At two operations (Jeff Finishing and Holst I Finishing), our study results show:
  - 28 readings over 30 ppb.
  - 3 readings over 50 ppb.
  - 4 monitoring sessions in which the 30-minute average was over 30 ppb.

The Pollution Control Agency and the Department of Health must immediately begin continuous air monitoring at Jeff Finishing and Holst I Finishing to further investigate H_2S exceedances and impacts on public health. Meanwhile, the Kohlnhofers must withdraw their Zumbrota Township proposal. Our public health is at risk.

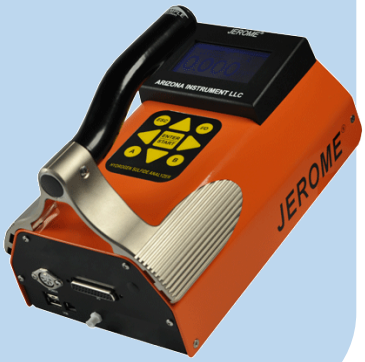
HOW CITIZENS PREPARED FOR HYDROGEN SULFIDE MONITORING

STEP 1: RESEARCH

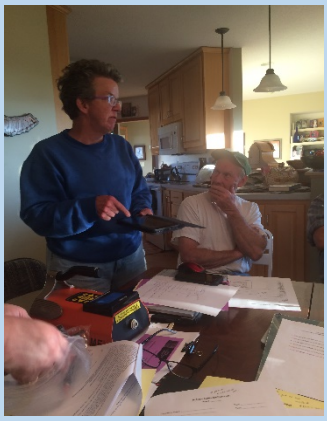
Citizens connected with other Land Stewardship Project members who have experienced high hydrogen sulfide levels near factory hog farms. They analyzed the models run by the Minnesota Pollution Control Agency that claim factory hog farms will be safe for neighbors. The models had many flaws, and they set out to research the actual H_2S emissions levels at Kohlnhofer hog facilities.

STEP 2: RENTING A HYDROGEN SULFIDE METER

For decades, the Minnesota Pollution Control Agency has relied on a hand-held hydrogen sulfide meter: the Jerome J605 Hydrogen Sulfide Analyzer. This high-tech machine is easy to use and displays the amount of hydrogen sulfide in parts per billion on the screen.



STEP 3: TRAINING ON THE METER & THE SCIENTIFIC PROTOCOL



In 1996, Land Stewardship Project members in Renville County, Minn., conducted in-depth H_2S monitoring near large hog facilities. The monitoring protocol was designed by the late Paul Homme, who was the past director of the microbiology branch of the U.S. Air Force's epidemiology division and had extensive experience setting up scientific investigations.

Julie Jansen, a Renville County resident who participated in H_2S monitoring with Homme, traveled to Goodhue County to train citizens in the H_2S monitoring protocol. She also trained citizens on how to operate and care for the H_2S meter.

STEP 4: HYDROGEN SULFIDE MONITORING

Citizens began H_2S monitoring on June 29, 2017. They monitored in teams of at least two people and recorded data in a monitoring log. Following the scientific protocol, they recorded the weather conditions and the exact location. If possible, they monitored down-wind from the manure pits.

The citizens conducted 47 monitoring sessions throughout a 35-day period, monitoring at the property boundary of 6 Kohlnhofer facilities in Goodhue County. They conducted about 16 hours of monitoring, which is approximately 0.02% of available hours within the 35-day period.

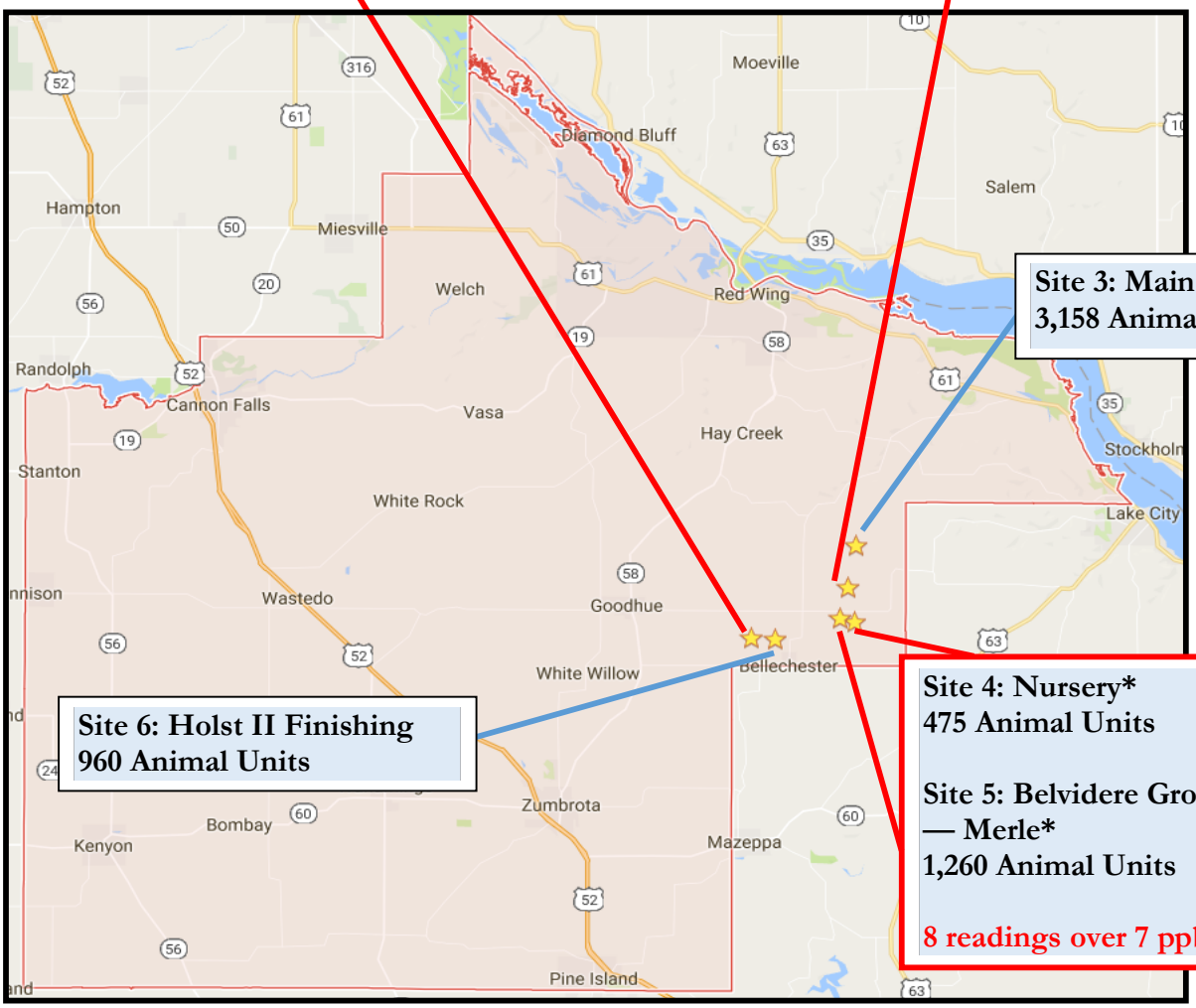
Kohlnhofer Factory Farms in Goodhue County and Citizen Hydrogen Sulfide Monitoring

Four Kohlnhofer hog facilities consistently had hydrogen sulfide emissions readings over 7 ppb (parts per billion). The Department of Health indicates that levels above 7 ppb over a sustained period of time pose a threat to public health.

Two Kohlnhofer hog facilities showed hydrogen sulfide readings over 30 ppb and 50 ppb, indicating the potential for violations of state air quality standards.

Site 1: Holst I Finishing
1,200 Animal Units
88 readings over 7 ppb
15 readings over 30 ppb
2 readings over 50 ppb
2 30-minute periods over 30 ppb

Site 2: Jeff Finishing
1,371 Animal Units
26 readings over 7 ppb
14 readings over 30 ppb
2 readings over 50 ppb
2 30-minute periods over 30 ppb



Site 3: Main Sow
3,158 Animal Units

Site 4: Nursery*
475 Animal Units

Site 5: Belvidere Group Partners — Merle*
1,260 Animal Units

8 readings over 7 ppb

Site 6: Holst II Finishing
960 Animal Units

*Note: Sites 4 and 5 are across the road from each other and were monitored together.

Hydrogen Sulfide Data: Readings that Show a Threat to Public Health and Indicate Potential for Violations

The following tables present the complete data for the four Kohlnhofer facilities that recorded high hydrogen sulfide readings. **Holst I Finishing**, **Jeff Finishing**, **Nursery** and **Belvidere Group Partners — Merle.** These facilities consistently showed readings above 7 ppb. The Minnesota Department of Health indicates that sustained hydrogen sulfide levels above 7 ppb pose a risk to public health.

The tables also show the two operations (Holst I Finishing and Jeff Finishing) that recorded readings over 30 ppb and 50 ppb, indicating the potential for violations of our state ambient air quality standards.

Please see appendix for complete emissions data on all 6 facilities monitored.

= Readings above 7 ppb, which show potential for **violation of health risk values** set by Dept. of Health.
= Readings above 30 ppb, which indicate potential for **violation of state ambient air quality standards**.
= Readings over 50 ppb, which indicate potential for **violation of state ambient air quality standards**.

Holst I Finishing

24589 390th St., Goodhue, MN
1,200 Animal Units (approximately 4,000 hogs)

Date	Time	Initial Reading	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	30-min. average	Potential for violation of health risk value	Potential for violation of ambient air quality standards
6/29/17	7:05 pm	12.29 ppb	0	0						✓	
7/6/17	7:55 pm	6.4 ppb	5.55	10.29	15.26	9.11				✓	
7/7/17	9:14 pm	15.21 ppb	14.79	14.72	23.47	21.35	18.98	17.71	18.03	✓	
7/7/17	9:37 pm	27.67 ppb	28.69	36.83	32.28	22.08	25.65	36.11	29.9	✓	✓
7/10/17	9:05 pm	5.42 ppb	4.11								
7/10/17	9:58 pm	32.69 ppb	29.03	25.45	25.97					✓	✓
7/12/17	9:31 pm	2.40 ppb	3.49	7.78	10.94	11.24	13.94			✓	
7/20/17	7:55 pm	0 ppb	9.3	22.77	3.19	0	0	5.86	5.87	✓	
7/26/17	9:15 pm	29.69 ppb	22.01	24.95	32.89	11.49	7.83	7	19.4	✓	✓
7/27/17	10:20 pm	24.8 ppb	20.81	17.34	24.08	11.69	14.7	12.67	18.01	✓	
7/28/17	10:00 pm	27.1 ppb	17.51	32.18	46.26	40.11	56.48	29.52	35.59	✓	✓
7/30/17	8:45 pm	28.24 ppb	14.02	22.88	32.62	47.49	47.81	37.96	33		✓
8/1/17	9:45 pm	16.27 ppb	13.98	12.05	11.17	5.49				✓	
8/2/17	7:42 pm	10.77 ppb	24.06	24.01	15.55	20.32	17.88	19.45	18.86		
8/2/17	8:17 pm	15.07 ppb	10.91	11.26	22.12	15.27	11.24	13.24	14.16		
8/2/17	9:27 pm	13.77 ppb	14.11	16.09	15.15	20.72	11.84	15.55	15.32		
8/2/17	10:02 pm	10.87 ppb	14.6	37.45	13.77	17.07	22.61	24.41	20.11		✓
8/2/17	10:37 pm	53.34 ppb*									✓

*Note: During the last monitoring session, meter read "Sensor Regeneration Required" and monitoring session was ended prematurely.

Jeff Finishing

37112 280th Ave., Goodhue, MN
1,371 Animal Units (approximately 4,570 hogs)

Date	Time	Initial Reading	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	30-min. average	Potential for violation of health risk value	Potential for violation of ambient air quality standards
6/29/17	7:42 pm	0 ppb									
7/3/17	10:15 pm	40.65 ppb	51.49	50.33	43.75	42.81	36.84	32.58	42.64	✓	✓
7/3/17	10:50 pm	34.18 ppb	39.44	37.41	31.03	30.4	40.63	30.6	33.38	✓	✓
7/5/17	1:09 pm	0 ppb									
7/8/17	7:03 am	4.04 ppb	0								
7/8/17	7:15 am	7.84 ppb	7.34	4.8							
7/15/17	6:06 am	11.25 ppb	11.83	6.55	8.59	6.03	3.28				
7/24/17	9:14 pm	13.27 ppb	12.36	6.29	9.47	10.23	25.89	16.74	13.46	✓	
8/1/17	12:27 am	27.2 ppb	3.84	0						✓	

Nursery & Belvidere Group Partners — Merle*

*Note: These two facilities are across the road from one another and were monitored together.

Nursery:
38448 280th Ave., Goodhue, MN
475 Animal Units
(approximately 9,500 piglets)

Belvidere Group Partners — Merle:
38449 280th Ave., Goodhue, MN
1,260 Animal Units
(approximately 4,200 hogs)

Date	Time	Initial Reading	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	30-min. average	Potential for violation of health risk value
6/30/17	4:43 am	4.59 ppb	0							
7/1/17	6:29 am	3.23 ppb	6.01	6.4						
7/2/17	6:28 am	4.19 ppb	4.44	8.43	4.85					✓
7/3/17	9:43 pm	5.45 ppb	0	0	5.54	4.02				
7/6/17	8:44 pm	4.88 ppb	6.22							
7/8/17	6:36 pm	0 ppb	8.02							✓
7/10/17	9:15 pm	0 ppb	17.54	15.03						✓
7/10/17	9:44 pm	3.81 ppb	3.3							
7/12/17	8:40 pm	0 ppb	4.17							
7/27/17	9:50 pm	5.7 ppb	5.6	5.93	5.07	5.7	0	4.3	7	
7/29/17	9:40 pm	25.7 ppb	22	16.56	16.84					✓

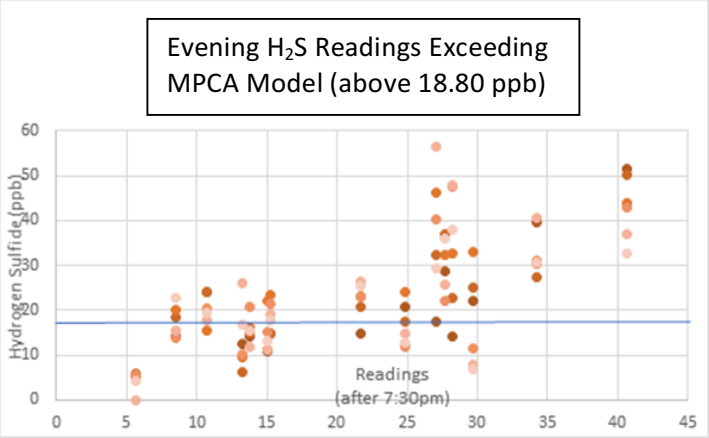
CONCLUSIONS:

Citizen hydrogen sulfide (H_2S) monitoring at Kohlnhofer factory hog farms in Goodhue County, Minn., showed high levels of H_2S emissions at the property boundaries.

H_2S is a toxic gas with proven negative human health impacts. H_2S data gathered over a 35-day period by a team of 15 citizens shows:

- Kohlnhofer hog facilities are likely exceeding health risk values designed by the Minnesota Department of Health, putting our community's health at risk.
- Two Kohlnhofer facilities (Holst I Finishing and Jeff Finishing) may be violating our state air quality standards.

Although citizens were able to monitor for approximately 16 hours, this is only 0.02% of total hours within the 35-day period. Continuous air quality monitoring, conducted by the Minnesota Pollution Control Agency and the Minnesota Department of Health, is needed.



Our data also shows that existing Kohlnhofer facilities are consistently exceeding MPCA H_2S emissions models. The MPCA's H_2S model for the Kohlnhofers' proposed 4,700-hog facility in Zumbrota Township predicts that the project would never exceed 18.80 ppb of H_2S emissions at the property line. Our data shows that smaller Kohlnhofer operations are consistently exceeding this amount, especially in the evening. We do not have confidence that the proposed operation will be safe for our community.

- **To further investigate H_2S emissions exceedances, the MPCA and MDH should immediately begin continuous air quality monitoring at Holst I Finishing and Jeff Finishing. If or when violations are found, the MPCA and MDH should take immediate corrective action to protect the health of the community.**

- **The Kohlnhofers must immediately withdraw their proposal for a 4,700-hog facility in Zumbrota Township. Our community's health is at risk.**

Appendix

I. Monitoring Protocol

II. Calibration Certificates for Jerome J605 Hydrogen Sulfide Analyzers

III. Complete List of H2S Recordings

Original monitoring sheets are available online at:
http://landstewardshipproject.org/repository/1/2251/original_h2s_monitoring_sheets_revised.pdf

[i] "Medical Management Guidelines for Hydrogen Sulfide," Agency for Toxic Substances & Disease Regulation. https://www.atsdr.cdc.gov/mmg/mmg.asp?id=385&tid=67

[ii] Rapaport, Diane. "Warning: Hydrogen Sulfide," Water Engineering & Management, Jan. 1990, Vol. 137, No. 1, p. 36

[iii] Yale Environmental Protection Clinic. Controlling Odor and Gaseous Emission Problems from Industrial Swine Facilities: A Handbook for All Interested Parties, Kerr Center for Sustainable Agriculture, Poteau, Okla., 1998, 65 pages

[iv] "Environmental Health Information: Excel Dairy, Marshall County, Minnesota," Minnesota Department of Health. http://health.state.mn.us/divs/eh/hazardous/sites/marshall/exceldairy/excelinfo.pdf