

HIDING IN PLAIN SIGHT

CAFO Air Emissions and Their Effect on Public Health

**By
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ACKNOWLEDGEMENT

This manuscript might never have been written had I not met Bob Watson of rural Decorah. I first encountered Bob when he and I attended the same DNR-sponsored public meeting at the NICC Dairy Center in Calmar, IA, some years ago. Neither of us received satisfactory answers to our questions. Both of us soon realized that further probing of a state official after receiving an unsatisfactory answer was futile.

Bob's experience and knowledge of wastewater technology enabled him to make an original insight of which no one else was aware. Bob perceived that swine CAFOs were misusing wastewater technology to raise animals for meat production. This unique insight made Bob a pioneer in conceptual thinking about swine CAFOs. It also gave him a leg-up in uncovering the multiple harms that such agricultural misuse wreaked on human health and on our natural resources. While researchers were talking about "odors" from swine CAFOs, Bob was constantly pointing out that the odors were, in fact, toxic sewer gases. And, of course, sewer gases have odors, but the problem is not that the sewer gases smell. The problem is that the sewer gases are toxic with clearly defined negative impacts on health.

Much of the following content has been gleaned from conversations with Bob, reviewing his work, and from doing collaborative work with him on a number of joint projects. The section, "The Need for a Review of Animal Husbandry Operations in Industrial Agriculture," especially leans on Bob's work. Bob graciously agreed to serve as the Editor for this current work.

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PROLOGUE

The major events discussed in this paper all occurred within a single month's span – March, 2026. They are listed below in chronological order.

- | | |
|----------------|---|
| March 13, 2026 | <i>Cancer in Iowa 2026</i> Report released. |
| March 14, 2026 | <i>Glyphosate Use and Cancer Clusters</i> – Food & Water Watch Study (2026) released.
Using county-level data, the study found links between residency in a county with higher rates of agricultural glyphosate application (top 20%) and higher rates of non-Hodgkin lymphoma. |
| March 17, 2026 | Yale University Study by Son <i>et al.</i> (2026) became available online.
Density of animal feeding operations, including concentrated animal feeding operations (CAFOs), and cancer incidence: A county-level ecological study across three U.S. states, <i>Environmental Research.</i> |
| March 25, 2026 | <i>Environmental Risk Factors and the Iowa Cancer Crisis</i> - Iowa Environmental Council & Harkin Institute Report released. |

Secondary events by the National Pork Producers Council and the Governor of Iowa centered on reactions to the Son *et al.* (2026) study and the IEC-Harkin (2026) report. They were reported in April and are listed below.

- | | |
|----------------|---|
| April 2, 2026 | Reaction by the NPPC spokesperson to the Son <i>et al.</i> (2026) study; Bienkowski, Higher cancer rates in counties with more CAFOs, study finds, <i>The New Lede</i> . |
| April 12, 2026 | Reaction by the NPPC spokesperson to the Son <i>et al.</i> (2026) study; Rodas, Cancer rates are higher near large livestock feeding operations in 3 states, <i>Inside Climate News</i> . |
| April 30, 2026 | Reaction by the NPPC spokesperson to the Son <i>et al.</i> (2026) study, AND reaction by Iowa Governor Kim Reynolds to the IEC-Harkin (2026) report; Shriver, Pork producers, governor get the Iowa cancer reports wrong, <i>Bleeding Heartland</i> . |

A final note to the reader. I have a multiplicity of footnotes in the following analysis in the interests of transparency, accountability, and scholarship. The reader can be aware of the source if they so choose. Others may prefer to ignore the footnotes, preferring to read an uninterrupted narrative. Finally, I use my own modification of the American Psychological Association style for citing sources that has been developed over the years, but use *The Bluebook* format for citing legal materials.

INTRODUCTION

Beginning as a critique of the IEC-Harkin Institute report's¹ mistreatment of particulate matter (PM_{2.5}) in Section 5 (which was a surprise since the first four sections that focused on pesticides, PFAS, nitrates, & radon were well done), this examination morphed in scope as ignorance of basic animal agricultural processes centering on swine CAFOs² became apparent when reading Section 5 of the report. What should have been a trail of breadcrumbs leading out of a dense shrouded forest towards a greater clarity and understanding of cancer in Iowa instead became a series of misleading holograms that directed attention away from the agricultural sector's role of being the largest emitter of fine particulate matter (PM_{2.5}) in Iowa. PM_{2.5} was declared a carcinogen to humans more than a decade ago. And yet a known carcinogen was not worth spending time on by both the Iowa Environmental Council and the Harkin Institute. That was troubling.

As a result of the ignorance displayed by the author(s) of Section 5 of the IEC-Harkin (2026) report about the basic agricultural operations of hog confinements, specific knowledge about the role and operation of swine CAFOs needed to be provided along with information about the transformation of Iowa agriculture from its historical pattern of diversification (diverse crops with farms engaging in both animal husbandry and row-crop agriculture) to one dominated by specialization (either row crop agriculture specializing in corn and soybean production OR animal production). And the ways in which multiple research studies were misrepresented by the author(s) of the particulate matter subsection in Section 5 of the IEC-Harkin Institute (2026) report meant that those studies' findings also needed to be presented and compared with the report's mistreatment of their research.

Just as critical as having to deal with the multiple misrepresentations were the omissions made by the IEC-Harkin (2026) report –

- a report by the ISU-UI Study Group (2002) focused on CAFOs and air quality and recommending ambient air quality standards for hydrogen sulfide, ammonia, & odor, followed by
- legislative passage of a law directing the Iowa DNR to study and develop ambient air quality standards for emissions of hydrogen sulfide and ammonia, followed by
- Iowa's adoption of ambient air quality standards designed to regulate CAFO emissions of hydrogen sulfide (H₂S) and ammonia (NH₃), which was immediately followed by
- the Iowa Legislature's subsequent nullification of those standards that had been legally adopted in 2002 by the Iowa Environmental Protection Commission to protect the

1. Iowa Environmental Council & the Harkin Institute for Public Policy & Citizen Engagement (2026). *Environmental risk factors and Iowa's cancer crisis*. Publisher not listed, nor can it be inferred. Available at: <https://www.iaenvironment.org/our-work/cancer-and-environmental-risk-factors-in-iowa/>. The study will be referenced throughout this analysis as: the IEC-Harkin (2026) report.

2. CAFO is an acronym that references: Concentrated Animal Feeding Operation.

public health and welfare of all Iowans.

Those omissions needed to be confronted and information about the "hidden from view" subjects bearing on air quality needed to be provided.

Another unexpected series of holograms also emerged from engaging in the effort to detect a clear trail of breadcrumbs – the efforts by agricultural interests in both the public and private arenas to provide misleading analyses and distorted reasoning in attacking narratives that diverged from and challenged the accepted agricultural view. These efforts occurred multiple times concerning different situations, but usually employed similar techniques of deception and distortion. And each needed to be dealt with individually. This required both analysis as well as the providing of information about techniques used to uncover bias and distortion. This unanticipated discovery also required presenting information about current initiatives to develop those skills in both students and adult citizens.

Most surprising was the attempt to take advantage of a mistake made by the Iowa Cancer Registry in its 2026 *Cancer in Iowa* report, which meant that time needed to be spent analyzing and explaining the basic research mistake after which more time was required analyzing and explaining how that mistake was being both misinterpreted and distorted by the National Pork Producers Council and the current Iowa governor to promote their own private agendas that opposed public interest in curbing agricultural emissions of carcinogenic and toxic particulate matter.

Yet another critical question arose from examining the Food and Water Watch (2026) study focused on glyphosate use and cancer incidence. The F&WW researchers noted the difference in rulings by two government agencies – the US Environmental Protection Agency and the World Health Organization. They reported that the US EPA ruled that glyphosate is not a carcinogen while the WHO declared glyphosate is a Level 2 carcinogen. Which raises a critical question regarding not only differences in rulings regarding glyphosate, but also PM_{2.5} and other substances – What explains the consistent differences whereby the one agency is harsher and the other agency is usually more lenient? This constituted a critical question that needed to be explored, so it was, even though it was not originally planned to do so.

Another unplanned excursion arose from the examination of the Bekbulat *et al.* (2025) study cited by the IEC-Harkin (2026) report's Section 5 authors who misrepresented the study's major findings via multiple lies of omission. Of the five economic sectors examined in the study, four sectors reduced their emissions of PM_{2.5}. The Bekbulat researchers attributed this to the fact that the four sectors reducing their emissions were governed by the Clean Air Act while the lone sector not reducing emissions, but actually increased their PM_{2.5} emissions – agriculture – was not. Which raised yet another critical question: What was the Clean Air Act and why wasn't agriculture governed by the statute? Answering that unexpected question wasn't originally planned, but arose through a combination of factors which included the author's ignorance. After all, if we're discussing particulate matter, but not including in the discussion how particulate

matter is regulated, wouldn't the Clean Air Act be the elephant in the room?

Finally, it should be noted that the major news events discussed in this paper occurred in March, 2026. Bad news about cancer in Iowa tumbled in almost daily, or so it seemed. Since the IEC-Harkin (2026) report's stated purpose was to examine possible causes of cancer contained in the ground, water, and air of Iowa, and since multiple reports about Iowa's cancer situation emerged from a variety of sources, *e.g.*,

- the Food & Water Watch Study – *Glyphosate Use and Cancer Clusters*;
- the Yale University Study by Son *et al.* – *Density of Animal Feeding Operations, including Concentrated Animal Feeding Operations (CAFOs), and Cancer Incidence*; and
- the studies cited by the author(s) of Section 5 of the IEC-Harkin (2026) report, but which were misrepresented:
 - M Wang *et al.* (2025) – *Particulate Matter Air Pollution as a Cause of Lung Cancer: Epidemiological and Experimental Evidence*;
 - B Bekbulat *et al.* (2025) – *Changes in PM_{2.5} -Attributable Mortality in the US by Sector, 2002-2019*;

it seemed that bringing together all of this news and evaluating it might help an audience develop a better understanding of Iowa's cancer problem and some of its causes. At least that is the intent.

CANCER IN IOWA

The *Cancer in Iowa* Reports, 2023–2026³

Before 2023 the annual release by the Iowa Cancer Registry of its annual *Cancer in Iowa* report generated little cause for alarm. Founded in 1973 following congressional passage of the 1972 National Cancer Act, the Iowa Cancer Registry began issuing annual reports in 1991.

However, 2023 proved to be a watershed year! The 2023 *Cancer in Iowa* report served up several bombshells that shattered Iowa's complacency about cancer.

- First, Iowa had the 2nd highest rate of new cancers in the U.S.
- Second, Iowa was the **ONLY** state where new cases of cancer were increasing.
- Third, it was revealed that in 2014 Iowa's cancer rates began increasing while the cancer rates in all other states began to either decrease or stay the same for the period 2015-2019.
- Fourth, according to data from the US Environmental Protection Agency, **Iowa has the "highest radon levels of any state."** More than 70% of Iowa homes have radon levels "at or above" the level at which the EPA recommends the home be fixed.
- Fifth, according to Iowa cancer data, smoking drives 91% of all lung cancers.
- Sixth, radon exposure is the leading cause of non-smoking related lung cancers.



But then we had to wait an additional THREE YEARS to get further news about radon that provided greater context. On May 5, 2026, the *Cedar Rapids Gazette* featured a story headlined "Radon requirement heads to governor; Bill requires mitigation systems in new homes" by reporter Maya Marchel Hoff. From the article, we learned the following information:

- "Iowa had an average indoor radon concentration **six times higher than the national average in 2023**," according to the Iowa Department of Public Health.
- Iowa has the **nation's highest percentage of homes (71.6%) that test above the EPA's "radon risk threshold,"** according to the Iowa Radon Survey.

Moving back to the annual reports by the Iowa Cancer Registry, the 2024 *Cancer in Iowa* report informed us that:

3. Iowa Cancer Registry (2023-2026). *Cancer in Iowa*. Iowa City, IA: College of Public Health, the University of Iowa. Available from the Iowa Cancer Registry's web page at: <https://shri.public-health.uiowa.edu/cancer-data/reports/iowa-cancer-reports/>

- Iowa had the 2nd highest overall cancer incidence for the second straight year.
- Iowa continued to have the fastest growing rate of new cancers in the country.
- Iowa's neighbors, Minnesota and Nebraska, are the two states with the next-highest rates of new cancers, but both had lower numbers than did Iowa.
- Iowa's remaining neighbors – Wisconsin, Illinois, Kansas, and Missouri – all had declining rates of new cancers.



In 2025 the *Cancer in Iowa* report continued the now-familiar litany:

- Iowa continued to have the second-highest rate of new cancer diagnoses in the USA, 2nd only to Kentucky.
- Iowa continued to have the fastest-growing rate of new cancers in the nation.
- Iowa is one of only two states with a rising rate of new cancers.



The May 26, 2025 *Cedar Rapids Gazette* provided further information in a news article by reporter Vanessa Miller, "State's cancer rates still nation's fastest growing; Federal funding cuts 'already happening' to ongoing research." Ms. Miller revealed that Trump administration cuts to health research funding were "already happening" as a clinical trial at MercyOne Cancer Center was recently closed by the feds and that a new hire at the Iowa Cancer Consortium had been "pink-slipped" due to a sudden loss of federal funds.

In 2026 the *Cancer in Iowa* report abandoned its now familiar litany. Instead they provided much new information about:

- the longitudinal *Agricultural Health Study* (AHS).
- the Hazard Classification System that was developed by the International Agency for Research on Cancer (IARC).
- research focused on nitrates and cancer that used data from the *Agricultural Health Study*.

But the 2026 *Cancer in Iowa* report didn't divulge current information about the state's current status regarding:

- Iowa's new cancer diagnoses ranking.



- Iowa's rate of increase/decrease ranking for new cancer diagnoses.

Nor did the 2026 *Cancer in Iowa* report divulge the newly released figures from the National Institutes of Health (NIH) for 2018-2022. Fortunately the *Cedar Rapids Gazette* did report the customary information usually provided by the Iowa Cancer Registry in a February 6, 2026 news article by Erin Murphy, "UI cancer study: Troubled counties, lung cancer spikes."

- Iowa continued to have the 2nd-highest rate of new cancer diagnoses.
- Iowa was the **only state** in the nation **with a rising cancer rate**.

And now for the missing new data regarding state-level diagnoses of new cancer cases for the five-year period 2018-2022 in the National Institutes of Health (NIH) Report not reported by the Iowa Cancer Registry. The NIH report for 2018-2022 revealed that:

- Iowa had the **2nd highest cancer incidence rates** in the nation.
- Iowa had the **fastest rising rate of new cancers**.
- Iowa was one of three states with increasing rates of new cancers for the five-year period, 2018-2022. The three states were Iowa, West Virginia, and Utah.

All Cancer Sites Incidence Rates Table by State
All Races (includes Hispanic/Latino), Both Sexes, All Ages, 2018-2022
Sorted by Rate

State	Age-Adjusted Incidence Rate [†] cases per 100,000 (95% Confidence Interval)	Average Annual Count	Recent 5-Year Trend	Recent 5-Year Trend [‡] in Incidence Rates (95% Confidence Interval)
United States	448.6 (448.3, 448.9)	1,821,045	falling ↓	-1.0 (-1.6, -0.5)
Kentucky	518.9 (516.2, 521.7)	29,054	stable →	-0.7 (-1.3, 0.0)
Iowa	498.5 (495.3, 501.7)	20,049	rising ↑	0.7 (0.4, 1.3)
West Virginia	498.1 (494.0, 502.1)	12,584	rising ↑	0.5 (0.1, 1.4)
Louisiana	489.5 (486.8, 492.2)	27,280	stable →	0.0 (-0.2, 0.1)
Minnesota	486.8 (484.4, 489.1)	33,837	stable →	0.8 (-0.5, 2.1)
Maine	482.3 (477.8, 486.9)	9,809	stable →	-0.1 (-0.4, 0.6)
North Carolina	479.0 (477.2, 480.7)	61,926	stable →	-0.1 (-0.3, 0.0)
New Jersey	477.1 (475.3, 478.9)	55,325	stable →	0.0 (-0.3, 0.5)
Connecticut	476.3 (473.4, 479.1)	22,517	stable →	0.3 (-0.1, 1.0)
Arkansas	476.0 (472.8, 479.2)	17,980	falling ↓	-2.2 (-3.0, -1.6)
New Hampshire	473.2 (468.6, 477.8)	9,075	falling ↓	-0.6 (-0.8, -0.5)
Ohio	472.9 (471.3, 474.5)	71,356	stable →	-0.1 (-0.2, 0.1)

And where does Iowa stand in the "Cancer Incidence Rates" standings for the subsequent five-year period, 2019–2023? According to the data visualization services of NIH data by HD Pulse on the National Institute of Health website, Iowa stands at the head of the class. However the class consisting of states with increasing rates of cancer incidence has grown since the 2018–2022 five-year comparison. The comparative data indicates the following:

- Iowa still has the **nation's fastest rising rate of new cancers**.
- Iowa has **moved from 2nd to 3rd** in terms of highest **cancer incidence rates** nationally.
- While West Virginia moved ahead of Iowa in terms of cancer incidence rates, West Virginia "stabilized" its rate of new cancers while **Iowa's rate of new cancers is still rising**.
- While the class of 2018-2022 for "rising rates of new cancers" had three members, the class of 2019-2023 increased to five members despite losing West Virginia due to its stabilization of new cancer rates. The five members for 2019-2023 include: Iowa, Wisconsin, Oklahoma, Utah, & Hawaii.

A portion of the NIH data for the five-year period of 2019-2023 as visualized by HD Pulse from the National Institute of Health website can be seen below.⁴

State	Age-Adjusted Incidence Rate ¹ cases per 100,000 (95% Confidence Interval)	Average Annual Count	Recent 5-Year Trend	Recent 5-Year Trend ² in Incidence Rates (95% Confidence Interval)
United States	453.4 (453.1, 453.7)	1,872,272	falling ↓	-0.6 (-1.0, -0.2)
Kentucky	524.6 (521.8, 527.3)	29,715	stable →	0.1 (0.0, 0.1)
West Virginia	503.8 (499.7, 507.9)	12,794	stable →	0.7 (-0.3, 1.7)
Iowa	503.7 (500.5, 506.9)	20,505	rising ↑	0.7 (0.5, 1.1)
Louisiana	492.9 (490.2, 495.5)	27,741	stable →	0.0 (-0.1, 0.2)
Minnesota	492.2 (489.8, 494.6)	34,827	stable →	0.9 (-0.4, 2.1)
Maine	489.4 (484.9, 493.9)	10,155	stable →	0.2 (-0.1, 0.7)
North Carolina	484.1 (482.3, 485.8)	64,064	falling ↓	-1.2 (-1.7, -0.6)
New Jersey	483.0 (481.2, 484.8)	56,801	stable →	0.1 (-0.2, 0.6)
Wisconsin	480.5 (478.2, 482.8)	37,121	rising ↑	0.5 (0.1, 1.1)
New Hampshire	480.1 (475.6, 484.7)	9,425	falling ↓	-0.5 (-0.6, -0.4)
Delaware	479.7 (474.3, 485.1)	6,754	falling ↓	-0.7 (-1.0, -0.5)
Ohio	479.0 (477.4, 480.6)	73,130	stable →	-0.7 (-1.4, 0.1)
Connecticut	477.0 (474.2, 479.9)	22,859	falling ↓	-1.3 (-2.2, -0.7)
Arkansas	476.0 (472.8, 479.2)	18,165	falling ↓	-2.2 (-3.1, -1.1)
Georgia	473.1 (471.4, 474.9)	58,637	stable →	0.0 (-0.2, 0.1)
Missouri	472.9 (470.7, 475.1)	37,243	stable →	-0.1 (-0.2, 0.1)
South Dakota	472.7 (466.7, 478.6)	5,274	stable →	0.2 (0.0, 0.7)
New York	472.0 (470.8, 473.2)	120,068	stable →	0.0 (-0.3, 0.6)
Mississippi	471.3 (468.1, 474.6)	17,317	falling ↓	-1.4 (-1.9, -0.7)
Florida	470.0 (468.8, 471.1)	149,440	stable →	-0.2 (-0.4, 0.0)
Illinois	468.4 (466.8, 469.9)	73,561	stable →	0.0 (-0.3, 0.4)

4. National Institute of Health (n.d.) *HD Pulse: An Ecosystem of Health Disparities and Specific Populations Health Resources*. Created 8-23-2026. Available from: <https://hdpulse.nimhd.nih.gov/data-portal/incidence/table>

THE NATIONAL PORK PRODUCERS PROMULGATE A FALSE NARRATIVE

Coming back to the 2026 *Cancer in Iowa* report and the information it provided about the Agricultural Health Study (AHS) – there were a few mistakes made by the Iowa Cancer Registry which turned out to have major consequences because the National Pork Producers and Governor Reynolds used those mistakes to:

- misinterpret the findings of a recent study using data from the Agricultural Health Study; and to
- misrepresent the AHS to the general public; and then subsequently
 - the National Pork Producers would use those mistakes by the 2026 *Cancer in Iowa* report in order to discredit a peer-reviewed scientific research study [See below for citation under "Yale Research Study"] by a team of Yale University researchers that investigated possible connections between residential exposure to CAFO air emissions in a **"high-density CAFO" area and cancer diagnoses.**
 - Iowa governor Kim Reynolds would use an approach similar to that used by the NPPC in order to deflect any immediacy towards providing needed funding and regulation to deal with the environmental cancer risks identified by the IEC-Harkin (2026) study.

It's a complex web of interconnecting events. First, information will be presented about the Yale study in order to understand the motivation by agri-business to use the 2026 *Cancer in Iowa* mistakes as a weapon to discredit the Yale University researchers and their report. Second, the mistakes made by the Iowa Cancer Registry in their 2026 *Cancer in Iowa* report will be discussed. Third, the distortion and misrepresentation by the National Pork Producers and by Governor Reynolds will be presented.

The Yale University Study

J-Y Son, NC Deziel, & ML Bell (2026). Density of animal feeding operations, including concentrated animal feeding operations (CAFOs), and cancer incidence: A county-level ecological study across three U.S. states. *Environmental Research*, 299: 124296. doi: 10.1016/j.envres.2026.124298.

The study investigated county-level incidences of cancer in three states (Iowa, California, Texas) in relation to exposure from CAFOs in "high-density areas" and compared those results with exposure in control (lower-density areas") counties. **The study covered cancer data from 2000 to 2021.** Counties were determined to be a high-density area for CAFOs if they were in "the top 25% of CAFO density for their state. Winneshiek County was determined to be a lower-density CAFO environment by the study's researchers and served as a "control" county.

The location of CAFOs within individual counties was determined by examining the annual NPDES CAFO Permitting Status Report compiled by the various regional EPA offices. CAFOs

over a certain size limit are required to obtain a NPDES (National Pollutant Discharge Elimination System) permit. Of course CAFOs below the size limit are not required to file for a NPDES, and so smaller CAFOs were not included in the study. Still, the NPDES forms a common platform for examining CAFOs from various states.

The study found:

- Significantly elevated all-cancer incidence rates for residents living in "high-density CAFO" counties for all three states. There were "significant positive associations" between being diagnosed with cancer and being a resident of a high-density CAFO county in Iowa, Texas, & California. "All cancer types except breast cancer in Texas showed positive associations with high AFO/CAFO exposure in all three states."
- Exceptions for significant linkage between cancer incidence and living in a high-density CAFO region were:
 - breast cancer in Texas and Iowa.
 - bladder cancer and leukemia in Iowa.

According to lead author Ji-Young Son, "'Multiple pathways' exist by which CAFOs could cause higher cancer rates." She continued:

CAFOs emit air pollutants including ammonia and hydrogen sulfide, particulate matter, and volatile organic compounds... Exposure to these substances is linked to inflammation, oxidative stress, and immunosuppression, which can all contribute to cancer development.

In addition, CAFOs are major sources of water pollution from the large amounts of manure that are stored or spread on fields as fertilizer. This can lead to nitrate contamination in water, which can lead to the formation of carcinogens. Nitrate pollution in water has been linked to various cancers including colon, bladder and thyroid cancers.⁵

It should be noted that this 2026 study was not the first go-around for Drs. Son & Bell regarding this research topic as can be seen by examining the studies annotated below.

[J-Y Son & ML Bell \(2024\). Disparities in exposure to concentrated animal feeding operations \(CAFOs\) and risk of adverse birth outcomes in Pennsylvania, USA. *Heliyon*, 10: e34985. doi: 10.1016/j.heliyon.2024.e34985.](#)

Drs. Son and Bell announced their finding:

Our results provide evidence that maternal exposure to CAFOs is associated with higher risk of preterm birth.

Citing other studies, they observed that "previous studies suggest that residential exposure to CAFOs during pregnancy was positively associated with risk of adverse birth outcomes." They continued:

5. B Bienkowski (April 2, 2026). Higher cancer rates in counties with more CAFOs, study finds. *The New Lede* (TNL).

Maternal exposure to CAFOs may contribute to adverse birth outcomes including preterm birth and low birth weight via several pathways such as maternal exposure to air pollution (e.g., PM_{2.5}) or water quality.

Drs. Son and Bell explained the possible biological mechanisms at work:

Evidence suggests that maternal exposure to air pollution may be associated with systemic inflammation in placenta and/or maternal/cord blood, intrauterine infection, or oxidative stress, which can lead to endothelial dysfunction and vasoconstriction. Other possible mechanisms include increased maternal susceptibility, endocrine disruption, and epigenetic alterations.

J-Y Son & ML Bell (April 8, 2025). Health disparities associated with exposure to animal feeding operations, including concentrated animal feeding operations (CAFOs), in North Carolina, Pennsylvania, and Virginia, USA. *Environmental Research Letters*, 20 (5): 10.1088/1748-9326/adc291. doi: 10.1088/1748-9326/adc291.

Drs. Son and Bell set out to investigate how exposure to CAFOs impacts mortality risk and to examine how the risk "differs across study populations and locations in three US states." The three states selected were among the top states in swine production (North Carolina), in milk production (Pennsylvania), and in poultry production (Virginia). They announced the results of their investigation:

Our findings from all three states showed that people living in ZIP codes with AFO/CAFO exposure had significantly higher risk of mortality from diabetes mellitus or cerebrovascular disease than the no AFO/CAFO exposure group.

J-Y Son, BM Lewis, & ML Bell (June 6, 2025). Disparities in exposure to concentrated animal feeding operations (CAFOs) and other animal feeding operations across multiple states in USA. *Journal of Exposure Science & Environmental Epidemiology*, 36 (1): 167-174. doi: 10.1038/s41370-025-00783-1.

While this study did not investigate health outcomes, it used the same procedures and tools to determine CAFO density areas as were used in the other studies examining health outcomes from exposure to CAFO air emissions. The states investigated included Iowa, North Carolina, Pennsylvania, South Carolina, Texas, Virginia, and Wisconsin.

J-Y Son, JL Miranda, & ML Bell (August 2, 2021). Exposure to concentrated animal feeding operations (CAFOs) and risk of mortality in North Carolina, USA. *Science of the Total Environment*, 799: 149407. doi: 10.1016/j.scitotenv.2021.149407.

The research team set up groups based on buffer sizes of residential distance from CAFOs, e.g., 5, 10, 15, and 20 km. And then there was the control group consisting of residences with no exposure to CAFO air emissions. The team announced the following findings:

We found significantly positive associations between cardiovascular mortality and all levels of CAFOs exposure (i.e., low, medium, and high exposure) compared to no exposure. We also found an increasing trend of mortality risk from cardiovascular disease with

higher levels of CAFOs exposure.

Nor were Dr. Son's multiple studies done in isolation as they were buttressed by the following studies:

B Bekbulat, A Unal, A Sharma, JS Apte, & JD Marshall (November 21, 2025). Changes in PM_{2.5}-attributable mortality in the US by sector, 2002-2019. *Environmental Science & Technology Letters*, 12 (12): 1644-1650. doi: 10.1021.acs.estlett.5c00901.

The Bekbulat *et al.* (2025) study was cited by the IEC-Harkin (2026) report in its two-paragraph discussion of particulate matter. The Bekbulat *et al.* (2025) study investigated the particulate matter (PM_{2.5}) emissions by five key economic sectors: electricity generation, industrial, transportation, residential, and agriculture.

Whereas electricity generation and transportation were the largest emitters of PM_{2.5} in the early 21st century while agriculture "played a relatively minor role," these roles had reversed themselves by 2019. The electricity generation and transportation economic sectors had reduced their particulate emissions while agriculture had become the leading emitter of particulate matter. Both regulation and the lack of regulation played key roles in this reversal.

The IEC-Harkin (2026) report ignored the following finding of the Bekbulat *et al.* study:

[A]griculture had emerged as the largest contributor [to PM_{2.5}-attributable mortality]... Emissions from agriculture remain largely unregulated compared with other major pollution sources.... Our 18-year sector-specific analysis reveals the emerging dominance of agricultural emissions and the declining role of electricity generation in air pollution-related mortality.

CD Berg, JH Schiller, P Boffetta, J Cai, C Connolly, A Kerpel-Fronius, AB Kitts, DCL Lam, A Mohan, R Myers, T Suri, MC Tammemagi, D Yang, S Lam, On behalf of the International Association for the Study of Lung Cancer (IASLC) Early Detection and Screening Committee (2023). Air pollution and lung cancer: A review by International Association for the Study of Lung Cancer Early Detection and Screening Committee. *Journal of Thoracic Oncology*, 18 (10): 1277-1289. doi: 10.1016/j.jtho.2023.-5.-24.

The Wang *et al.* (2025) study cited this research investigation. The Wang *et al.* (2025) study was cited by the IEC-Harkin (2026) report.

The Berg *et al.* (2023) research team announced one of the results of their investigation within the context of the IARC's action in classifying "outdoor air pollution and particulate matter" (PM_{2.5}) as "carcinogenic to humans" and declaring them as "a cause of lung cancer":

The number of estimated attributable lung cancer deaths has increased by nearly 30% since 2007 as smoking has decreased and air pollution has increased.

The Berg *et al.* (2023) research team also cited the finding by the Turner *et al.* (2014) study:

Smoking and air pollution interact in a positive synergistic fashion.

Turner *et al.* (2014). Interactions between cigarette smoking

and fine particulate matter in the risk of lung cancer mortality in Cancer Prevention Study II. *American Journal of Epidemiology*, 180 (12): 1145-1149. doi: 10.1093/aje/kwu275.

One of the suggested courses of action recommended by the Turner *et al.* (2014) study flowed from their finding:

[T]hese results suggest that attempted reductions in lung cancer risk through **both** tobacco control and air quality management may exceed expectations based on reducing exposure to either risk factor alone. [Emphasis added]

It would seem that this recommendation should be given thoughtful consideration by both the Iowa Cancer Registry personnel and the Iowa governor's office. Focusing on reducing smoking in isolation has not worked to reduce new cancer rates in Iowa. Regulating the air emissions of the electrical generation, transportation, manufacturing, and residential economic sectors while not regulating agricultural air emissions has not worked either. Perhaps the gigantic elephant in the room needs to be regulated as well. Perhaps then Iowa's new cancer rates will begin to be reduced and Iowa's environment will not threaten the public health.

Getting back to the Berg *et al.* (2023) study, the research team used prior research to describe the mechanisms of carcinogenesis:

Research reveals that PM_{2.5} can promote carcinogenesis in the lungs. PM_{2.5} has high PAH concentrations, which can induce oxidative stress and aryl hydrocarbon receptor activation in human bronchial epithelial cells (BEAS-2B). Aryl hydrocarbon receptor activation promotes lung cancer cell invasion and metastasis...

And the Berg *et al.* (2023) research team cited other research studies to describe another pathway to carcinogenesis via PM_{2.5}:

In addition to causing local inflammation and oxidative stress, PM_{2.5} penetrates deep into the lungs and terminal bronchioles, and from there into the circulation, causing systemic inflammation.... Long-term exposure to fine particle air pollutants can produce genotoxicity and mutagenicity. It may increase the risk of lung cancer through inflammatory damage, reactive oxygen species production, and oxidative DNA damage.

It's difficult to understand how the author(s) of Section 5 of the IEC-Harkin (2026) study either missed these two reports or chose not to report them, particularly since they cited the Wang *et al.* (2025) study, which in turn cited the Berg *et al.* (2023) study, which in its turn cited the Turner *et al.* (2014) study. It's either the result of sloppy work or a deliberate decision. But then, as will be shown subsequently, the author(s) of Section 5 mishandled the Burkholder *et al.* (2006), Wang *et al.* (2025), and Bekbulat *et al.* (2025) studies as well.

JA Fisher, LEB Freeman, JN Hofman, A Blair, CG Parks, PS Thorne, MH Ward, & RR Jones (July, 2020). Residential proximity to intensive animal agriculture and risk of lymphohematopoietic cancers in the Agricultural Health Study. *Epidemiology*, 31 (4): 478-489. doi: 10.1097/EDE.0000000000001186.

Cited by the 2026 Son *et al.* study, but neither cited nor discussed by the Iowa Cancer Registry in their 2026 *Cancer in Iowa* report.

This 2020 study followed 11 months after the Lerro *et al.* (2019) study that was discussed by the Iowa Cancer Registry in their 2026 *Cancer in Iowa* report. The Fisher *et al.* (2020) research investigation also focused on a cohort of Iowa farmers from the Agricultural Health Study. The difference was that instead of focusing on pesticide applicators and their spouses, this cohort was selected on the basis of residences situated within 2-5 km of permitted animal feeding operations in Iowa.

The conclusion reached by the Fisher *et al.* (2020) research team following their study of the AHS data:

Residential proximity to intensive animal agriculture was positively associated with risk of NHL [non-Hodgkin lymphoma] and leukemia, even after consideration of occupational animal and pesticide exposures.

D Heederik, T Sigsgaard, PS Thorne, R Avery, JH Bønløkke, EA Chrischilles, JA Dosman, C Duchaine, SR Kirkhorn, K Kulhankova, & JA Merchant (February, 2007). Health effects of airborne exposures from concentrated animal feeding operations. *Environmental Health Perspectives*, 115 (2): 298-302. doi: 10.1289/ehp.8835.

Cited by Son *et al.* (2026) in support of the following statement:

Chronic exposure to [pollutants contained in CAFO air emissions] has been linked to inflammation, oxidative stress, and immunosuppression which may contribute to cancer development.

IARC (International Agency for Research on Cancer, World Health Organization) (2015). *Outdoor air pollution: IARC monographs on the evaluation of carcinogenic risks to humans, volume 109*. Lyon, France: International Agency for Research on Cancer. Accessed 4-14-2026 from: <https://publications.iarc.who.int/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Outdoor-Air-Pollution-2015>

Cited by the IEC-Harkin report (2026) on p. 58 in the report's two-paragraph discussion of particulate matter. Also cited by the Son *et al.* (2026) study in support of the following assertion:

... particulate matter can provoke systemic inflammation and facilitate the delivery of carcinogenic compounds into the lungs.

While the results of the IARC determination that PM_{2.5} is a carcinogen were initially published in *The Lancet Oncology* (2013), the actual 451-page IARC report (2015) took longer as 28 pages of double-columned cited research studies needed to be discussed and explained to the public.

J Kravchenko, SH Rhew, I Akushevich, P Agarwal, & HK Lyerly (2018). Mortality and health outcomes in North Carolina communities located in close proximity to hog concentrated animal feeding operations. *North Carolina Medical Journal*, 79 (5): 278-288. doi: 10.18043/ncm.79.5.278.

North Carolina communities located near hog CAFOs had higher all-cause and infant mortality, mortality due to anemia, kidney disease, tuberculosis, septicemia, and higher hospital admissions/ED visits of LBW infants. Although not establishing causality with exposures from hog CAFOs, our findings support the need for future studies to determine factors that influence these outcomes, as well as the need to improve screening and diagnostic strategies for these diseases in North Carolina communities adjacent to hog

CAFOs.

D Loomis, Y Grosse, B Lauby-Secretan, F El Ghissassi, V Bouvard, L Benbrahim-Tallaa, N Guha, R Baan, H Mattock, & K Streif (December, 2013). The carcinogenicity of outdoor air pollution. *The Lancet Oncology*, 14(13): 1262-1263. doi: 10.1016/S1470-2045(13)70487-X.

Loomis *et al.* (2013) is a pre-publication summary of the IARC (International Agency for Research on Cancer) report finding that PM_{2.5} is a carcinogen. While the actual IARC report (2015) was cited by the IEC-Harkin (2025) report, the summary of IARC findings published in *The Lancet Oncology* (2013) was cited by the Wang *et al.* report (2025). Wang *et al.* (2025) was in turn cited by the IEC-Harkin report (2026) in its two-paragraph discussion of particulate matter.

According to the Loomis *et al.* (2013) research team's initial summary of the IARC's findings:

The findings regarding the carcinogenicity of outdoor air pollution as a mixture, and of particulate matter specifically, are remarkably consistent in epidemiological research, studies of cancer in experimental animals, and a wide range of studies of mechanisms related to cancer.

Particularly, an increased risk of lung cancer was consistently observed in cohort and case-control studies including millions of people and many thousands of lung cancer cases from Europe, North America, and Asia. The largest and most informative studies were a pooled analysis of data from ten European countries and a large nationwide cohort study in the USA.

CA Pope III, RT Burnett, MJ Thun, EE Calle, D Krewski, K Ito, & GD Thurston (March 6, 2002). Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Journal of the American Medical Association*, 287 (9): 1132-1141. doi: 10.1001/jama.287.9.1132.

The Pope III *et al.* (2002) research was cited by Wang *et al.* (2025). In turn the Wang *et al.* (2025) study was cited by the IEC-Harkin (2026) report in its two-paragraph discussion of particulate matter on p. 58 of the report. Findings of the Pope *et al.* (2002) study:

Fine particulate and sulfur oxide-related pollution were associated with all-cause, lung cancer, and cardiopulmonary mortality.

CA Pope III & DW Dockery (June, 2006). Health effects of fine particulate air pollution: Lines that connect. *Journal of the Air & Waste Management Association*, 55 (6): 709-742. doi: 10.1080/10473289.10464486.

The Pope III & Dockery (2006) study was cited by Wang *et al.* (2025). In turn the Wang *et al.* (2025) research was cited by the IEC-Harkin (2026) report in its two-paragraph discussion of particulate matter on p. 58 of the report. The study by Pope III & Dockery (2006) contains 502 research citations. Based on their extensive review, Pope III & Dockery (2006) concluded that:

there is growing evidence that the epidemiologically observed links between PM and cardiopulmonary disease and death may be plausible. There remains a need to further elucidate the biological mechanisms.

CA Pope III, JS Lefler, M Ezzati, JD Higbee, JD Marshall, S-Y Kim, M Bechle, KS Gilliat, SE Vernon, AL Robinson, & RT Burnett (July 21, 2019). Mortality risk and fine particulate air pollution in a large, representative cohort of U.S. adults. *Environmental Health Perspectives*, 127 (7): 077007. doi: 10.1289/EHP4438.

The Pope III *et al.* (2019) research was cited by the Bekbulat *et al.* (2025) study. The Bekbulat *et al.* (2019) study in turn was cited by the IEC-Harkin report (2026) in its two-paragraph discussion of particulate matter. The research team of Pope III *et al.* (2019) found the following:

In general, PM_{2.5}-mortality associations were consistently positive for all-cause and cardiopulmonary mortality across key modeling choices and across subgroups of sex, age, race-ethnicity, income, education levels, and geographic regions.

Elevated long-term exposure to PM_{2.5} was associated with elevated risk of all-cause, cardiopulmonary, cardiovascular, cerebrovascular, influenza pneumonia, cancer, and lung cancer mortality.

S Reuter, SC Gupta, MM Chaturvedi, & BB Aggarwal (December 1, 2010). Oxidative stress, inflammation, and cancer: How are they linked? *Free Radical Biology and Medicine*, 49 (11): 1603-1616. doi: 10.1016/freeradviomed.2010.09.006.

Cited by Son *et al.* (2026) in support of the following statement:

Chronic exposure to [pollutants contained in CAFO air emissions] has been linked to inflammation, oxidative stress, and immunosuppression which may contribute to the cancer development.

The Reuter *et al.* (2010) research team pointed out that modern-day scientific research studies showing a link between inflammation and cancer only served to confirm a much older finding:

The link between inflammation and cancer has been suggested by epidemiological and experimental data and confirmed by anti-inflammatory therapies that show efficacy in cancer prevention and treatment. The fact that continuous irritation over long periods of time can lead to cancer had already been described in the traditional Ayurvedic (meaning "the science of long life") medical system, written as far back as 5,000 years ago.

MC Turner, A Cohen, M Jerrett, SM Gapstur, WR Diver, CA Pope III, D Krewski, BS Beckerman, & JM Samet (2014). Interactions between cigarette smoking and fine particulate matter in the risk of lung cancer mortality in Cancer Prevention Study II. *American Journal of Epidemiology*, 180 (12): 1145-1149. doi: 10.1093/aje/kwu275.

Cited by the Berg *et al.* (2023) study, which in turn had been cited by the Wang *et al.* (2025) study. The Turner *et al.* (2014) study utilized data collected by the Cancer Prevention II that began in 1982 and was a US cohort consisting of approximately 1.2 million participants.

Based on their examination of the data, the Turner *et al.* (2014) concluded:

Smoking and air pollution interact in a positive synergistic fashion.

One of the suggested courses of action recommended by the Turner *et al.* (2014) study flowed from their finding:

[T]hese results suggest that attempted reductions in lung cancer risk through **both** tobacco control and air quality management may exceed expectations based on reducing exposure to either risk factor alone. [Emphasis added]

Synergy also served as a focal point in a previous study by Donham *et al.* (2002)⁶ examining the synergistic effects of both dust and ammonia on human health. The Donham *et al.* (2002) research combined with other factors to earn the disrespect of a federal agency's ability to formulate meaningful occupational exposure limits for toxins, which was presented in the ISU-UI Study Group (2002) report to be discussed later in this analysis.

MC Turner, D Krewski, CA Pope III, Y Chen, SM Gapstur, & MJ Thun (December 11, 2011). Long-term ambient fine particulate matter air pollution and lung cancer in a large cohort of never-smokers. *American Journal of Respiratory and Critical Care Medicine*, 18 (12): 1374-1381. doi: 10.1164/rccm.201106-1011OC.

Cited by the Loomis *et al.* (2013) IARC report of findings declaring PM_{2.5} to be a carcinogen. In turn Loomis *et al.* (2013) was cited by the Wang *et al.* (2025) study. Wang *et al.* (2025) was subsequently cited by the IEC-Harkin (2026) report in its two-paragraph discussion of particulate matter.

The Turner *et al.* (2011) study was based on examining the data obtained from 188,699 "lifelong never-smokers" in a 26-year research project from 1982-2008. The Turner *et al.* (2011) research team concluded:

The present findings strengthen the evidence that ambient concentrations of PM_{2.5} measured in recent decades are associated with small but measurable increases in lung cancer mortality.

M Wang, RY Kim, MRJ Kohonen-Corish, H Chen, C Donovan, & BG Oliver (2025). Particulate matter air pollution as a cause of lung cancer: Epidemiological and experimental evidence. *British Journal of Cancer*, 132: 986-996. doi: 10.1038/s41416-025-02999-2.

Cited by the IEC-Harkin (2026) report in its two-paragraph discussion of particulate matter. The Wang *et al.* (2025) research team's findings:

Epidemiological evidence strongly suggests that airborne particulate matter (PM), the dust components of polluted air, is associated with increased incidence of lung cancer. PM_{2.5} carries different toxic substances, such as sulfates, organic compounds..., which are considered major carcinogens that increase lung cancer risk.

PM_{2.5} from agricultural activities are due to ammonia emissions, fertiliser use, biomass burning, and farm machinery emissions.

A study in Indonesia showed that compared with workers in other sectors, the risk of lung cancer was nearly three times higher for workers involved in crop and animal production...

6. KJ Donham, D Cumro, & S Reynolds (2002). Synergistic effects of dust and ammonia on the occupational health effects of poultry production workers. *Journal of Agromedicine*, 8 (2): 57-76. doi: 10.1300/J096v08n02_09.

The preceding body of research is what the National Pork Producers would try to negate by attempting to discredit the Yale study by Son *et al.* (2026) that had no methodological or reasoning flaws. In case the reader has doubts, consider the following studies and their cited research retrieved from the body of peer-reviewed scientific research that can be discovered by reading the actual research cited by the IEC-Harkin (2026) report. Listed on the following page are the number of peer-reviewed studies and reports that support the Yale University research team's work:

STUDY	Peer-Reviewed Studies	Reports	TOTAL Cited
Bekbulat <i>et al.</i> (2025)	35	7	42
Berg <i>et al.</i> (2023)	91	11	102
Fisher <i>et al.</i> (2020)	51	8	59
Heederik <i>et al.</i> (2007)	61	0	61
IARC. (2015)	734	19	753
Kravchenko <i>et al.</i> (2018)	42	5	47
Loomis <i>et al.</i> (2013)	11	1	12
Pope <i>et al.</i> (2002)	19	10	29
Pope <i>et al.</i> (2006)	460	42	502
Pope <i>et al.</i> (2019)	33	4	37
Reuter <i>et al.</i> (2010)	313	0	313
Son <i>et al.</i> (2021)	34	3	37
Son <i>et al.</i> (2024)	15	5	20
Son <i>et al.</i> 2025, April)	33	5	38
Turner <i>et al.</i> (2011)	34	5	39
Wang <i>et al.</i> (2025)	136	4	140
TOTAL:	2,102	129	2,231

And this is the body of research that the National Pork Producers Council thinks it can negate via a false message aimed at unjustly criticizing a single peer-reviewed scientific-based research study.

Now we can turn our attention to discussing the mistakes made by a credible institution, the Iowa Cancer Registry, that were used by the National Pork Producers and the Iowa governor to mount their attack on credible peer-reviewed scientific research.

Mistakes by the Iowa Cancer Registry in the 2026 *Cancer in Iowa* Report

First, the Agricultural Health Study (AHS) is not a single study. Instead it is a **database** consisting of health information from 89,000+ farmers/spouses in Iowa and North Carolina who've been involved since 1993. There is no single Agricultural Health Study. Instead there are currently 415 scientific research studies that have emerged from the data contained in the AHS. This context was not fully presented by the 2026 *Cancer in Iowa* report.

Second, in discussing a study (whose findings they misrepresented), the Iowa Cancer Registry did not clearly identify the study in the text of their discussion nor did they cite that study when discussing the misrepresented findings. And although the Iowa Cancer Registry twice footnoted the study, neither footnote appeared in the discussion of the results of the study whose findings it was summarizing in pages 7-9 of the 2026 *Cancer in Iowa* report. Instead, the first footnote to the Lerro *et al.* (2019) study appeared on page 10 where the report discussed the methodology used to compare "cancer rates in the AHS to those in the overall Iowa population," a method called the "standardized incidence ratio."⁷ The second footnote referencing the Lerro *et al.* (2019) study appeared on page 11 in the section entitled "Cancers That Occurred Less Often in AHS Participants." The statement observed:

Many of the cancers that were less common in the AHS are linked to behaviors people can change, like smoking and drinking alcohol.⁸

Again, neither did the narrative text of the 2026 *Cancer in Iowa* report clearly identify the Lerro *et al.* (2019) study. The study being discussed by the 1926 *Cancer in Iowa* report, but not identified, was:

CC Lerro, S Koutros, G Andreotti, DP Sandler, CF Lynch, LM Louis, A Blair, CG Parks, S Shrestha, JH Lubin, PS Albert, JN Hoffman, & LEB Freeman (February 25, 2019). Cancer incidence in the Agricultural Health Study after 20 years of follow-up. *Cancer Causes & Control*, 30: 311-322. doi: 10.1007/s10552-019-01140-y.

This particular study did not include ALL 89,000+ AHS farmers, but was instead focused only on a cohort within that group consisting of private and commercial applicators of pesticides plus their spouses. This was not clearly identified by the Iowa Cancer Registry in the 2026 *Cancer in Iowa* report, even though it was clearly identified by the Lerro *et al.* (2019) researchers in both the abstract and the study itself.

So far only a couple of small errors have been presented. However, as will be shown, these small errors permitted unprincipled misinterpretation and misrepresentation by others.

Next we come to a more serious error. The problematic statement that would be trumpeted by the NPPC and the Iowa governor occurs on page 7 of the 2026 *Cancer in Iowa* report and resides

7. Iowa Cancer Registry (2026), p. 10. *Cancer in Iowa 2026*. Iowa City, IA: College of Public Health, the University of Iowa. Available from the Iowa Cancer Registry's web page at: <https://shri.public-health.uiowa.edu/cancer-data/reports/iowa-cancer-reports/>

8. Iowa Cancer Registry (2026). *Cancer in Iowa 2026*, p. 11, *op. cit.*

in the first bullet point under the heading "Cancer Among Iowa Participants in the AHS." It reads:

Iowa farmers in the AHS had 13% fewer cancers overall than expected compared to the general population in Iowa from 1994-2015.⁹

Besides being a false statement, multiple problems reside in this statement. First, it appears to be talking about ALL Iowa farmers enrolled in the AHS when in fact the Lerro *et al.* (2019) study focused ONLY on a single cohort of pesticide applicators and their spouses. Second, to a lay audience the statement makes it appear as if the AHS is only a single study instead of being a database for use by researchers. Third, the actual study being discussed is neither footnoted nor identified in the text of this particular discussion.

A fourth problem presents itself when one wonders why the Iowa Cancer Registry ignored the Fisher *et al.* (2020) study that also utilized the database from the Agricultural Health Study:

JA Fisher, LE Beane Freeman, JN Hofmann, A Blair, CG Parks, PS Thorne, MH Ward, & RR Jones (July, 2020). [Residential proximity to intensive animal agriculture and risk of lymphohematopoietic cancers in the Agricultural Health Study.](#) *Epidemiology*, 31 (4): 478-489. doi: 10.1097/EDE.0000000000001186.

The neglected Fisher *et al.* (2020) study followed 13 months after the cited Lerro *et al.* (2019) study. Although both studies utilized the Agricultural Health Study database, the Fisher *et al.* (2020) study differed. Whereas the cited Lerro *et al.* (2019) study focused on Iowa pesticide applicators and their spouses, the uncited Fisher *et al.* (2020) selected its Iowa farmer study group based on farm homes being located within 2-5 km of permitted animal feeding operations. Focusing solely on residential proximity to a CAFO, this study also included a portion of pesticide applicators as well. The conclusion reached by the Fisher *et al.* (2020) research team following their investigation of the AHS database follows:

[W]e observed increased risk among applicators with the highest estimated farm animal exposure within 5 km of the home.

Residential proximity to intensive animal agriculture was positively associated with risk of NHL [non-Hodgkin lymphoma] and leukemia, even after consideration of occupational animal and pesticide exposures.

The Fisher *et al.* (2020) study built on the previous work (discussed previously on pp. 12-13) by Heederik *et al.* (2007) and by Kravchenko *et al.* (2018), all to be confirmed further by the subsequent studies of Son *et al.* (2021), Son *et al.* (2024), Son & Bell (2025), and Son *et al.* (2026), all of which were briefly discussed previously.

The fifth and final problem with the erroneous statement by the Iowa Cancer Registry in the 2026 *Cancer in Iowa* report arises from subsequent misuse by the Iowa governor and the National Pork Producers of a caveat that followed the preceding problematic statement. The

9. Iowa Cancer Registry (2026). *Cancer in Iowa 2026*, p. 7, *op. cit.*

2026 *Cancer in Iowa* report states on page 7, 3rd bullet point under "Cancer Among Iowa Participants in the AHS," that

... lower rates of smoking and alcohol consumption among AHS farmers and their spouses likely contributed to a lower burden of many cancers.

Another caveat about the erroneous finding would be offered in the press release by the University of Iowa College of Public Health regarding the 2026 *Cancer in Iowa* report, which stated:

The "healthy worker effect" – the tendency for actively working people to have fewer illnesses – may also play a role [in the lower incidence of cancers among Iowa farmers and their spouses].¹⁰

As will be shown, both caveats will be carefully omitted by the National Pork Producers in their subsequent attempt to use the Iowa Cancer Registry's statement to discredit a recently published peer-reviewed research study finding possible links between cancer diagnoses and physical residence in a high-density CAFO area. And both caveats will also be omitted by Iowa governor Kim Reynolds in trying to deflect any immediacy towards providing any needed funding and regulation to deal with the environmental cancer risks identified by the IEC-Harkin (2026) study.

The Iowa Cancer Registry's selection of the Lerro *et al.* (2019) study while ignoring the Fisher *et al.* (2020) study had several negative consequences, the main one of which was opening the door for misuse by the National Pork Producers and the governor of Iowa. Neither of these parties could have constructed their false narrative in the absence of Iowa Cancer Registry errors centered on the Lerro *et al.* (2019) study in the 2026 *Cancer in Iowa* report.

The Pork Producers & Iowa Governor Build Narratives Based on Falsehoods

The National Pork Producers Council didn't wait long to use the gaff published in the Iowa Cancer Registry's 2026 *Cancer in Iowa* report to discredit the recent Yale University researchers' study that found positive correlations between residential exposure to CAFO air emissions (from living in a "high-density CAFO" area) and cancer diagnoses. But wait, the National Pork Producers Council had an objection. According to the NPPC spokesperson:

A separate report on cancer in Iowa published last month by the Iowa Cancer registry found that Iowa farmers have 13% fewer cancers overall than the general population in the state.¹¹

The NPPC spokesperson continued:

The most rigorous, long-term research available – following actual farmers for 30 years – finds that Iowa farmers are significantly less likely to

10. University of Iowa College of Public Health (March 13, 2026). *2026 Cancer in Iowa Report highlights cancer incidence among Iowa's farming population*. Press Release. Iowa City, IA: University of Iowa College of Public Health. Accessed at: <https://www.public-health.uiowa.edu/news-items/2026-cancer-in-iowa-report-highlights-cancer-incidence-among-iowas-farming-population/>

11. B Bienkowski (April 2, 2026). Higher cancer rates in counties with more CAFOs, study finds. *The New Lede* (TNL).

develop cancers than the general population, not more. That finding should be the headline here.¹²

Wendy Brannen, NPPC vice president of communications and marketing, concluded:

The Yale research is not as thorough as other analysis on the same industries... Yale's county-level comparisons, which the study's authors described as 'exploratory,' does 'not refute' Iowa's long-term data.^{13, 14}

And what did Iowa governor Kim Reynolds say? She simply echoed the statements made by the National Pork Producers at her press conference of April 7, 2026. When asked by Tom Barton of the *Cedar Rapids Gazette* about the IEC-Harkin report's linking cancer rates to "environmental exposures, such as pesticides, nitrates, and radon" and whether "the government was open to regulating or funding in those areas," Governor Reynolds replied:

"We're balancing that with the cancer report" issued by the University of Iowa [the 2026 *Cancer in Iowa* report]. She cited a decades-long study with a cohort of farmers and non-farmers, which (according to Reynolds) "actually found that they [Iowa farmers]" were lower in cancer rates" than the cohort not tied to the farm.¹⁵

After further noting how much money had already been spent investigating Iowa's high cancer rates and how the initial investigative stage concluded that cancer in Iowa was caused primarily by personal choices of residents about drinking, smoking, and obesity, Reynolds noted that the next investigative phase would focus on environmental impacts. However, she cautioned, "[T]here's 'not a lot of data' across Iowa." Governor Reynolds concluded by "again emphasiz[ing] the other ten-year study showing farmers had 'a lower cancer rate.'"¹⁶

Fact Checking the Pork Producers' and the Iowa Governor's Claims

First, as pointed out earlier, the claim that "All farmers in Iowa" had lower cancer rates than other people is false. The actual Lerro *et al.* (2019) study focused on a single cohort of the Agricultural Health Study consisting of "pesticide applicators" and their spouses, NOT "All farmers." The National Pork Producers and Governor Reynolds simply repeated the false statement made initially by the Iowa Cancer Registry in their 2026 *Cancer in Iowa* report.

Second, as predicted earlier, the National Pork Producers Council's and Iowa governor Reynolds'

12. Bienkowski (April 2, 2026), *op. cit.*

13. S Rodas (April 12, 2026). Cancer rates are higher near large livestock feeding operations in 3 states, a new study finds. Researchers comparing maps of CAFOs with county-level disease data from California, Texas and Iowa found increased rates of all types of cancer, but said more research is needed to determine the cause. *Inside Climate News*.

14. A Shriver, The Harkin Institute at Drake University (April 30, 2026). Pork producers, governor get the Iowa cancer reports wrong. *Bleeding Heartland*.

15. Bleeding Heartland (April 28, 2026). *Iowa governor touts study showing lower cancer rate for farmers*. Video of Governor Reynolds' Press Conference. Accessed 4-30-2026 from: <https://www.youtube.com/watch?v=3qkcmR5tlm8>

16. Bleeding Heartland (April 28, 2026), *op. cit.*

responses completely omitted the first caveat offered by the Iowa Cancer Registry in both the press release and the 2026 *Cancer in Iowa* report that

... lower rates of smoking and alcohol consumption among AHS farmers and their spouses likely contributed to a lower burden of many cancers.^{17, 18}

Third, both the National Pork Producers Council's and Iowa governor Kim Reynolds' responses also omitted the additional caveat offered by the Iowa Cancer Registry in its press release for the 2026 *Cancer in Iowa* report as well as the report itself:

The "healthy worker effect" – the tendency for actively working people to have fewer illnesses – may also play a role.^{14, 15}

Fourth, the omissions discussed so far provided a false basis for the National Pork Producers to mount their attack on the credibility of the Yale University study that found a link between cancer and living in a CAFO-dense area. As pointed out by Adam Shriver, Harkin Institute Director of Wellness and Nutrition:

... the finding that *pesticide applicators* had a lower rate of cancer than the general population does not in any way, shape, or form refute a study result that is *specifically focused on how close one lives to concentrated animal feeding operations*. [Emphasis added]¹⁹

The close reader may recall that the previously Fisher *et al.* (2020) study, which was not cited by the Iowa Cancer Registry, did find increased cancer risks for pesticide applicators living in proximity to CAFOs.

Fifth, the omissions of the caveats and the use of the false statement regarding "All farmers having lower cancer rates" in the AHS study combined to provide a false basis upon which Governor Reynolds could build her false narrative. The Iowa governor next noted how much money Iowa had already spent investigating Iowa's high cancer rates and how the initial stage concluded that

cancer in Iowa was caused primarily by personal choices of residents about drinking, smoking, and obesity.²⁰

These facts, the governor implied, combined with the finding asserted by the Iowa Cancer Registry, should explain why it's premature for the state to think about spending more money or

17. University of Iowa College of Public Health (March 13, 2026). *2026 Cancer in Iowa Report highlights cancer incidence among Iowa's farming population*. Press Release. Iowa City, IA: University of Iowa College of Public Health. Accessed at: <https://www.public-health.uiowa.edu/news-items/2026-cancer-in-iowa-report-highlights-cancer-incidence-among-iowas-farming-population/>

18. Iowa Cancer Registry (2026). *Cancer in Iowa 2026*. Iowa City, IA: College of Public Health, the University of Iowa. Available from the Iowa Cancer Registry's web page at: <https://shri.public-health.uiowa.edu/cancer-data/reports/iowa-cancer-reports/>

19. A Shriver, The Harkin Institute at Drake University (April 30, 2026). Pork producers, governor get the Iowa cancer reports wrong. *Bleeding Heartland*.

20. Bleeding Heartland (April 28, 2026), *op. cit.*

to consider any new regulations.

Governor Reynolds next announced that the next investigative phase would focus on "environmental impacts." As if the IEC-Harkin (2026) report released earlier either hadn't focused on "environmental impacts" or perhaps was so insignificant that it wouldn't have any significant impact on government decision-making.

However, the governor said, as if to warn about getting ones hopes too high about the results of the next stage:

[T]here's "not a lot of data" across Iowa.²¹

Again, this statement ignores the significant data cited by the recently released IEC-Harkin report about pesticides, PFAS, nitrates, and radon, particularly regarding their connection to cancer. It also ignores the body of PM_{2.5} research that has already been presented in this analysis as well as the subsequent PM_{2.5} research that will be discussed later in this report.

Governor Reynolds concluded her remarks by once again quoting the false statement reported by the Iowa Cancer Registry in its 2026 *Cancer in Iowa* report. The careful observer will note that the governor used the false statement about **Iowa farmers having lower rates of cancer than the general population** to bookend her false narrative, placing it at both the beginning and the ending of her press conference.²²

Seventh, and most disturbing, is the consideration that no platform would have been created that would have allowed either the National Pork Producers or the Iowa governor to build their false narratives in order to promote their nonpublic agendas had the Iowa Cancer Registry chosen to cite the Fisher *et al.* (2020) study instead of the Lerro *et al.* (2019) study.

21. Bleeding Heartland (April 28, 2026), *op. cit.*

22. Bleeding Heartland (April 28, 2026), *op. cit.*

THE 2026 FOOD & WATER WATCH REPORT: "Glyphosate Use and Cancer Clusters"

And then in mid-march, 2026 came news that researchers at the environmental nonprofit, Food & Water Watch, had finished their examination of a possible relationship between exposure to glyphosate use and subsequent diagnoses of non-Hodgkin lymphoma (NHL). The Food & Water Watch (2026) report, *Glyphosate Use and Cancer Clusters*, built on the results of a previous study, Gerken *et al.* (2024) that used

county-wide agricultural pesticide data, along with cancer incidence and covariate data [smoking, the Social Vulnerability Index (SVI), agricultural land use, and total population] to determine the effect of use pattern profiles on cancer incidence.²³

The previous Gerken *et al.* (2024) study found

that elevated risk pesticide use is associated with an increased risk of all the cancers evaluated. ...the effects of pesticide use remained significant on par with smoking even when adjusting the models for agricultural land use, total population, and social vulnerability index. Non-Hodgkin's lymphoma and leukemia are potentially two of the most vigorously discussed cancers evaluated in this study.²⁴

While the Gerken *et al.* (2024) study focused on multiple cancers and their incidence rate at the county level paired with levels of pesticide use for the nation, the Food and Water Watch report cited below focused on a single cancer, non-Hodgkin lymphoma, and a single pesticide, glyphosate, also at the county level.

Food & Water Watch (March, 2026). *Glyphosate use and cancer clusters*. Washington, DC: Food & Water Watch. Available from F&WW at: https://www.foodandwaterwatch.org/wp-content/uploads/2026/03/2603_RB_GlyphosateCancerClusters.pdf

According to one journalist's coverage:

A report from the environmental group Food & Water Watch found that the majority of counties that are in the top 20% for glyphosate application have non-Hodgkin lymphoma rates above the national average.²⁵

Food & Water Watch researchers mapped the counties that sprayed the most glyphosate

23. J Gerken, GT Vincent, D Zapata, IG Barron, & I Zapata (2024). Comprehensive assessment of pesticide use patterns and increased cancer risk. *Frontiers in Cancer Control and Society*, 2: 1368086. doi: 10.3389/fcacs.2024.1368086.

24. Gerken *et al.* (2024), *op. cit.*

25. C Koons (March 16, 2020). Report: Counties that spray the most glyphosate have higher non-Hodgkin lymphoma rates. Iowa lawmaker launches pesticide exposure study. *Iowa Capital Dispatch*. Accessed 3-17-2026 from: <https://iowacapitaldispatch.com/2026/03/16/report-counties-that-spray-the-most-glyphosate-have-higher-non-hodgkin-lymphoma-rates/>

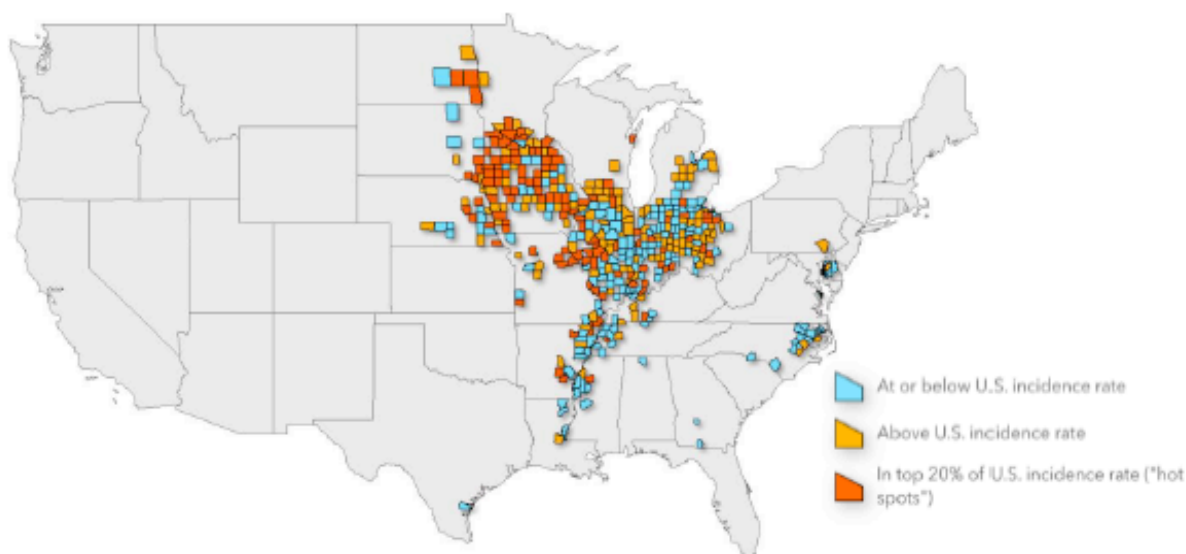
herbicides per square mile of cropland in 2022, *i.e.*, the top 20% of all counties in the nation that applied glyphosate to commodity crops. The glyphosate data was obtained from the USDA's Agricultural Use Program as well as from the USDA's 2022 Census of Agriculture. The F&WW researchers then overlapped this data with incidence rates for non-Hodgkin lymphoma (NHL) obtained from the National Cancer Institute's "State Cancer Profiles." The researchers then

accessed the latest five-year averages (2018-2022) for non-Hodgkin lymphoma (NHL) at the county level for all races, sexes, ages, and rural/urban residence.

Researchers then mapped the two sets of data using ArcGIS Pro. The map generated by the data displayed

only those counties that are in the top [20%] for total glyphosate applied per square mile, and that also have reported county-level data for NHL incidence (all stages).

Fig. 1: Counties that spray the most glyphosate, by non-Hodgkin lymphoma cancer rates



Counties in the top 20 percent for total glyphosate sprayed per square mile of cropland in 2022, with available county-level non-Hodgkin lymphoma (NHL) incidence rates (all stages of diagnoses, 2018-2022 averages). Note: Alaska and Hawaii had no county-level NHL incidence data available.

As can be seen from the map above, the greatest overlap was in the Midwest. Only the colored counties were in the top 20% of glyphosate spraying. Blue indicated those glyphosate "hot spots" where the incidence of NHL was at or below the US incidence rate. Gold indicated those glyphosate "hot spots" where the incidence of NHL was above the US incidence rate. Red indicated those glyphosate "hot spots" where the incidence rate of NHL was in the top 20% in the nation – in other words, a double-whammy hot spot.

Another finding of the Food & Water Watch (2026) report was:

In Iowa, 95% of "high-spray counties" had elevated NHL incidence rates with 61% of those counties being "hot spots" in terms of being in the top 20% nationally for NHL incidence.

Lets take a closer look at some quantitative figures received from the F&WW Director of Research regarding amounts of glyphosate application and counties with county-level information about residents diagnosed with non-Hodgkin Lymphoma (NHL):²⁶

Number of Iowa counties	99
# of "high spray" glyphosate counties	77
# of counties with glyphosate application rates below "high spray"	22
# of "high-spray" counties w/no county-level data re NHL	17
# of "high-spray counties with county-level data re NHL	60
# of "high-spray" counties w/NHL rates at/below the US average	11
# of "high-spray" counties w/NHL rates ABOVE the US average	49
# of "high-spray" counties w/NHL rates ABOVE the US average who are also in the "TOP 20%" of the national NHL rates	31

Based on those figures, 77 of 99 or 78% of all Iowa counties received designation as a high-spray county; as such, each of the "high-spray" counties earned a spot in a select group – a member of the top 20% of ALL the nation's counties in terms of amounts of glyphosate application. And while we have 17 "high-spray" counties that have not recorded their NHL data, we do have 60 of 77 "high-spray" counties that have recorded their NHL data. Of those 60 "high-spray" counties with NHL data, 49 counties had NHL rates ABOVE the national average. Of those 49 counties with "high-spray" glyphosate application rates and ABOVE-AVERAGE NHL rates, 31 Iowa counties were designated as NHL "hot spots" because they were in the top 20% of US NHL rates. That's right – 31 counties in Iowa were named Industrial Agriculture All-Stars for having the nation's highest rates of glyphosate application AND the nation's highest rates of non-Hodgkin lymphoma.

Iowa is truly **"First in the Nation"** in the following areas:

- #1 in hogs.
- #1 in corn.
- #1 in the percent of land in the state used for agricultural production.
- #1 in the percent of land in the state devoted to "monocultural row-crop" production of corn and soybeans.
- #1 in terms of having the lowest percentage of land containing plant biodiversity.
- #1 in terms of contributing the highest percentage amounts of pollution to the Gulf's Dead Zone.

26. A Starbuck, F&WW Research Director (September 10, 2026). Personal communication.

- #1 in the number of counties with "top 20% high-spray" rates of glyphosate application.
- #1 in the number of counties with "top 20%" for rates of non-Hodgkin lymphoma.
- #1 in the number of counties having "top 20%" rankings for BOTH "high-rates" of glyphosate application AND residents diagnosed with non-Hodgkin lymphoma.
- #1 in the total number of hog CAFOs.
- #1 in the total number of CAFOs for hogs, cattle, & poultry.
- #1 in the number of counties designated as "high-density" CAFO areas.
- #1 in the production of "untreated" animal waste in terms of total pounds per unit of human population.
- #1 in the spreading of "untreated" animal waste (total pounds per unit of human population) on agricultural fields by "unlicensed" personnel, which then volatilizes and disperses multiple toxins, drug-resistant organisms, and carcinogens into the surrounding atmosphere.
- #1 in the total number and the percentage of "impaired" public waterways.
- #1 in the number of "shallow-water wells" containing high levels of nitrates.
- #1 in total agricultural emissions of PM_{2.5}.
- #1 in having the highest rate of new cancer diagnoses each year.

Pardon me for not cheering.

However, a joke about Iowa's lack of biodiversity arose in the wake of 9/11 when more participants from the East Coast began to participate in RAGRBRAI in greater numbers. The joke goes something like this:

A new participant in RAGBRAI from Manhattan, getting ready for the first morning's ride, asked a Native Iowan about what kind of views they could expect to see during their bike ride across Iowa. The Iowan replied:

Well, you've got your four basic views:

First, you've got corn on both sides of the road.

Second, you've got soybeans on both sides of the road.

Third, it begins to get more interesting – you've got corn on the right and soybeans on the left.

Fourth, just to vary things up – you've got soybeans on the right and corn on the left.

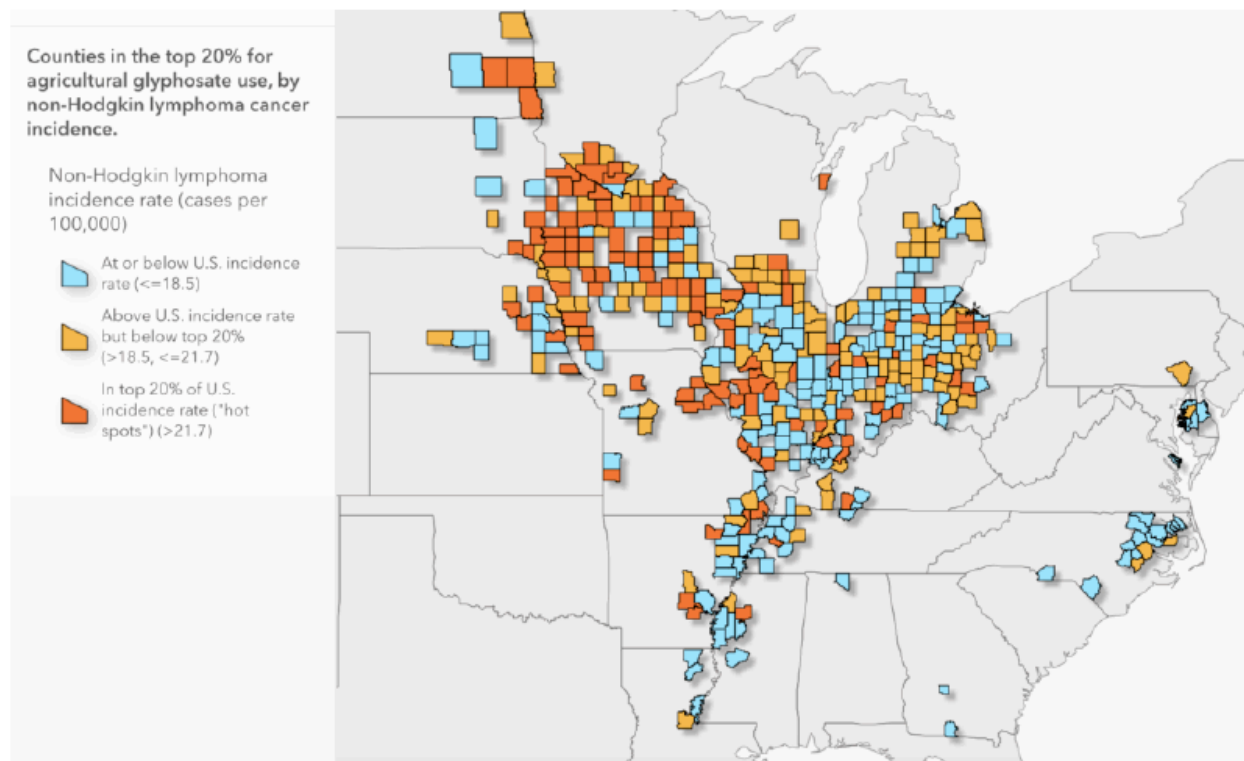
And there you've got your four basic views of Iowa.²⁷

The Food & Water Watch researchers indicated that while the US Environmental Protection

27. T Janson (August 5, 2002). Personal communication.

Agency holds that glyphosate is not a carcinogen,²⁸ the World Health Organization has declared that glyphosate is a Level 2 carcinogen, meaning there is enough research evidence to conclude that glyphosate is "probably carcinogenic to humans," but not sufficient enough evidence to rule that beyond a reasonable doubt, glyphosate is definitely carcinogenic to humans.²⁹

Winneshiek County, a NE Iowa county bordering Minnesota, is an example of the F&WW study's "blue" counties. Winneshiek is in the top 20% nationally in terms of the amount of glyphosate sprayed per square mile of cropland, but is just below 18.5 cases per 100,000, the US incidence rate for non-Hodgkin lymphoma.³⁰ Winneshiek County's incidence rate for non-Hodgkin lymphoma is 17.9.³¹ In the diagonally opposite corner of the state on the Missouri border, Taylor County in SW Iowa doesn't even appear on the map due to the lack of county-level information about NHL, even though it's in the top 20% nationally for glyphosate application rates.³² A closer map view of the central and eastern states follows below:³³



Three counties in central Iowa – Dallas, Boone, & Story – form a clump representing the "gold" counties of the F&WW study's grouping. They are in the top 20% of US glyphosate application

28. C Koons (March 16, 2026), *op. cit.*

29. Food & Water Watch (March, 2026), *op. cit.*

30. A Starbuck, Food & Water Watch Research Director (March 24, 2026). Personal communication.

31. A Starbuck, F&WW Research Director (March 24, 2026). Spreadsheet of Glyphosate & non-Hodgkin lymphoma rates. Personal communication.

32. A Starbuck, F&WW Research Director (July 29, 2026). Personal communication.

33. C Koons (March 16, 2026), *op. cit.*

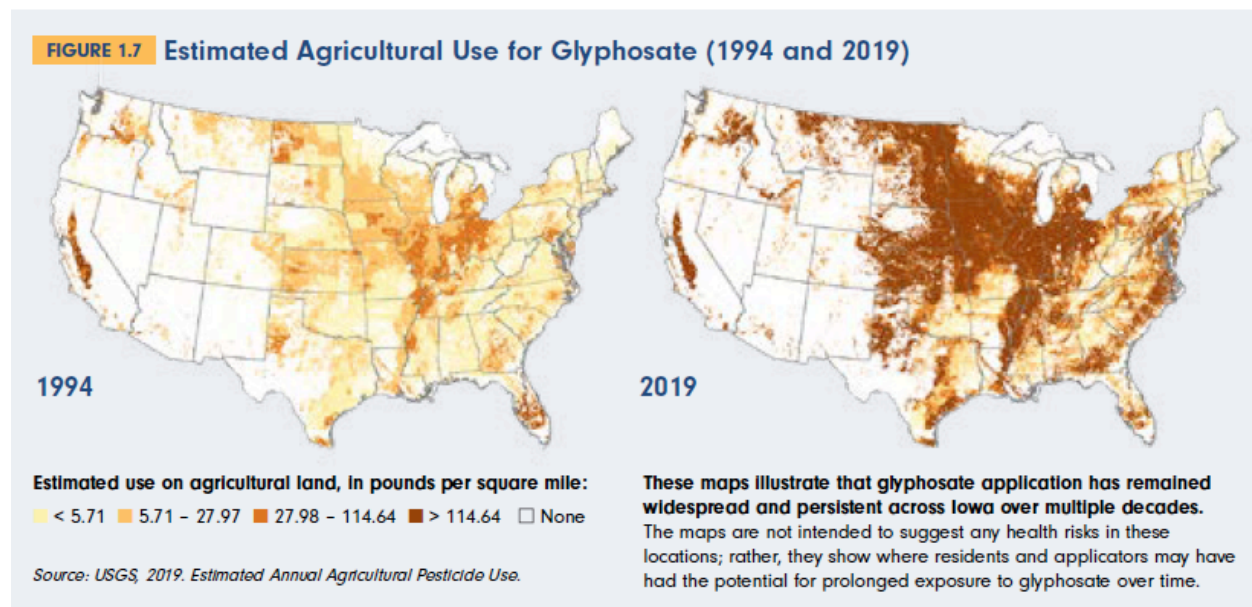
rates and above the US incidence rate for non-Hodgkin lymphoma (18.5), but below the "hot spot's" top 20% rate of NHL incidence.

As can also be seen, seven NW Iowa counties form a tight cluster of the F&WW study's "red" counties – Lyon, Sioux, Plymouth, Cherokee, O'Brien, Clay, & Osceola. They are examples of "hot spots" for both glyphosate applications and for non-Hodgkin lymphoma incidence rates. Of regional interest, this solid block of counties in NW Iowa links up with counties in southwestern Minnesota and counties in southeastern South Dakota to form an even greater regional block of "hot spot" counties.

THE DIFFERENCES IN RULINGS ON THE CARCINOGENICITY OF GLYPHOSATE BY THE INTERNATIONAL IARC AND THE NATIONAL REGULATORY AGENCIES IN THE US AND THE EU

The US Environmental Protection Agency (EPA) and the IARC

Glyphosate application rates relate directly to higher cancer rates according to the Food & Water Watch (2026) research report, the IEC-Harkin (2026) research report, and the Gerken *et al.* (2024) research study. Industrial agriculture's use of glyphosate on farm fields in the continental United States over a quarter-century time period increased drastically. The following graphic from the IEC-Harkin (2026) report that was obtained from the US Geological Survey (2019) report, "Estimated Annual Agricultural Pesticide Use," vividly illustrates those changes.³⁴



Both the Food & Water Watch (2026) report, the previously cited Gerken *et al.* (2024) study, and Section 1 of the IEC-Harkin (2026) report will lend research support for the IARC to use in revisiting its current "probably carcinogenic" ruling on glyphosate and issue a new ruling stating that glyphosate is a carcinogen. Under its current rules and procedures, it is doubtful that the US EPA will revise its current ruling that glyphosate is "'unlikely' to be carcinogenic to humans."³⁵

What explains the difference between the rulings by the US EPA and the IARC? An agricultural economics professor with extensive service in the field of agriculture seems able to do so. Charles M. Benbrook – who previously served as a research professor at Washington State University, as director of the National Academy of Sciences Board on Agriculture, as a member

34. Iowa Environmental Council & The Harkin Institute (2026), p. 26. *Environmental risk factors and Iowa's cancer crisis*. Des Moines, IA: Iowa Environmental Council. Accessed 3-30-2026 at: <https://www.iaenvironment.org/our-work/cancer-and-environmental-risk-factors-in-iowa/>

35. Iowa Environmental Council & The Harkin Institute (2026), p. 28, *op.cit.*

of USDA Secretary Vilsack's "Roundup Ready Alfalfa Task Force," and as an "expert witness in several lawsuits involving pesticides and agricultural biotechnology"³⁶ – wrote just such an article in a peer-reviewed scientific journal.³⁷

Dr. Benbrook breaks down the reasons for the different decisions between the EPA and the IARC as flowing from three primary differences. The first reason centers on the types of studies each agency favors.

In the core tables compiled by EPA and IARC, the EPA relied mostly on registrant-commissioned, unpublished regulatory studies, 99% of which were negative, while IARC relied mostly on peer-reviewed studies of which 70% were positive (83 of 118).³⁸

An article in the *University of Miami Law Review* stated it in simpler terms:

[O]ne distinct aspect between the two agencies' [US EPA & IARC] investigations into glyphosate might also explain the reason for this international disagreement: the source of the data.

The EPA conventionally relies on industry-funded studies that are unavailable in the public domain, whereas the IARC reviewed public studies by independent and uninterested scientists.³⁹

In other words, the IARC depends on peer-reviewed research methods are subject to public review by other scientists and are subject to criticism of their methods, procedures, and analysis. Not so with the majority of studies used by the EPA. The EPA favors "private" research that is closed to public scrutiny and analysis of their research methods, procedures, and conclusions by other scientists. Thus bias and other errors are "protected" from public scrutiny by other scientific experts in the particular research field.

Discussing the investigatory process used by the IARC in reviewing "glyphosate and GBH carcinogenicity," Dr. Benbrook reported:

As the case with all IARC reviews, the Working Group assessing glyphosate and GBH carcinogenicity relied predominantly on publicly available, **peer-reviewed studies**. [Emphasis added]⁴⁰

The second reason for the difference between the two agencies, according to Dr. Benbrook,

36. Benbrook's [aka Chuck Benbrook, aka Charles M. Benbrook] faculty page, Center for Sustaining Agriculture and Natural Resources, Washington State University. Accessed 8-01-2026 at:

<https://web.archive.org/web/20150220112830/http://csanr.wsu.edu/people/chuck-benbrook/>

37. CM Benbrook (2019). How did the US EPA and IARC reach diametrically opposed conclusions on the genotoxicity of glyphosate-based herbicides? *Environmental Sciences Europe*, 31: 2. doi: 10.1186/s12302-018-0184-7. Accessed 7-30-2026 from: <https://link.springer.com/article/10.1186/s12302-018-0184-7>

38. Benbrook (2019), p. 1, *op. cit.*

39. G Argimón-Cartaya (January 31, 2024). 'Rounding up' roundup: One last hope for glyphosate regulation, p. 620. *University of Miami Law Review*, 78 (2): 601-669. Accessed 8-01-2026 from: <https://repository.law.miami.edu/umlr/vol78/iss2/10>

40. Benbrook (2019), p. 2, *op. cit.*

resides in the substance to which animals were exposed in the case of animal studies. The "vast majority" of industry-funded studies examined by the US EPA dosed the animal subjects with technical glyphosate instead of the pesticide formulation actually being used on agricultural fields. Dr. Benbrook flatly stated this choice by the EPA was "inappropriate for three reasons":

- (1) formulated GBHs [Glyphosate-Based Herbicides] account for ALL commercial uses and human exposures (no herbicide products contain just glyphosate);
- (2) regulators are aware that the co-formulants in GBHs markedly alter the absorption, distribution, metabolism, excretion, and possibly the toxicity, of the glyphosate in formulated GBSs; and
- (3) multiple studies report that formulated GBHs are more toxic than glyphosate technical [pure glyphosate].⁴¹

The third reason articulated by Dr. Benbrook for the differing rulings on glyphosate by the IARC and the EPC provides one explanation for their differing rulings – different foci for their evaluations.

IARC's evaluation encompassed data from typical dietary, occupational, and elevated exposure scenarios.⁴²

The EPA, on the other hand, focused on "typical, general population dietary exposures" which assumed "legal, food-crop uses," and ignored real-life exposures resulting from residential, occupational, and "elevated exposure scenarios."⁴³ Citing the Benbrook (2019) study, the author(s) of Section 1 of the IEC-Harkin (2026) report summarized the third reason for the IARC & US EPA differences regarding glyphosate in plainer terms:

Finally, the EPA evaluation was focused on exposures to the general public through diet, rather than examining occupational exposures, which are often higher...⁴⁴

While discussing Benbrook's first reason for the differing rulings regarding glyphosate in general terms and not getting into the specifics of how the data sets differed (*i.e.*, EPA's preference for industry-funded, private studies and IARC's preference for public, peer-reviewed studies) the author(s) of the IEC-Harkin (2026) report's Section 1 did get into specifics regarding the differing types of chemicals to which study subjects were exposed.

[T]he EPA focus[ed] on glyphosate as a stand-alone chemical, while the IARC ... placed significant weight on analyses of glyphosate pesticides in their formulation and in the chemicals formed during its breakdown.⁴⁵

41. Benbrook (2019), p. 3, *op. cit.*

42. Benbrook (2019), p. 1, *op. cit.*

43. Benbrook (2019), p. 1, *op. cit.*

44. Iowa Environmental Council & The Harkin Institute (2026), p. 28, *op.cit.*

45. Iowa Environmental Council & The Harkin Institute (2026), p. 28, *op. cit.*

The IEC-Harkin (2026) report's Section 1 author(s) also provided readers with a discussion of scientific research-based, peer-reviewed studies illustrating the validity of the IARC's approach over the EPA's approach:

Ten human-cell-based studies associated glyphosate and glyphosate-based herbicides with changes induced in gene expression, DNA damage, and reduced cell viability. These studies found that glyphosate-based herbicides showed greater cytotoxicity than glyphosate alone. These findings raise concerns regarding potentially carcinogenic effects of the metabolites of glyphosate and glyphosate-based herbicides (Schluter *et al.*, 2024).⁴⁶

The previous discussion of the Schluter *et al.* (2024) study by the IEC-Harkin (2026) report lends weight to the IARC's classification of glyphosate as "probably carcinogenic to humans" as well as helping explain the ways that glyphosate operates in ways similar to two "known human carcinogens" as discussed by the IARC in its 2015 finding regarding glyphosate. Dr. Benbrook quoted the IARC's rationale:

In making this overall evaluation, the Working Group noted that the mechanistic and other relevant data support the classification of glyphosate in Group 2A ["probably carcinogenic to humans"]. In addition to limited evidence for the carcinogenicity of glyphosate in humans and sufficient evidence for the carcinogenicity of glyphosate in experimental animals, there is strong evidence that glyphosate can operate through two key characteristics of known human carcinogens, and that these can be operative in humans.⁴⁷

Dr. Benbrook summarized the results of 26 studies published after the IARC's 2015 ruling and prior to December 24, 2018, all of which focused on "possible mechanisms of genotoxic action for glyphosate and/or formulated GBHs [Glyphosate-Based Herbicides]":⁴⁸

- 18 studies identified DNA damage resulting from exposure.
- 6 studies dealt with oxidative stress arising from exposure.
- 2 studies dealing with "other genotoxicity mechanisms."

Benbrook continued:

These studies lend further support to the IARC Working Group's conclusion that there is "strong evidence" that formulated GBHs can trigger cell damage through at least two mechanisms of action (DNA damage and oxidative stress), thereby possibly triggering or accelerating the progression of cancerous cell growths.⁴⁹

The author(s) of Section 1 of the IEC-Harkin (2026) report continued their discussion of glyphosate by summarizing a study that indicated a need to revise current research methodologies into more specific examination of how glyphosate specifically works to disrupt

46. Iowa Environmental Council & The Harkin Institute (2026), p. 28, *op. cit.*

47. Benbrook (2019), p. 2, *op. cit.*

48. Benbrook (2019), p. 11, *op. cit.*

49. Benbrook (2019), p. 11, *op. cit.*

health:

Research by Davoren and Schiestl (2018) argues that glyphosate's prevalence and complex compound structure require updated research methodologies to consider the pesticide's effect on endocrine or microbiome disruption.⁵⁰

Instead of the reader having to search to discover the previous studies cited by the IEC-Harkin (2026) report, the citations for the Schluter *et al.* (2024) and the Davoren & Schiestl (2018) studies are provided below:

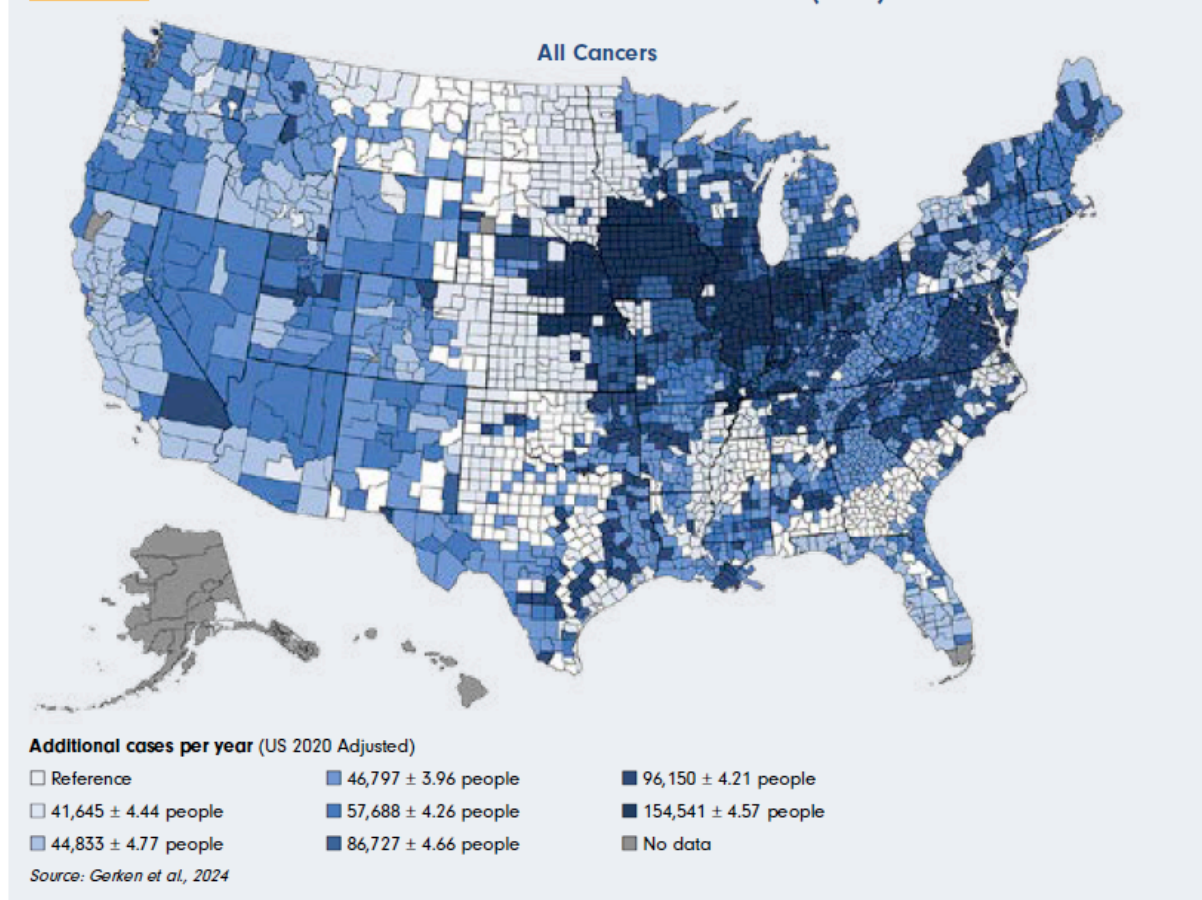
- MJ Davoren & RH Schiestl (July 28, 2018). Glyphosate-based herbicides and cancer risk: A post-IARC decision review of potential mechanisms, policy and avenues of research. *Carcinogenesis*, 39 (10): 1207-1215. doi: 10.1093/carcin/bgy105. Accessed 8-02-2026 at: <https://pmc.ncbi.nlm.nih.gov/articles/PMC7530464/-s8>.
- HM Schluter, H Bariami, & HL Park (2024). Potential role of glyphosate, glyphosate-based herbicides, and AMPA in breast cancer development: A review of human and human cell-based studies. *International Journal of Environmental Research and Public Health*, 21 (8): 1087. doi: 10.3390/ijerph21081087. Accessed 8-02-2026 at: <https://www.mdpi.com/1660-4601/21/8/1087>.

Currently it appears to be the case that the US EPA is playing by a set of rules that favors the pesticide industry at the expense of the nation's public health. The scenario playing out in the United States resembles previous scenarios involving the asbestos industry's battle against regulating their product, the chemical companies' campaign against regulating DDT, and the tobacco industry's campaign against tobacco regulation. Each of those regulatory actions pitted the public health of the nation against industry privilege and money. The result of the current battle being waged by the pesticide industry against government regulation acting on behalf of the people's health in America can be partially seen in the graphic on the following page:⁵¹

50. Iowa Environmental Council & The Harkin Institute (2026), p. 28, *op. cit.*

51. Iowa Environmental Council & The Harkin Institute (2026), p. 29. Graphic obtained from the Gerken *et al.* study (2024).

FIGURE 1.9 Additional Cancer Cases Attributed to Pesticide Use (2024)



The EU European Food Safety Authority (EFSA) and the IARC

The European Union's counterpart to the US's Environmental Protection Agency is the European Food Safety Authority (EFSA). Although the EU regulatory process contains other agencies, it is EFSA who has the major responsibilities for the whole process of assessment and approval for the European Union.⁵²

Unfortunately the US EPA's regulatory scheme is not unique. Dr. Eva Novotny, Cambridge University professor of science and Scientists for Global Responsibility coordinator for biotechnology issues, summarized the European Union's assessment process as documented by the Robinson *et al.* (2020) research team:⁵³

52. E Novotny (2022). Glyphosate, Roundup and the failures of regulatory assessment [in Europe], pp. 2-3, *Toxics*, 10 (6): 321. doi: 10.3390/toxics10060321.

53. C Robinson, CJ Portier, A Cavoski, R Mesnage, A Roger, P Clausen, P Whaley, H Muilerman, & A Lyssimachou (2020). Achieving a high level of protection from pesticides in Europe: Problems with the current risk assessment procedure and solutions. *European Journal of Risk Regulation*, 11 (3): 450-480. doi: 10.1017/err.2020.18.

Robinson *et al.* described how the assessment process in the EU is governed by 'hard' and 'soft' laws, which are not fully implemented and that may not even suit the purpose; how scientific misconduct plays an important role in assessments; how regulators dismiss most peer-reviewed studies in favour of industry-sponsored studies; how scientific methods may be used in a flawed way; how regulation suffers from a lack of independence of the regulatory agencies; and what improvements should be made to ensure the safety of the approved products.⁵⁴

Professor Novotny further described the EU regulatory system in the abstract of her peer-reviewed assessment and drew a comparison with the regulatory system in the United States:

There are close ties between the regulators and the industry they are supposed to regulate. Objectionable practices include 'revolving doors' between the regulators and the industry, heavy reliance on unpublished papers produced by the industry while dismissing papers published by independent scientists, and strong covert influence on the regulatory process by industry. Although this paper focuses on the European Union (EU), the situation is much the same in the United States.⁵⁵

In much the same fashion as Dr. Benbrook's analysis of the failures of the US regulatory system, so Dr. Novotny's analysis identified four key failures of the EU regulatory system.

Four major issues corrupt the regulatory process:

- (1) failure to distinguish between glyphosate and Roundup;
- (2) 'revolving doors' between a regulatory authority and the industry it is meant to regulate;
- (3) reliance for safety data on unpublished industry documents while largely ignoring publications by independent scientists; and
- (4) covert influence by the industry.⁵⁶

Professor Novotny identified a shared weakness by the EU and US regulatory systems:

In both the European Union (EU) and the United States, regulatory agencies have been infiltrated by the pesticide and GM industries and therefore continue to maintain that glyphosate, and therefore Roundup, is a safe herbicide.⁵⁷

Dr. Novotny highlighted further problems with the US regulatory system by quoting from a published book by science reporter Carey Gillam centered on glyphosate, the Monsanto

54. Novotny (2022), p. 2, *op. cit.*

55. Novotny (2022), p. 1, *op. cit.*

56. Novotny (2022), p. 3, *op. cit.*

57. Novotny (2022), p. 2, *op. cit.*

Corporation [prior to its purchase by Bayer], and cancer.⁵⁸

Many of the same failures of regulation occur in the United States as in the European Union. In her book *Whitewash: The Story of a Weed Killer, Cancer, and the Corruption of Science*, Gillam (p. 114) wrote about the corrupt influence of Monsanto Company and others in the United States:

What the records clearly show is a roster of U.S. academics – people employed by tax-payer institutions – quietly working with Monsanto, other agrochemical companies, and public relations experts to tout the benefits of company products, to counter anything that points to problems with glyphosate or glyphosate-tolerant crops, and to cripple unfavourable legislation or regulation.⁵⁹

While the IARC occupies a position of independence from politics and industry and can remain focused on a body of independent scientific research published in peer-reviewed journals, neither the European Union EFSA nor the United States EPA have that degree of independence under the current governmental set-up. While industrial corporations are quite content with the current setup, the public health needs of the US and the EU nations continue to take a back seat to the needs and profits of the chemical industry and its partners in the Agro-Business Coalition.

58. C Gillam (2017). *Whitewash: The story of a weed killer, cancer, and the corruption of science*. Washington, DC: Island Press; subsequently published in 2019 by Princeton University Press following the book's being awarded the Rachel Carson Environment Book Award in 2018.

59. Novotny (2022), p. 6, *op. cit.*

THE 2026 IOWA ENVIRONMENTAL COUNCIL -HARKIN INSTITUTE REPORT: Part I

An Initial Examination

So far this paper has presented the reports on cancer by the Iowa Cancer Registry from 2023-2026 informing Iowans that they're the only state in the nation with increasing rates of cancer. The reader has also been informed about the Yale study by the Son *et al.* (2026) research team finding links between cancer and residency in CAFO-dense counties in three agricultural regions (Iowa, Texas, and California) and the research base on which the study was built, the mistakes made by the Iowa Cancer Registry in its 2026 *Cancer in Iowa* report, the attempts by both the National Pork Producers Council and Iowa governor Kim Reynolds to use those mistakes to craft error-laden narratives based on falsehood to promote their own non-public agendas, and about the results of the 2026 Food & Water Watch research report finding links between exposure to glyphosate applications and subsequent diagnoses of non-Hodgkin lymphoma (particularly in "high-spray counties") across the nation. Finally, this paper discussed the differences between the rulings on glyphosate's carcinogenicity by the International Agency for Research on Cancer and the rulings by both regulatory agencies for the United States and the European Union.

By now we're in late March of 2026 when we learned that the Iowa Environmental Council teamed with the Harkin Institute for Public Policy & Citizen Engagement to author a report examining various environmental factors that could contribute to the "Cancer Crisis" in Iowa. *Environmental Risk Factors and Iowa's Cancer Crisis* devoted an entire chapter to each of what they considered to be the leading contenders for environmental risks that exposed Iowans to the risk of cancer – pesticides, PFAS, nitrate, and radon. And then they used the fifth chapter to briefly discuss other possible environmental risk factors. The first four chapters looked quite impressive. And a brief analysis of the number and type of citations for each of the first four chapters seemed to validate the early impression.

<u>TOPIC</u>	<u>PEER-REVIEWED</u>	<u>REPORTS</u>	<u>TOTAL</u>
Pesticides	53	32	85
PFAS	58	5	63
Nitrates	44	25	69
Radon	21	21	42

And media coverage also validated the early impression as they reported that the IEC-Harkin report linked each of the four top environmental risk factors to higher incidences of cancer, as can be seen from the table of newspaper headlines on the following page:

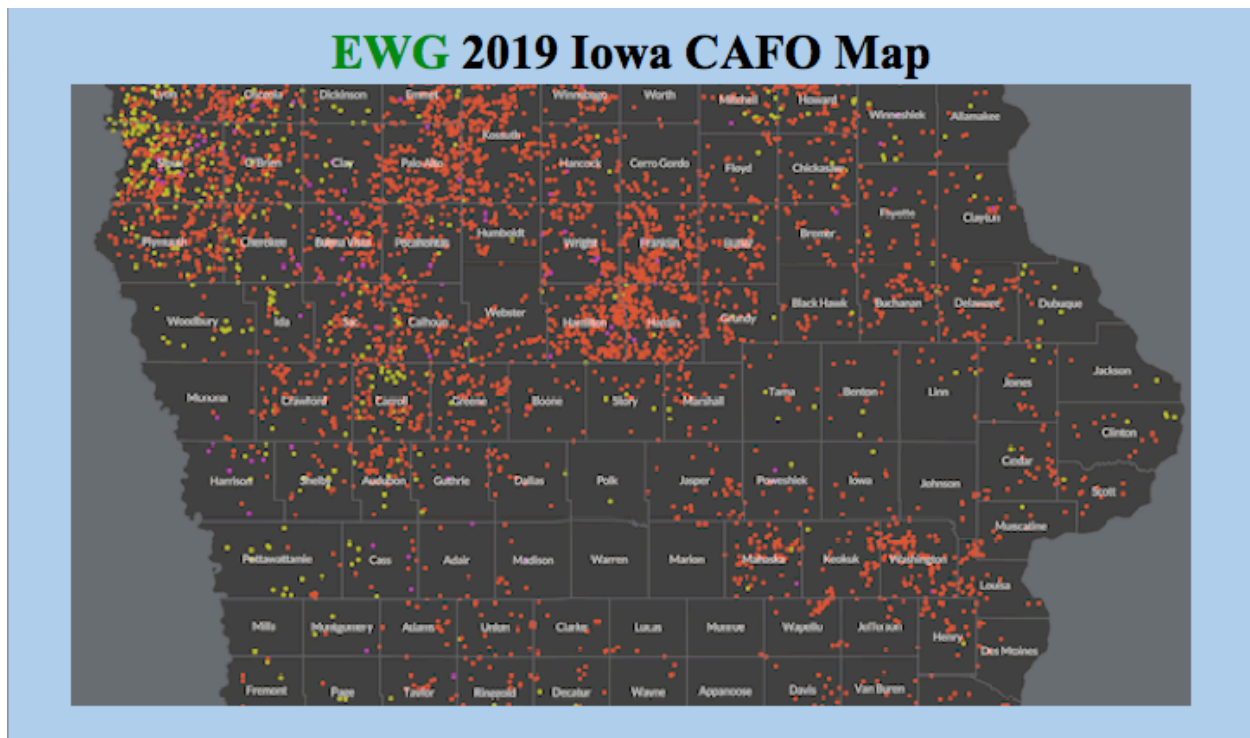
<i>Cedar Rapids Gazette</i>	New report links environmental risk factors, Iowa cancer risk.
<i>Investigate Midwest</i>	Iowa's high cancer rate linked to nitrate, pesticides, PFAS, and radon, new report finds.
<i>KWWL News</i>	Iowa's cancer crisis tied to environmental factors, new study finds.
<i>Iowa Capital Dispatch</i>	Researchers connect environmental issues with cancer rates in new report.
<i>Little Village (Iowa)</i>	Report identifies four environmental factors raising cancer risk in Iowa.

However, a brief analysis of the number and type of citations for the fifth chapter, however, presents a different scenario for the items discussed in the fifth chapter, or Section Five according to the IEC-Harkin (2026) report's terminology.

<u>TOPIC</u>	<u>PEER-REVIEWED</u>	<u>REPORTS</u>	<u>TOTAL</u>
Metals	5	3	8
Particulate Matter	5	2	7
Industrial Air Toxins	2	4	6
Chemical Contamination	1	3	4

At first glance, there appears to be a lack of sufficient research on each topic that would require a full chapter. Is that decision warranted, or is it purposeful on the part of the author(s) of Section Five to justify a prior decision that was made? Being a native Iowan, I can think of one major subject not covered by the IEC-Harkin (2026) report – air emissions from CAFOs. The map from the Environmental Working Group (EWG) on the following page illustrates the current situation in Iowa.⁶⁰

60. Environmental Working Group (2020). *Big CAFOs in Iowa up fivefold since 1990*. Web Page. Washington, DC: Environmental Working Group. Accessed at: <https://www.ewg.org/interactive-maps/2020-iowa-cafos/map/>



According to the EWG news release:

The number of large concentrated animal feeding operations, or large CAFOs, in Iowa increased nearly fivefold in the past two decades a new study from Environmental Working Group reveals, with almost all of the growth from big hog-feeding operations.⁶¹

Conducting a word search in the IEC-Harkin (2026) report for the term "CAFO" yields several hits in the chapter on nitrates & water quality. The search yields a single reference to "CAFO" in Section Five's two-paragraph discussion of particulate matter. It occurs in the second paragraph:

CAFOs release ammonia in large quantities during the manure management process, including through the volatilization of nitrogen in animal manure stored in lagoons, airborne dust, and other pollutants that impact air quality (Burkholder *et al.*, 2006).

The author(s) of Section 5 used the Burkholder *et al.* (2006) research study to reference the release of ammonia into the air during the "manure management process." Before we examine the research study, the confusion over that statement's inaccuracy regarding CAFO agriculture in Iowa needs to be addressed.

First of all, the type of CAFO isn't identified. CAFO operations vary according to the type of animal husbandry involved – cattle (dairy & beef), poultry (chicken & turkey), or swine. Since

61. J Konopacky & S Rundquist (January 21, 2020). *EWG study and mapping show large CAFOs in Iowa up fivefold since 1990*. Website news release. Accessed at: <https://www.ewg.org/interactive-maps/2020-iowa-cafos/-methodology>

Iowa is the leading pork producer in the United States, producing "a third of all pork raised in the US," swine CAFOs might be in line for consideration.⁶² This seems reasonable, particularly since the second leading state for pork production, Minnesota, is a far-distant second with it's much lower market share at 12% of US pork production. But perhaps swine CAFOs don't form a firm majority of the various types of CAFOs in Iowa. Let's take a look at the comparative numbers.⁶³

Swine CAFOs	10,172 facilities
Cattle CAFOs	4,801 facilities
Poultry CAFOs	336 facilities

Since two-thirds of all CAFOs in Iowa produced swine, it seems reasonable to be talking about the operation of swine CAFOs, especially considering the higher polluting values (CBOD & TSS) associated with swine waste.

Second, if one wished to focus on CAFO air emissions and their impact on air quality, one would certainly focus on those emissions that occur constantly for 24 hours-per-day, 7 days-per-week during the actual day-to-day operation of the CAFO. But that isn't what was referenced. It looks as if the author(s) of Section 5 don't know the basic cycles of swine CAFO operations – the cycle of actual operations for approximately six months and the cycle of slurry removal & application to a farm field – or the difference between air emissions from 24/7 CAFO operations and those from the removal/application of CAFO slurry according to the Manure Management Plan. Two different operations, two vastly different time periods and emissions totals, but both involving CAFOs.

Also, the type of storage facility for the animal waste isn't specified – concrete deep pit under the CAFO structure, anaerobic lagoon, or earthen pit. Most swine waste storage structures in Iowa are deep concrete pits under the CAFO barn. Some anaerobic lagoons are used as well. Probably the reason that deep concrete pits under the CAFO structure are more widely used in Iowa is that the nitrogen content of waste from a deep pit is better than the nitrogen content of swine waste stored in an anaerobic lagoon or other outside structure.^{64, 65}

62. E Bahe & A Schechinger (July 14, 2026). *Drowning in manure: How livestock farms threaten Iowa's drinking water and public health*. Washington, DC: Environmental Working Group. Accessed 8-08-2026 from: <https://www.ewg.org/research/drowning-manure-how-livestock-farms-threaten-iowas-drinking-water-and-public-health>

63. C Koons (July 15, 2026). Imagery mapping finds Iowa has 15,309 animal feeding operations in Iowa. Environmental Working Group report notes increase in large animal farming operations in Iowa. *Iowa Capital Dispatch*. Retrieved 8-08-2026 from: <https://iowacapitaldispatch.com/2026/07/15/imagery-mapping-finds-iowa-has-15000-plus-animal-feeding-operations/>

64. JP Chastain, Clemson University Extension (2015). *Fertilizer value of swine manure: A comparison of lagoons and deep pit slurry systems*. Slide presentation presented at the Waste to Worth: Spreading Science and Solutions Conference (March 30-April 3, 2015), The Westin Seattle Hotel, Seattle, WA. Accessed 8-12-2026 at: <https://lpeic.org/fertilizer-value-of-swine-manure-a-comparison-of-a-lagoon-and-a-deep-pit-slurry-system/>

65. JC Lorimer & K Kohl, ISU Extension Agricultural Engineers (1999). Liquid swine manure nutrients," *Iowa State University Animal Industry Report*, 1 (1). Accessed 8-12-2026 at: <https://iastatedigitalpress.com/air/article/id/7633/print/>

It appears that the author(s) of Section 5 don't know much about how swine CAFOs in Iowa actually work since they mistook the operations of a manure management plan for the actual CAFO operations. We'll have to come back to the preceding statement in Section 5's discussion of particulate matter that cites a study by the Burkholder *et al.* (2006) research team following a short review of how swine CAFO operations in Iowa operate in real life.

The Need for a Review of Animal Husbandry Operations in Industrial Agriculture

The Operational Cycle of Swine CAFOs in Iowa



First of all, what is a CAFO? According to the United States Environmental Protection Agency, an animal feeding operation (AFO) is an operation that confines animals in a small area for at least 45 days in a 12-month period without any sustaining vegetation and that houses more than 1,000 animal units.⁶⁶ The US EPA likes to play mind games because instead of using that definition for CAFO, they prefer to define CAFO's according to the size of the AFO (small, medium & large) instead of what the operation actually looks like and does. According to the US EPA, AFOs that look and act like CAFOs, but are smaller than the regulatory size are not CAFOs, but are AFOs instead. This, of course, violates the old adage:

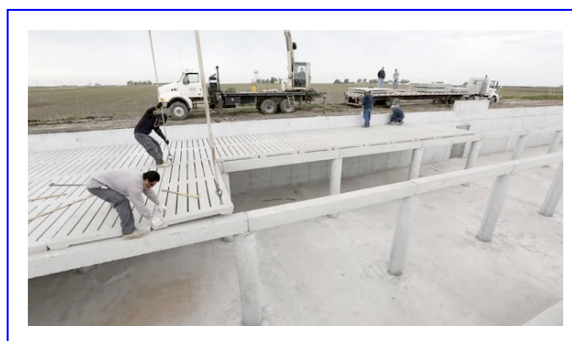
If it looks like a duck and walks like a duck and quacks like a duck, then it's a duck.

66. United States Environmental Protection Agency (n.d.). *Animal feeding operations* (AFOs). Website. Washington, DC: United States Environmental Protection Agency. Accessed at: <https://www.epa.gov/npdes/animal-feeding-operations-afos>

For our purposes, all operations that look, act, and operate like a concentrated animal feeding operation are CAFOs, regardless of their size.

Pictured on the preceding page are swine CAFOs in full operation. What can not be seen are the manure pits on which each of the CAFO structures sits and the large ventilator fans.

Most Iowa swine CAFOs generally have a huge pit lying below a slatted floor on which the pigs will live for the next six months (see right-side photo on the following page).⁶⁷ The pigs will defecate and urinate through the floor openings into the pit on which the CAFO sits. Since the mixture of feces and urine will be sitting in an anaerobic environment (*i.e.*, the mixture will not be stirred in order to incorporate oxygen into the waste), it will not break down into its constituent parts by exposure to sunlight and air as it did in pre-industrial agriculture. Instead, what began as simple animal waste will sit and accumulate volume while being transformed into a toxic chemical stew that emits a variety of chemical toxins and carcinogenic substances.



These toxic substances must be removed from the CAFOs interior. Otherwise the pigs will die. That is the function of the fans that one will see in virtually all swine CAFOs in Iowa, as can be seen in the photo above.⁶⁸ Part of the fans expel the toxins emitted by the slurry mix into the environment outside of the CAFO. Part of the fans bring in fresh air to replace the toxic air being expelled to the outside environment. All such CAFOs are equipped with a generator in order to keep the fans running should a power outage occur. If the fans stop operating, the pigs will be poisoned and die.

What are the toxins and harmful substances being expelled into the outside air? Below is a partial list:

- Hydrogen Sulfide (H₂S), a toxic gas.
- Particulate Matter (PM_{2.5} & PM₁₀), a carcinogen.
- Methane (CH₄), an explosive substance and a greenhouse gas.

67. Photo taken by Christopher Gannon for an article in the January 24, 2018 edition of the *Des Moines Register*.

68. Photo taken by Larry Stone, Elkader, Iowa. Larry served as a nature writer and photographer for the *Des Moines Register* prior to his retirement.

- Ammonia (NH₃); both a toxic gas and a secondary precursor to PM_{2.5}.
- 100+ VOCs (Volatile Organic Compounds); a secondary precursor to PM_{2.5}.
- Antibiotic-resistant Organisms.
- Endotoxins.

These CAFO air emissions of toxic substances (one of which is a greenhouse gas), carcinogenic particulate matter, antibiotic-resistant organisms, VOCs, and endotoxins occur without interruption twenty-four hours per day, seven days per week of CAFO operations.

According to the State Code of Iowa, CAFO slurry may only be removed from the CAFO two times each year, which means two six-month cycles of pigs to be fattened and sent to market per each CAFO structure. These removals are governed in Iowa by a "Manure Management Plan" or MMP in the parlance of the trade. Many CAFO owners and operators rely on initial guidance from the Iowa Pork Producers Association for developing such a plan that accords with the requirements outlined in the Code of Iowa and the administrative rules of the Iowa Department of Natural Resources. According to the guidance offered by the Iowa Pork Producers:

A manure management plan (MMP) defines how you will apply the manure generated on the farm... You will list the fields you plan to use, the application rates and methods. The MMP is submitted to the Iowa Department of Natural Resources.⁶⁹



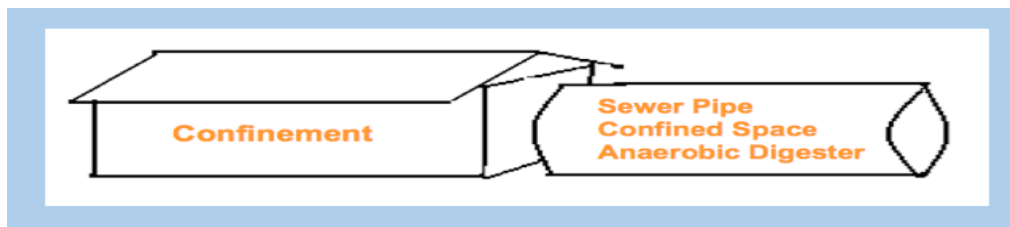
Larry Stone

One of the weaknesses in this scheme is that no state officials monitor the amounts of CAFO slurry actually put on the fields. In fact, one study to be discussed later [see discussion of the Jackson *et al.* (2000) research located in the "Treatment of the Burkholder *et al.* (2006) study"] actually found that Iowa law doesn't require CAFO owners/operators to actually implement the

69. Iowa Pork Producers Association (n.d.). *Manure management plans*. Website. Accessed 3-31-2026 at: <https://www.iowapork.org/producers/rules-and-regulations/manure-management-plans>

details of the official Manure Management Plan that they submitted to the state. This and additional flaws will be presented in the following sections that center on Section 5's discussion of particulate matter in the IEC-Harkin (2026) report, *Environmental Risk Factors and Iowa's Cancer Crisis*.

Similarities and Differences Between Treatment of Human and CAFO Waste⁷⁰



Both municipal waste water treatment systems and CAFOs have untreated fecal waste in them. The waste in both constantly generates toxic sewer gases, particulate matter, and other unhealthy substances. The causes of disease and death from the toxic sewer gases are the same in both.

The differences, however, are severe.

- Sewers are designed to **contain poisonous gases**, while CAFOs are designed to **blow poisonous gases** from the CAFOs interior into the surrounding atmosphere outside of the CAFO.
- The waste in sewers is **treated** while CAFO waste is **not treated**.
- **Waste Water plants** are heavily regulated to protect the public from harmful sewer gases and require licensed personnel to operate the treatment of human waste.
- **CAFOs** have no regulations to protect the public from harmful sewer gases as do waste water treatment plants.⁷¹ CAFO personnel are not required to be licensed to operate the CAFO and its constant emission of poisonous sewer gases. Iowa law requires that waste water treatment personnel be licensed.

There also exist extreme differences in the bio-chemical composition of the two types of waste in the respective systems:⁷²

70. Bob Watson, a waste water specialist, developed the material in this section. The author of the original waste water curriculum for the program at Des Moines Area Community College, Bob was one of the first people to recognize that CAFOs were a poor and inadequate application of waste water technology. See: B Watson & L Stone (2015). *Unintended health and environmental consequences of CAFO agriculture*. Powerpoint. In B Watson, L Stone, & R Janson (2022), Chapter 1, *Hog confinements and human health: The intersection of science, morals, and law. A handbook for regulating hog confinements*. Available at: <https://civandinc.com/ebook-hog-confinements-and-human-health-the-intersection-of-science-morals-and-law-2/>

71. B Watson, Guest Editorial (June 19, 2011). No exemption for poisons. *Cedar Rapids Gazette*. Accessed at: https://www.thegazette.com/opinion/guest-columnists/no-exemption-for-poisons/article_d1f6e164-3812-51df-8fff-b14de4a93a22.html

72. Data was obtained from the Iowa Department of Natural Resources by Bob Watson.

	<u>Raw Human Waste</u>	<u>Raw CAFO Waste</u>
CBOD (Carbonaceous Biochemical Oxygen Demand)	200	1,000
TSS (Total Suspended Solids)	200	1,000
Ammonia/Nitrogen	15-20	300-400

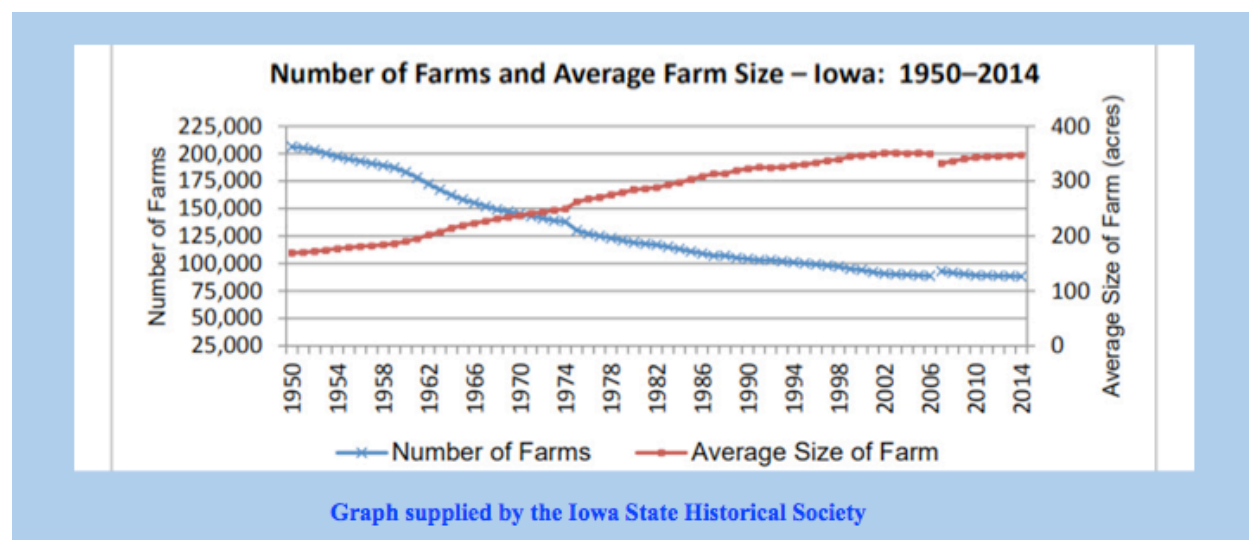
As can be seen from figures supplied by the Iowa DNR, hog waste is five times (5X) more polluting than human waste. The last USDA Farm Census indicated that Iowa had approximately 24 million hogs in Iowa. In terms of the comparative toxicities of human and hog waste, CAFO operations are similar to having 120 million people having their waste collected and spread untreated on the land within Iowa's borders.

To sum up, readers have learned that CAFOs are an inappropriate and incomplete replication of waste water technology.⁷³

Instead of containing toxic sewer gases as in municipal and rural waster systems, CAFOs expel those toxic sewer gases and carcinogenic particulate matter into the public atmosphere. Instead of treating waste to remove polluting components, *e.g.*, CBODs, TSS, *etc.*, animal waste is not treated. Iowa has the most untreated animal waste of any state, the most CAFOs of any state, and has no regulation of the toxic sewer gases or of the carcinogenic particulate matter (PM_{2.5}) contained in the CAFO air emissions across the state.

Demographic Changes in Iowa's Agriculture

Agriculture in Iowa has undergone a huge transformation during the second half of the 20th and the first portion of the 21st century. First, the following graph illustrates the decreasing number of farms with the increasing size of farms in Iowa.

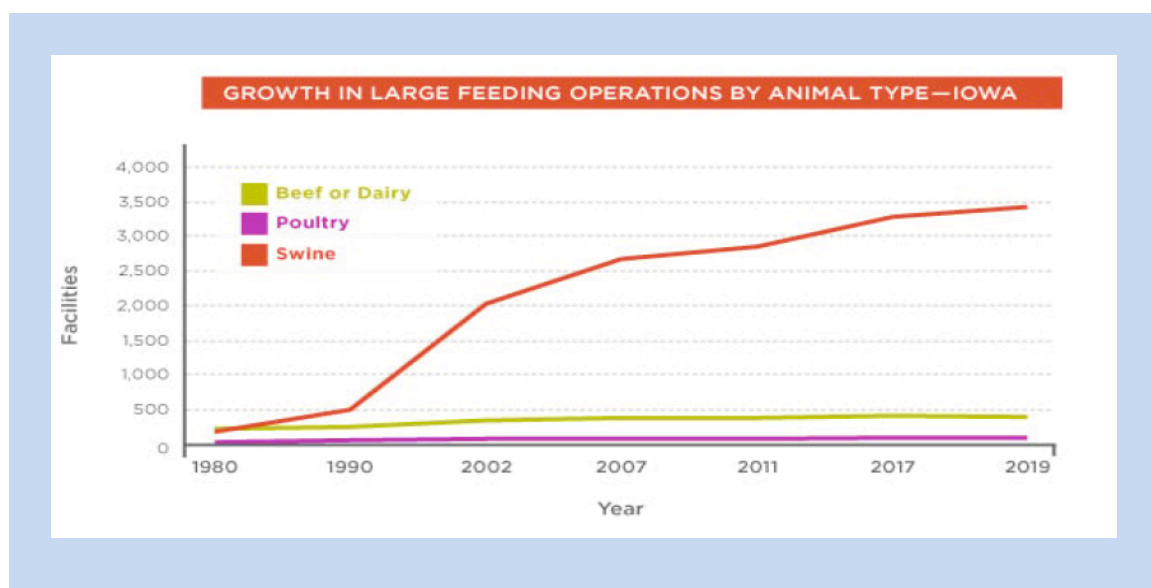


73. B Watson (January 1, 2000). Is the pork you eat raised in a sewer? *Countryside & Small Stock Journal*. Accessed 8-07-2026 from: <https://www.thefreelibrary.com/Is+the+pork+you+eat+raised+in+a+sewer%3F-a058617267>

The contrasting increase – decrease scenario that played out with the number and size of farms also played out with totals for the number of pigs being raised and the number of farms raising pigs as can be seen from the figures listed below. Data were obtained from the USDA Agricultural Census for each of the years reported in the table on the following page that portray the decreasing number of farms and the increasing number of pigs AKA the industrialization of animal agriculture.⁷⁴

YEAR	TOTAL Number of Pigs	TOTAL Number of Reporting Farms
1954	13,283,683	151,508
1964	13,674,088	106,184
1978	14,784,098	59,134
1987	12,983,074	36,670
1997	14,651,919	17,585
2007	19,295,092	8,330
2017	22,730,540	5,660
2024	24,600,000	????

And between 1990 and 2019 the number of swine CAFOs in Iowa exploded as can be seen by the graph developed by the Environmental Working Group in their 2020 report on CAFO density in Iowa.⁷⁵



74. National Agricultural Statistics Service, US Department of Agriculture (1954-2017). *Census of Agriculture*. Washington, DC: US Department of Agriculture. Available at: <https://www.nass.usda.gov/AgCensus/index.php>

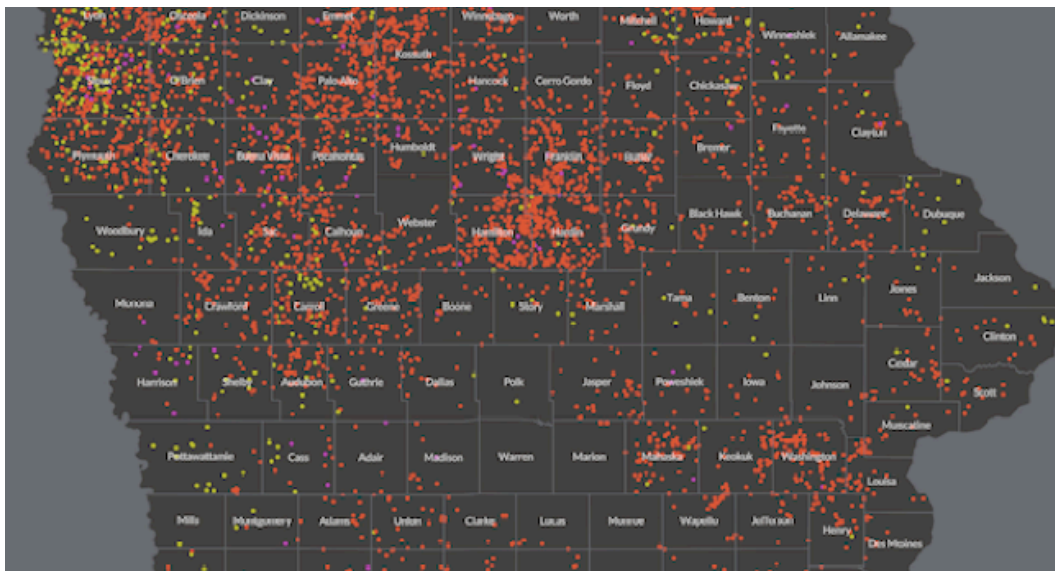
75. J Konopacky & S Rundquist (January 21, 2020). *EWG study and mapping show large CAFOs in Iowa up fivefold since 1990*. Website news release. Accessed at: <https://www.ewg.org/interactive-maps/2020-iowa-cafos/-methodology>

As can be seen, swine CAFOs vastly outnumber CAFOs for cattle and poultry in Iowa. Two maps shown below provide a comparative view illustrating increasing CAFO density from 1990 to 2019.⁷⁶

1990 Iowa CAFO Map



2019 Iowa CAFO Map



Each dot on the preceding maps represents CAFOs which are emitting multiple toxic poisons and carcinogenic particulate matter into the public atmosphere,

76. Konopacky & Rundquist (January 21, 2020), *op. cit.*

- their carcinogenic and toxic air emissions unregulated by any state or federal regulations,
- their operators not required to possess any professional licensure, and
- their waste not required to undergo any treatment in a closed environment to prevent the release of toxins and carcinogenic particulate matter into public air space.

Such is the predominant state of current animal agriculture in Iowa.

The 2026 Iowa Environmental Council-Harkin Institute Report – Part II
Section 5 of the IEC-Harkin (2026) Report – Discussion of Particulate Matter
Section 5's Treatment of the Burkholder *et al.* (2006) Study

Research | Mini-Monograph

Impacts of Waste from Concentrated Animal Feeding Operations on Water Quality

JoAnn Burkholder,¹ Bob Libra,² Peter Weyer,³ Susan Heathcote,⁴ Dana Kolpin,⁵ Peter S. Thorne,³ and Michael Wichman⁶

¹North Carolina State University, Raleigh, North Carolina, USA; ²Iowa Geological Survey, Iowa City, Iowa, USA; ³The University of Iowa, Iowa City, Iowa, USA; ⁴Iowa Environmental Council, Des Moines, Iowa, USA; ⁵Toxic Substances Hydrology Program, U.S. Geological Survey, Iowa City, Iowa, USA; ⁶University Hygienic Laboratory, Iowa City, Iowa, USA

Section 5's use of the Burkholder *et al.* (2006) waved the first red flag about: (1) their use of research; (2) their knowledge of current Iowa agriculture. Section 5 cited the Burkholder *et al.* (2006) study as justification for the following statement:

Excerpt From p. 58, the IEC-Harkin Institute Report
CAFOs release ammonia in large quantities during the manure management process, including through the volatilization of nitrogen in animal manure stored in lagoons, airborne dust, and other pollutants that impact air quality (Burkholder *et al.*, 2006).

Ignorance of the actual operation of swine CAFOs in expelling toxic substances every hour of every day's operation via air emissions could explain why the author(s) of the Section 5 component focused on particulate matter misinterpreted a simple assertion in the Burkholder *et al.* study that actually focuses on CAFO air emissions for their mistaken reference to "managing manure." The Burkholder *et al.* (2006) research team described air emissions from CAFO operations moving "off-site" from the CAFOs physical location to nearby public air spaces and waters, NOT emissions from the application of CAFO slurry to farm fields as per the manure management plan.

Many studies have shown, for example, that high nutrient concentrations (e.g., ammonia from swine CAFOs, or ammonia oxidized to NO₃, or phosphorous from poultry CAFOs) commonly move off-site to contaminate the overlying air and/or adjacent surface and sub-surface waters.⁷⁷

77. JA Burkholder, B Libra, P Weyer, S Heathcote, D Kolpin, PS Thorne, & M Wichman (2006). Impacts of waste from concentrated animal feeding operations on water quality. *Environmental Health Perspectives*, 115 (2): 308-312. doi: 10.289/ehp.8839.

Notwithstanding the single reference to air quality, the major focus of the Burkholder *et al.* (2006) study was on water quality. This can be seen by referencing the title of the study as it appeared in the peer-reviewed scientific journal in which it was published – ["Impacts of Waste from Concentrated Animal Feeding Operations on Water Quality."](#)

If that provides insufficient evidence for the assertion that the major focus of the Burkholder *et al.* (2006) study was water quality and not air quality, consider the language used in the abstract of the Burkholder. The following words emerge in the order of their occurrence:

- water resources;
- water quality;
- water resources;
- surface water sources;
- water; and
- freshwater and marine ecosystems.

The term "air quality" did not receive even a single mention in the Burkholder study's abstract. It is most difficult to see how a study focused on water quality was used to cite a discussion on air quality, especially when the single sentence in the Burkholder *et al.* (2006) study referencing air quality was misinterpreted and misused.

Finally we come to the context of the Burkholder study, of which the author(s) of Section 5's discussion on particulate matter appeared to be ignorant, especially since the context of the Burkholder *et al.* (2006) study was firmly grounded in water quality. The Burkholder *et al.* (2006) research study came about as the result of a 2004 international conference hosted by The University of Iowa entitled "Environmental Health Impacts of Concentrated Animal Feeding Operations: Anticipating Hazards – Searching for Solutions." Five workgroups were formed at the conference and given the task of authoring a research review centered on their subgroup's topic. The study was to be started following the end of the conference. The authors of the Burkholder *et al.* (2006) study were all members of:

[The Workgroup on Impacts of CAFOs on Water Quality](#).⁷⁸

So the use of the Burkholder *et al.* (2006) study focused on water quality in order to justify a confused statement regarding air quality and manure management is perplexing at best.

Another puzzling aspect of the Section 5 writers' decision to use the Burkholder *et al.* (2006) study centers on "volatilization" of the CAFO slurry. If one wished to cite a study centered on "volatilization," they would need to distinguish between the "volatilization" that occurs in the storage pit as the animal waste cooks into a liquid toxic stew 24 hours per day, seven days a week, for a period of several months and the "volatilization" that occurs once the CAFO slurry is

78. PS Thorne (November 14, 2006). Environmental health impacts of concentrated animal feeding operations: Anticipating hazards – searching for solutions. *Environmental Health Perspectives*, 115 (2): 296-297. doi: 10.1289/ehp.8831.

spread on an agricultural field in according with the manure management plan drawn up by the owner/operator of the CAFO. A knowledgeable researcher would have selected the Jackson *et al.* (2000) study as it was either the earliest, or one of the earliest, studies to examine manure management plans and to study the "volatilization" that occurs with CAFO slurry.⁷⁹ The fact that the Jackson *et al.* (2000) study has been cited at least 20 times by subsequent research illustrates its seminal status.

Manure Management Plans (MMP) for CAFOs were a matter of public record when the Jackson study was done. The Jackson *et al.* (2000) study accessed the manure management plans of 10 CAFOs in Hamilton County, Iowa, that housed "59,700 finishing hogs" producing "an estimated 811,500 kg of nitrogen (N) each year." The Jackson *et al.* (2000) research team's observations about the difference between the legal status of the MMP's statements and actual actions is instructive:

Iowa law does not require CAFOs to follow their MMPs. Actual manure management practices must be documented and kept available for inspection by the IDNR [Iowa Department of Natural Resources], but they are not available to the public. [Emphasis added]

Thus, our study reports what each CAFO has said it would do to comply with state law and assumes that each CAFO operates within the law. Because there is a strong economic incentive to dispose of manure inexpensively and because monitoring of CAFO practices is limited, our study probably offers conservative estimates of livestock concentration, ammonia volatilization, and nutrient application rates.⁸⁰

The Jackson *et al.* (2000) study focused on TOTAL amounts of "volatilization" of nitrogen from CAFO waste, thus focusing on the volatilization arising from the continuing CAFO operation as well as the volatilization arising from the field application of CAFO slurry according to the MMP. The Jackson *et al.* (2000) study's abstract summarized the research team's findings:

[M]ore than 70% of which [the nitrogen in the CAFO waste] volatilized into the atmosphere. CAFOs [the manure management plans] minimized the area required for applying manure by underestimating manure N content, projecting above average crop yields, and applying manure to soybeans.

Some fields were claimed by more than one CAFO, and some field sizes were overestimated. Manure application based on crop demand for phosphorous would require 9,350 ha of cropland, compared to the 990 ha used by CAFOs. [Emphasis added]⁸¹

The Jackson *et al.* (2000) study concluded by offering multiple recommendations designed to

79. LL Jackson, DR Keeney, & EM Gilbert (2000). Swine manure management plans in North-Central Iowa: Nutrient loading and policy implications. *Journal of Soil and Water Conservation*, 55 (2): 205-212. doi: 10.1080/00224561.2000.12436395.

80. Jackson *et al.* (2000), *op. cit.*

81. Jackson *et al.* (2000), *op. cit.*

better protect "Iowa's waters from nonpoint source pollution."⁸² Twenty-six years later, none have been implemented by either state or federal agencies & legislatures. The author(s) of Section 5's discussion of particulate matter also ignored the Jackson *et al.* (2000) study, which appears to be shameful as "volatilization" of nitrogen creates ammonia (NH₃), which is both a toxic gas and a precursor to PM_{2.5} [See section featuring discussion of the Bekbulat *et al.* (2025) study]. If one is discussing particulate matter, why would the Jackson *et al.* (2000) study be ignored?

The IARC Decision Declaring Particulate Matter (PM_{2.5}) To Be a Carcinogen



The author(s) of the Section 5 discussion on particulate matter cited the IARC decision to declare PM_{2.5} as a part of outdoor air pollution "to be carcinogenic to humans," but then they didn't go anywhere with it. That failure will be discussed later as it is a critical decision that should have involved discussions of CAFO air emissions containing PM_{2.5} but didn't. And as will be shown later in the discussion involving both the Wang *et al.* (2025) and the Bekbulat *et al.* (2025) research studies, this failure to discuss agricultural emissions of a major carcinogen (PM_{2.5}) borders on negligence.

IARC is an acronym that denotes the International Agency for Research on Cancer headquartered in Lyon, France. The IARC is a part of the World Health Organization headquartered in Geneva, Switzerland. Its decision about the carcinogenicity of PM_{2.5} was made in 2013. The decision was announced and published in the British research journal *Lancet Oncology* in December, 2013. According to the IARC:

The findings regarding the carcinogenicity of outdoor air pollution as a mixture, and of particulate matter specifically, are remarkably consistent in epidemiological research [on humans], studies of cancer in experimental animals, and a wide range of studies of mechanisms related to cancer.⁸³

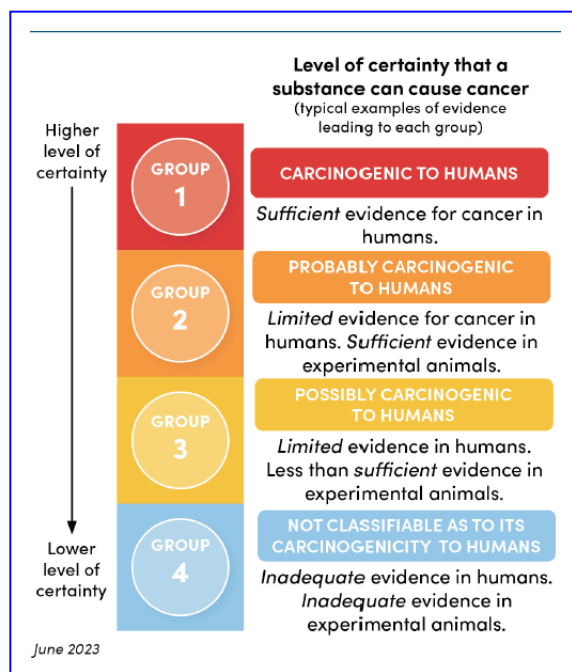
The actual 451-page report took longer to prepare as the bibliography containing 28 pages of double-columned references needed to be discussed and explained.⁸⁴ It is instructive to examine the IARC classifications, shown on the following page, which was provided by the Iowa Cancer

82. Jackson *et al.* (2000), *op. cit.*

83. Loomis *et al.* (December, 2013). The carcinogenicity of outdoor air pollution. *Lancet Oncology*, 14 (13): 1262-1263. doi: 10.1016/S1470-2045(13)70487-X.

84. International Agency for Research on Cancer (2016). *Outdoor air pollution, volume 109: IARC monographs on the evaluation of carcinogenic risks to humans*. Lyon, France: International Agency for Research on Cancer, World Health Organization. Accessed 4-14-2026 at: <https://publications.iarc.who.int/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Outdoor-Air-Pollution-2015> NOTE: The same report is available as an e-book from the IARC; however, its title is different from the original – Air pollution and cancer, IARC scientific publication No. 161.

Registry in their 2026 *Cancer in Iowa* report.⁸⁵



Section 5's Treatment of the Wang *et al.* (2025) Study



The Wang *et al.* (2025) initially appeared in the *British Journal of Cancer*, a peer-reviewed scientific research journal published in the public arena.⁸⁶ It would appear from the title that the major thrust of the Wang *et al.* (2025) study aimed at exploring the possible connections between inhaling particulate matter and being diagnosed with lung cancer, a cancer which, as we learned earlier from the past four issues of *Cancer in Iowa* (2023-2026), is the leading cause of cancer-related deaths in Iowa. Let's see how the author(s) of Section 5 used the Wang *et al.* (2025) research study.

85. Iowa Cancer Registry (2026), p. 13. *Cancer in Iowa 2026*. Iowa City, IA: Iowa City, IA: College of Public Health, the University of Iowa. Available from the Iowa Cancer Registry's web page at: <https://shri.public-health.uiowa.edu/cancer-data/reports/iowa-cancer-reports/>

86. Wang *et al.* (2026). Particulate matter air pollution as a cause of lung cancer: Epidemiological and experimental evidence. *British Journal of Science*, 132: 986-996. doi: 10.1038/s41416-025-02999-2.

Excerpt From p. 58, the IEC-Harkin Institute Report
Typical forms of PM_{2.5} in Iowa include airborne dust, soot, smoke, and liquid droplets. The particles can attach to a variety of harmful substances, which can enter airways, lungs, and ultimately the bloodstream of people when they breathe polluted air (Wang *et al.*, 2025).

The author(s) of Section 5 made no mention of airborne CAFO emissions when discussing the "typical forms of PM_{2.5} in Iowa" despite its widespread prevalence. Nor did they mention any airborne emissions of particulate matter from other agricultural production activities.

A closer look at the Wang *et al.* (2025) study's abstract reveals the statement that "the major carcinogens that increase lung cancer risk" include toxic substances such as "sulfates, organic compounds," etc. The careful reader will recall that swine CAFOs emit "**hydrogen sulfide**" and more than 100 "**Volatile Organic Compounds**."

The Wang *et al.* (2025) study devoted an entire paragraph to discussing various air emissions from "agricultural activities" that are sources of PM_{2.5}. The Wang study also referenced a study which found that

the risk of lung cancer was nearly three times higher for workers involved in crop and crop and animal production... [Emphasis added]⁸⁷

Suraya *et al.* (2021). Excess risk of lung cancer among agriculture and construction workers in Indonesia. *Annals of Global Health*, 87(1): 8.

The research scientists authoring the Wang *et al.* (2025) study reminded readers about the primary sources of PM emissions.

Major anthropogenic sources of PM include factories, combustion engines, agricultural activities, and mining. They emit a variety of PM with toxic subcomponents such as metals and chemicals. [Emphasis added]⁸⁸

And they drew attention to the IARC's classification of diesel exhaust (a major by-product of agricultural machinery in crop production and of semi-trucks hauling grain and livestock) as a human carcinogen.

Diesel exhaust fumes are classified as a Group 1 carcinogen by the Inter-

87. Wang *et al.* (2025), p. 987, *op. cit.*

88. Wang *et al.* (2025), p. 987, *op. cit.*

national Agency for Research on Cancer.⁸⁹

None of the preceding information from the Wang *et al.* (2025) study was mentioned by the author(s) of Section 5 in the IEC-Harkin report, *Environmental Risk Factors and Iowa's Cancer Crisis*. Given that the title suggests the report will be investigating possible environmental causes of the Cancer Crisis in Iowa, these omissions of critical information about particulate matter emissions from the animal husbandry and row-crop agricultural sector are, at best, puzzling and strange.

These omissions would go undiscovered by the general public unless individuals had access to the cited report and examined it for themselves. Most would not, but would instead trust that the Iowa Environmental Council and the Harkin Institute would be trustworthy purveyors of information. Thus the author(s) of Section 5 might assume they can get by with their misrepresentation of the Wang *et al.* (2025) study as only a focus on the mechanism by which particulate matter enters the body rather than a focus on exploring

the different sources of PM_{2.5} and relevant carcinogenic mechanisms in the context of epidemiological studies on the development of lung cancer from various geographical regions worldwide. [Emphasis added]⁹⁰

This preceding manipulation of the study permits the author(s) of Section 5 to avoid discussing agricultural air emissions of two carcinogens – PM_{2.5} and diesel exhaust from farm machinery.

Not only does the misrepresentation of the Wang study permit the author(s) of Section 5 to avoid discussing agricultural air emissions of carcinogens, it also gives them a pass to avoid discussing studies cited by the Wang *et al.* (2025) study that discuss the impact of long-term exposures to PM_{2.5}, *e.g.*, the Berg *et al.* (2023) study:

Long-term exposure to fine particle air pollutants can produce genotoxicity and mutagenicity. It may increase the risk of lung cancer through inflammatory damage, reactive oxygen species production, and oxidative DNA damage.⁹¹

Given the proclivity of the state task force on cancer to focus on behavioral causes of cancer, *e.g.*, smoking, and ignore the environmental risks, state officials would do well to heed the conversation taking place in the Berg *et al.* (2023) study via their own statements as well as the statements of the Turner *et al.* (2014) study. First of all the Berg *et al.* (2023) research team noted:

The number of estimated attributable lung cancer deaths has increased by nearly

89. Wang *et al.* (2025), p. 987, *op. cit.*, citing the IARC re: diesel exhaust: International Agency for Research on Cancer (2012). IARC: Diesel engine exhaust carcinogenic. *Central European Journal of Public Health*, 20 (2): 120, 138.

90. Wang *et al.* (2025), p. 986, *op. cit.*

91. Berg *et al.* (2023). Air pollution and lung cancer: A review by International Association for the Study of Lung Cancer Early Detection and Screening Committee, p. 1280. *Journal of Thoracic Oncology*, 18 (10): 1277-1289. doi: 10.1016/j.jtho.2023.

30% since 2007 as smoking has decreased and air pollution has increased.⁹²

Next the Berg *et al.* (2023) researchers paraphrased the following finding from a Turner *et al.* (2014) study and cited the Turner *et al.* (2014) research team as the source of the Berg *et al.* (2023) paraphrase that "smoking and air pollution interact in a positive synergistic fashion..."⁹³ Following the actual statement made by the Turner *et al.* (2014) researchers that was cited by Berg *et al.* (2023), the Turner *et al.* (2014) research team made a policy recommendation based on their finding, a recommendation that officials in Iowa might do well to heed:

... [T]hese results suggest that attempted reductions in lung cancer risk through both tobacco control and air quality management may exceed expectations based on reducing exposure to either risk factor alone.⁹⁴

Unfortunately Iowa has focused public attention on one factor alone – smoking – without any measurable result while carcinogenic emissions from the agricultural sector have been ignored. Even the director of the Iowa Cancer Registry has admitted no progress in reducing lung cancer:

Iowa has shown the least progress of all states in reducing lung cancer incidence.⁹⁵

Dr. Charlton's statement about Iowa's failure to reduce lung cancer in the state is borne out by the documented record contained in the last four *Cancer in Iowa* reports for 2023, 2024, 2025, & 2026 [see previous section of this paper, "Cancer in Iowa."]. And unfortunately, Iowa's failure to reduce lung cancer offers a cautionary postlude regarding failure to heed the Turner *et al.* (2014) research team's public policy recommendation that flowed from scientific work.

Thoughtful readers might surmise that perhaps the advice provided by the Turner *et al.* (2014) research team as replayed through the efforts of the Berg *et al.* (2023) research team and the Wang *et al.* (2025) research team should be given some serious consideration.

It appears that the author(s) of Section 5 didn't bother with checking the actual studies referenced by a study they not only cited, but also misrepresented. And thereby a valuable conversation taking place between three separate scientific research teams over the course of a decade got lost in the shuffle. And so it seems that the hopeless path of denial about agriculture's contributions via toxic and carcinogenic air emissions to Iowans' cancer risks will continue.

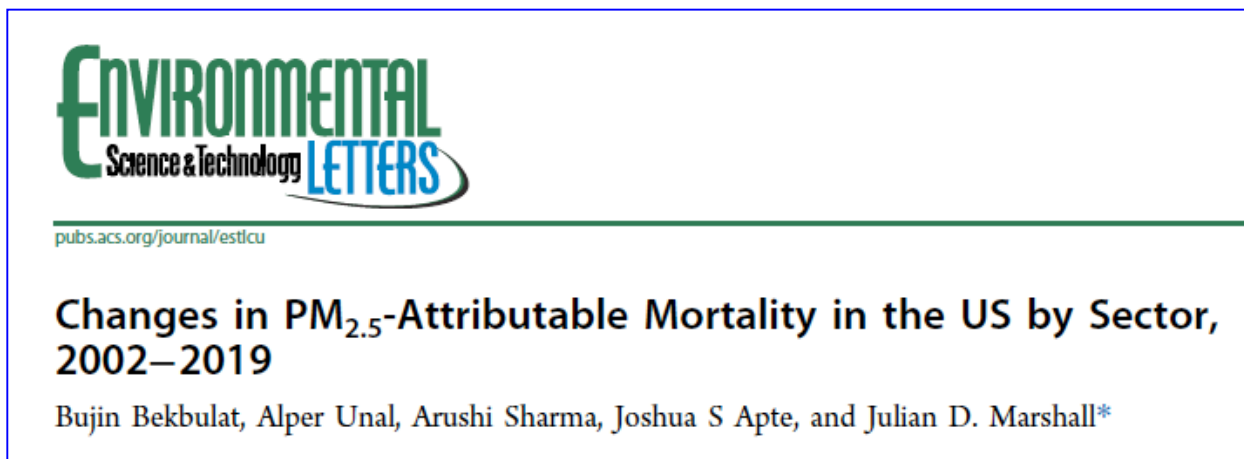
92. Berg *et al.* (2023), p. 1277, *op. cit.*

93. Berg *et al.* (2023), p. 1278, *op. cit.*, citing the following study in support of their statement:
MC Turner, A Cohen, M Jerrett, SM Gapstur, WR Diver, CA Pope III, D Krewski, BS Beckerman, & JM Samet (2014). Interactions between cigarette smoking and fine particulate matter in the risk of lung cancer mortality in Cancer Prevention Study II. *American Journal of Epidemiology*, 180 (12): 1145-1149. doi: 10.1093/aje/kwu275.

94. Turner *et al.* (2014), pp. 1145-1146, *op. cit.*

95. B Miller (March 24, 2024). Cancer in Iowa: Cancer rates soar, but why? *Cedar Rapids Gazette*, pp. 1A, 4A-5A.

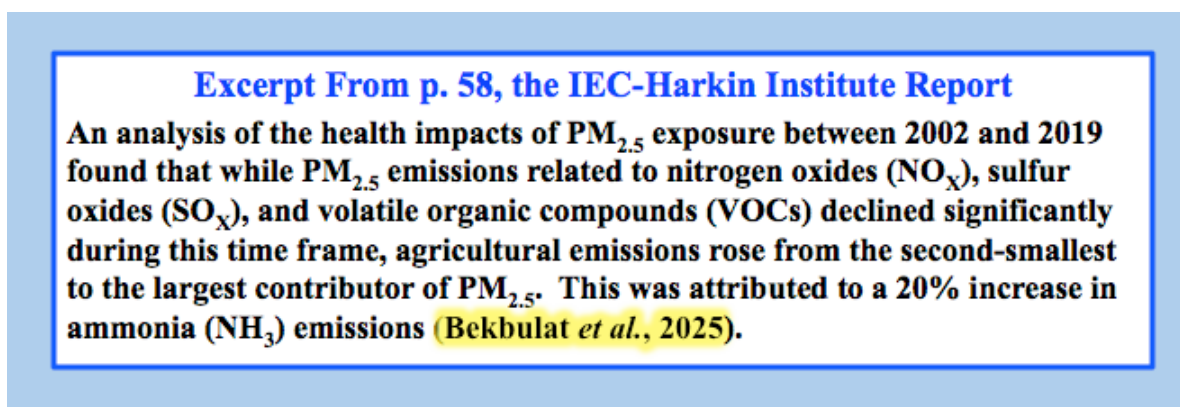
Section 5's Treatment of the Bekbulat *et al.* (2025) Study



Introduction – Laying Out the Groundwork

As can be seen from the graphic shown above, the Bekbulat *et al.* (2025) study first appeared in the peer-reviewed scientific research journal, *Environmental Science & Technology Letters*.⁹⁶ Researchers Bekbulat, Unal, Sharma, and Marshall conduct research and teach at the Department of Civil and Environmental Engineering, University of Washington, while Dr. Apte has dual appointments in the Department of Civil and Environmental Engineering AND the School of Public Health, both at the University of California, Berkeley.

Let's see how the author(s) of Section 5 of the IEC-Harkin (2026) report use the Bekbulat *et al.* (2025) research study.



The statement by the author(s) of Section 5 of the IEC-Harkin (2026) report about "health impacts" is somewhat misleading because it doesn't define what health impacts were identified.

96. B Bekbulat, A Unal, A Sharma, JS Apte, & JD Marshall (2025). Changes in PM_{2.5}-attributable mortality in the US by sector, 2002–2019. *Environmental Science & Technology Letters*, 12: 1644-1650. doi: 10.1021/acs.estlett.5c00901.

In a report focused on environmental risks and cancer, the reader might assume the "health impacts" being studied related to specific cancer diseases. That would be a mistaken assumption.

The Bekbulat *et al.* research team clearly identified the "health impact" upon which their study focused and inferred the study's framework in the title of their research article. In addition the Bekbulat researchers spelled out their analytical framework in the study's abstract. Both the identification of the "health impact" and the analytical framework for the study are missing in the characterization made of the Bekbulat *et al.* research team's study by the author(s) of Section 5 that was pictured previously. The reader can see that the title of the Bekbulat team's research includes the term "PM_{2.5} - Attributable Mortality" and the term "Sector." The Bekbulat team's abstract clearly defines both the analytical framework and the purpose of their study.

This study evaluates emission reductions across five key economic sectors – electricity, industrial, transportation, agriculture, and residential – and their impact on air quality and health.⁹⁷

The Bekbulat *et al.* (2025) research team's abstract continues by explaining the specific aspect of "health" being examined by their study:

Using a national source-receptor matrix, we estimate annual PM_{2.5} - attributable mortality and its variability spatiotemporally and by sector.⁹⁸

None of this specificity is identified in the characterization of the Bekbulat *et al.* study by the author(s) of Section 5's two-paragraph discussion of particulate matter in the IEC-Harkin report. These omissions leave the reader's imagination free to wander instead of anchoring attention to important detail and purpose.

It should also be mentioned that prior to the discussion centered on the Bekbulat *et al.* (2025) citation, the author(s) of Section 5 made statements connecting the cited research to Iowa. The general reader might assume that the Bekbulat *et al.* (2025) research centered on Iowa. Again, such an assumption would be questionable. All of the findings were centered on the US. However, color-coded maps indicated which economic sector was the current leader in PM_{2.5} emissions in each state.

The Bekbulat *et al.* (2025) study examined five types of emissions from each of the five economic sectors. These emissions included:

- Primary PM_{2.5} and
- The four secondary precursors of PM_{2.5} :
 - NO_x ,
 - SO_x ,
 - NH₃ , and

97. Bekbulat *et al.* (2025), p. 1644, *op. cit.*

98. Bekbulat *et al.* (2025), p. 1644, *op. cit.*

- VOCs.

The reader will recall that **CAFOs emit both NH₃ and VOCs** as well as PM_{2.5} (a carcinogen) and antibiotic-resistant organisms. Secondary precursors of PM_{2.5} are gaseous compounds, *e.g.*, NH₃, emitted into the atmosphere that transform into particles due to atmospheric interactions with sunlight, water vapor, and other chemicals.⁹⁹ When secondary precursors are transformed into PM_{2.5}, they become a carcinogen, thus making NH₃ and VOCs potential carcinogens.

Perhaps we should examine the details of the Bekbulat *et al.* (2025) research study to see if anything else of critical importance was left out by the author(s) of Section 5 in their discussion of particulate matter.

What the Bekbulat *et al.* (2025) Study Actually Researched and Reported

What were the findings of the Bekbulat *et al.* (2025) research study?

First, according to the Bekbulat *et al.* (2025) research team:

Our 18-year sector-specific analysis reveals the emerging dominance of agricultural emissions and the declining role of electricity generation in air pollution-related mortality.¹⁰⁰

Second, four of the five economic sectors reduced their PM_{2.5}-attributable mortality data "substantially between 2002 and 2019." The transportation, electricity, industrial, and residential sectors all reduced their PM_{2.5}-attributable mortality figures. Agriculture was the only economic sector to increase its PM_{2.5}-attributable mortality numbers. The national figures for each sector's reduction of PM_{2.5}-attributable mortality responsibility are shown below in blue while the increased emissions for agriculture are shown in red:

Transportation	- 61% reduction
Electricity	- 88% reduction
Industrial	- 45% reduction
Residential	- 38% reduction
Agriculture	+ 28% increase ¹⁰¹

The decreased emissions in four of the five economic sectors were enough to counteract the increased emissions from agriculture so that total US PM_{2.5}-attributable mortality from 2002-2019 "decreased 51%." The Bekbulat *et al.* research team observed that

future progress [in reducing PM_{2.5}-attributable mortality figures] may need to

99. *Commentary on the EFRA Air Quality report (2nd Feb 2021) and Government response: Hearing on air quality before the Environment, Food and Rural Affairs Committee, Parliament, United Kingdom* (July 6, 2021) (written evidence from Professor Alastair Lewis, University of York and Director, National Centre for Atmospheric Science). Accessed from: <https://committees.parliament.uk/work/1349/air-quality-follow-up/publications/written-evidence/>

100. Bekbulat *et al.* (2025), p. 1648, *op. cit.*

101. Bekbulat *et al.* (2025), p. 1646, *op. cit.*

focus greater attention on agricultural emissions...¹⁰²

Drawing attention to the shifting pattern for PM_{2.5} -attributable mortality responsibility, the Bekbulat *et al.* (2025) researchers noted the following contrasts:

In 2002, electricity generation and transportation were the leading contributors to PM_{2.5} -attributable mortality, whereas agriculture played a relatively minor role.

By 2019, electricity had become one of the lowest-impact sectors, whereas agriculture had emerged as the largest contributor.¹⁰³

To what circumstances did the Bekbulat *et al.* (2025) attribute the shifting pattern of PM_{2.5} -attributable mortality?

This shift reflects in part the success of regulatory controls on fossil fuel combustion sources and the relative lack of comparable controls on agricultural emissions.

The Bekbulat *et al.* (2025) team of researchers continued:

Reductions in PM_{2.5} -attributable mortality are driven by reductions in PM_{2.5} levels; demographic changes, such as population aging, play a lesser role.¹⁰⁴

The Bekbulat *et al.* (2025) study drew attention to the critical threat that air pollution poses to health by citing a research article from the British medical journal *Lancet*.¹⁰⁵

Air pollution remains the leading environmental health risk in the United States.¹⁰⁶

And the Bekbulat *et al.* (2025) study cited several examples wherein levels of air pollution "have declined substantially in the United States," which in turn yielded "large public health benefits." And to what did the Bekbulat research team credit for the success in reducing air pollution in the US?

These improvements reflect local, regional, and national policy efforts, driven largely by the Clean Air Act.¹⁰⁷

And in support of the preceding statement, they cited the following US government reports:

LG Chestnut & DM Mills (November, 2005). A fresh look at the benefits and costs of the US acid rain program. *Journal of Environmental Management*, 77 (3): 252-266. doi: 10.1016/j.jenvman.2005.05.014.

102. Bekbulat *et al.* (2025), p. 1644, *op. cit.*

103. Bekbulat *et al.* (2025), pp. 1647-1647, *op. cit.*

104. Bekbulat *et al.* (2025), p. 1647, *op. cit.*

105. GBD 2019 Risk Factor Collaborators (October 17, 2020). Global burden of 87 risk factors in 204 countries and territories, 1990-2019: A systematic analysis for the Global Burden of Disease Study 2019. *Lancet*, 396 (10258): 1223-1249. doi: 10.1016/S0140-6736(20)30752-2.

106. Bekbulat *et al.* (2025), p. 1648, *op. cit.*

107. Bekbulat *et al.* (2025), p. 1644, *op. cit.*

US Environmental Protection Agency (April, 2011). *Benefits and costs of the Clean Air Act 1990-2020, the Second Prospective Study*. Washington, DC: Environmental Protection Agency. Available at: <https://www.epa.gov/clean-air-act-overview/benefits-and-costs-clean-air-act-1990-2020-report-documents-andgraphics>

The study found that the central benefits exceeded costs by a factor of 30 to one.

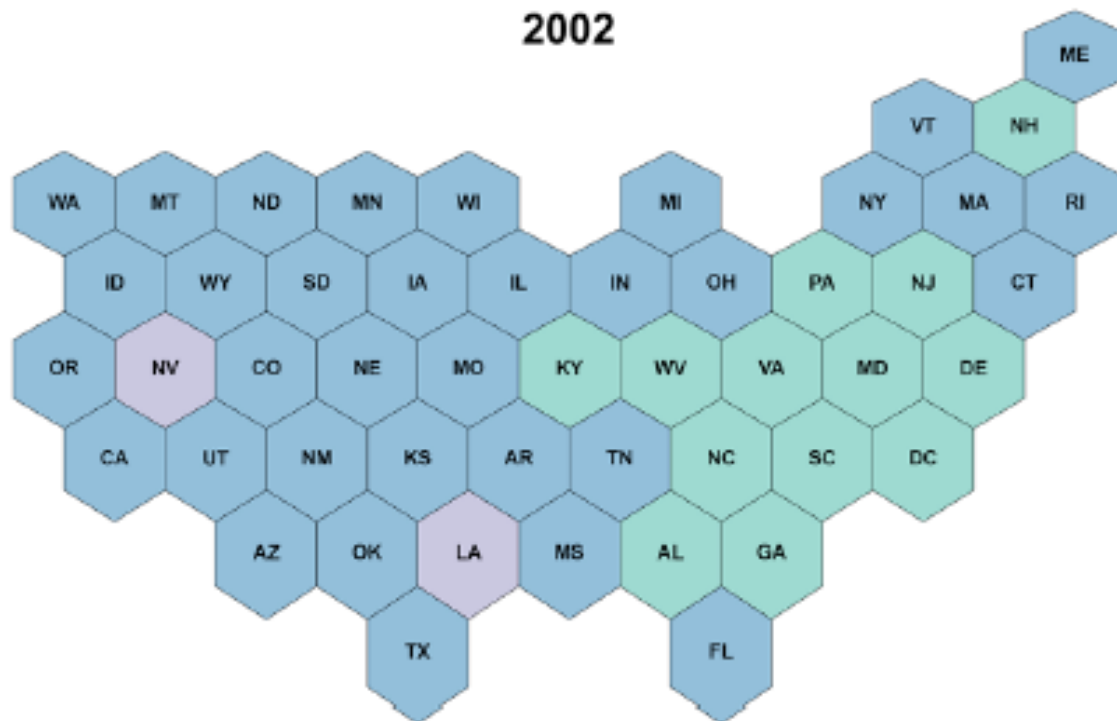
US Environmental Protection Agency (?). *Control of air pollution from motor vehicles: Tier 3 motor vehicle emission and fuel standards final rule*. Washington, DC: Environmental Protection Agency. Available at: <https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-control-air-pollution-motor-vehicles-tier-3>

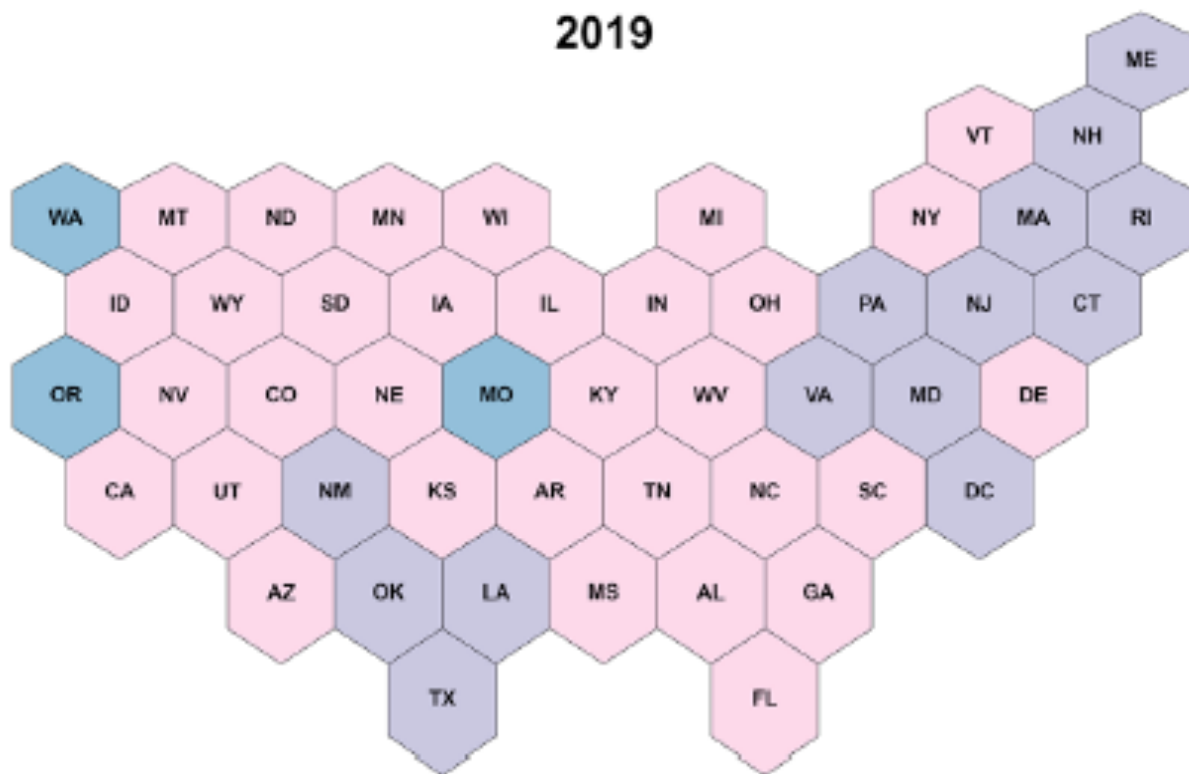
"The program considers the vehicle and its fuel as an integrated system, setting new vehicle emissions standards and a new gasoline sulfur standard beginning in 2017. The vehicle emissions standards will reduce both tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles."

However, the Bekbulat *et al.* (2026) research team cautioned:

Despite this progress, PM_{2.5}-attributable mortality is the largest environmental risk factor in the US.¹⁰⁸

The Bekbulat *et al.* (2025) research team also identified the economic sector for each state that had the largest contribution to "attributable mortality" for both 2002 and 2019. In Iowa, the economic sector having the largest contribution to "attributable mortality" for 2002 was transportation (blue-grey), but that shifted to the agricultural sector (pink) by 2019 as can be seen in the following graphics.¹⁰⁹





How Section 5 of the IEC-Harkin (2026) Report Distorted and Misused the Bekbulat *et al.* (2025) Research Study

Which of the Bekbulat *et al.* (2025) study's findings previously presented in this analysis were reported by the author(s) of Section 5 in their discussion of particulate matter, particularly PM_{2.5}? Only the finding that agricultural emissions became "the largest contributor of PM_{2.5}", which was minimized as will be shown subsequently in the analysis of the statements made in the IEC-Harkin (2026) report referencing the Bekbulat *et al.* (2025) study. The remainder of the Bekbulat *et al.* (2025) research team's findings were ignored by the author(s) of Section 5

Findings and facts from the Bekbulat *et al.* (2025) study that were not reported by the authors of Section 5 in the IEC-Harkin (2026) report include the following:

- Not the finding that agriculture was the ONLY economic sector that didn't reduce emissions of PM_{2.5} .
- Not the finding that all of the other four economic sectors studied by the Bekbulat *et al.* researchers reduced their emissions of PM_{2.5} .
- Not the fact that ALL of the other four economic sectors' emissions were regulated.
- Not the fact that the agricultural economic sector was the only sector whose emissions

were not regulated.

- Not the research-based fact that air pollution constitutes the top environmental health risk in the United States.
- Not the research-based fact that with regards to air pollution, PM_{2.5} "is the largest environmental risk factor in the US."

None of the preceding findings nor facts were mentioned by the authors of Section 5 in their discussion of particulate matter in a report titled *Environmental Risk Factors and the Cancer Crisis in Iowa*.

Let's examine what was discussed and what was omitted regarding the IEC-Harkin (2026) report's citation of the Bekbulat *et al.* (2025) study.

Excerpt From p. 58, the IEC-Harkin Institute Report

An analysis of the health impacts of PM_{2.5} exposure between 2002 and 2019 found that while PM_{2.5} emissions related to nitrogen oxides (NO_x), sulfur oxides (SO_x), and volatile organic compounds (VOCs) declined significantly during this time frame, agricultural emissions rose from the second-smallest to the largest contributor of PM_{2.5}. This was attributed to a 20% increase in ammonia (NH₃) emissions (Bekbulat *et al.*, 2025).

First of all, their last sentence is false. While the Bekbulat *et al.* (2025) researchers did report that the agricultural sector's emissions increased, and while they did report a 20% increase in ammonia emissions from agriculture, their report did not attribute agriculture's increase in emissions to the increased emissions of ammonia. A careful reader of the Bekbulat report will search in vain for that attribution.

Second, the Section 5 author(s) omit the fact that the data figures they are citing are totals for the entire nation and do not refer to Iowa emissions. Since the author(s) mention the Iowa situation specifically in the sentence immediately preceding their discussion citing the Bekbulat *et al.* (2025) study, one might infer that the figures being discussed are Iowa figures. That would be an incorrect inference resulting from the failure to distinguish between data referencing the nation and data referencing only Iowa.

Third, the failure to distinguish the data reference (national vs. Iowa) distorts the actual situation in Iowa regarding ammonia (NH₃) emissions because it serves to "under-report" actual ammonia (NH₃) emissions in a state literally covered by CAFOs and row-crop agriculture.

Fourth, the Section 5 author(s) bookend their discussion of the Bekbulat *et al.* (2025) study in a way that minimizes agriculture's responsibility for PM_{2.5} ambient air emissions. The bookend preceding the Bekbulat study references "well-known outdoor sources" of PM_{2.5} without

mentioning CAFO air emissions or row-crop agriculture's use of pesticides, herbicides, anhydrous ammonia, and the use of diesel-powered farm equipment. The bookend following the Bekbulat *et al.* (2025) study refers to CAFO manure releasing ammonia via their manure management process, which to Iowans who've lived with agriculture for a lifetime, a link is created to a situation with which they're familiar – farmers spreading livestock waste on their fields every spring that they've stored in an outside environment over the winter. And they're moved back to the memories of the many small-scale farms and farm families that supported small towns, their public activities, their businesses, and their schools. And for the moment they forget that Big Ag's "bigger is better" attitude killed Jefferson's democratic dream of the independent land-owning farmer – the "yeoman farmer" – as constituting the strong backbone of a successful American democracy.

And of course current agriculturalists say of the odor, "That's the smell of money you're smelling," tying the smell of manure in the field to the money to be made from the sale of crops made bountiful via the application of manure. And it references the fact that manure in the fields has always smelled during and immediately following application on the field. Of course, as discussed previously, the waste in the image of traditional agriculture is vastly different from the actual waste from industrial-scale agriculture. And, of course, there are no harmful toxins or carcinogens present in that idyllic image of agriculture.

Fifth, while the Section 5 author(s) mention ammonia (NH₃) emissions in their discussion of the Bekbulat *et al.* (2025) study, they fail to mention: (1) the primary sources of those ammonia air emissions from today's agriculture – CAFO operations and the application of anhydrous ammonia as fertilizer to row-crop fields; (2) the other multiple emissions of toxins and carcinogens from CAFOs.

Sixth, the Section 5 author(s) distort the focus of the Bekbulat *et al.* (2025) study by not mentioning the study's economic sector framework and instead focusing attention on the substances being evaluated, *i.e.*, NO_x, SO_x, VOCs. The fact that economic sectors provided the basis for examining harmful air emissions is omitted, and thus a focus on agriculture as an entity with responsibility for harmful air emissions is reduced or eliminated. This becomes clearer when considering the next omission from the Bekbulat *et al.* (2025) research study.

Seventh, the Section 5 author(s) omitted any reference to the term "[PM_{2.5} -attributable mortality](#)" that appeared in the title of the Bekbulat *et al.* (2025) study, served as the health impact being studied, and served as a term repeatedly used throughout the study. The omission of the term, "[PM_{2.5} -attributable mortality](#)," serves again to minimize the sense of any urgency in dealing with particulate matter generally, and with agricultural emissions of PM_{2.5} particularly.

In conclusion, the sheer number of mistakes, misinterpretations, and misuses of multiple scientific, peer-reviewed scientific studies is breath-taking, especially when it occurs in a two-paragraph discussion about particulate matter (PM_{2.5}). Instead of receiving its own chapter, the subject of "particulate matter" was diminished in importance to two paragraphs. All of us need to ask a simple question:

In view of the evidence, was the decision to minimize particulate matter as a scientifically proven environmental risk factor for cancer incidence justified?

The Clean Air Act, the US Environmental Protection Agency, and Particulate Matter (PM_{2.5})

History of the Clean Air Act

Confusion abounds regarding the Clean Air Act, *e.g.*, what is the difference between a "criteria pollutant" and a "Hazardous Air Pollutant?" Partly the confusion results from the fact that the Clean Air Act actually consists of multiple "clean air acts" passed by Congress over a four-decades-long time span. And confusion exists regarding what was the nation's first Clean Air Act and when was it passed?

The first act passed by Congress that focused on air pollution was the Air Pollution Act of 1955.¹¹⁰ Officially, the act was a part of a congressional bill entitled "An Act to amend the Water Pollution Control Act in order to provide for the control of air pollution."¹¹¹ The Air Pollution Act of 1955 primarily provided funding "for research by the Public Health Service,"¹¹² but did little else as it "left states principally in charge of prevention and control of air pollution at the source."¹¹³ The act specifically recognized the following dangers that air pollution posed for "public health and welfare, agriculture, livestock, and deterioration of property."¹¹⁴

The first congressional action actually entitled the "Clean Air Act" was enacted in 1963 to create funding for "the study and cleanup of air pollution."¹¹⁵ The funding primarily went to "state and local governments and air pollution agencies in order to fund research and create control programs."¹¹⁶ The Clean Air Act of 1963 was the first act to draw attention to the dangers posed

110. American Meteorological Society (n.d.). *Legislation: A look at U.S. air pollution laws and their amendments*. Website. Material archived from the original. Boston, MA: American Meteorological Society. Retrieved 9-17-2026 from:

<https://web.archive.org/web/20120609184408/http://www.ametsoc.org/sloan/cleanair/cleanairlegisl.html>

111. GovTrack.us (n.d.). *S. 928 (84th): An Act to amend the Water Pollution Control Act in order to provide for the control of air pollution*. Website. No physical address provided. Accessed 9-17-2026 at:

<https://www.govtrack.us/congress/bills/84/s928>

112. American Meteorological Society (n.d.), *op. cit.*

113. Wikipedia (n.d.). *Air Pollution Control Act of 1955*. Website. Accessed 9-17-2026 at:

https://en.wikipedia.org/wiki/Air_Pollution_Control_Act_of_1955

114. American Meteorological Society (n.d.), *op. cit.*

115. United States Environmental Protection Agency, Office of Air Quality Planning and Standards (2007). *The plain English guide to the Clean Air Act*, p. 2. Research Triangle Park, NC: US EPA Office of Air Quality Planning and Standards. Retrieved 9-15-2026 from: <https://www.epa.gov/clean-air-act-overview/plain-english-guide-clean-air-act> Hereafter, referenced as "US EPA, *Plain English Guide* (2007)."

116. American Meteorological Society (n.d.), *op. cit.*

by motor vehicle exhaust and to make a distinction between "stationary" and "mobile" sources of air pollution.¹¹⁷

What follows in the remainder of this section is equivalent to a fly-over that focuses on the major details (from my perspective) and doesn't get mired in the myriad nitty-gritty details of each act. For those details, the reader can use the resources listed in this analysis.

In 1970 Congress passed a "much stronger Clean Air Act," while at the same time creating the Environmental Protection Agency in a separate legislative act and empowering it with the major responsibility for putting the Clean Air Act into action.¹¹⁸ The 1970 Clean Air Act directed the EPA to identify "criteria pollutants" and to "establish permissible levels that those pollutants" could be present in the nation's air without damaging public health.¹¹⁹ The 1970 Clean Air Act also required the EPA's head administrator to determine the following:¹²⁰

- 1) the emissions' cause or contribution to air pollution which may reasonably be anticipated to impact human health or welfare;
- 2) if pollution comes from diverse or multiple stationary or mobile sources; and
- 3) whether the criteria was not established prior to December 31, 1970.

Once pollutants were identified as "criteria pollutants" by the EPA, the 1970 Clean Air Act required the agency to develop "National Ambient Air Quality Standards (NAAQS)" for that pollutant that were designed "to protect human health and welfare."¹²¹ Since the 1970 Clean Air Act, the EPA has identified only six pollutants as "criteria pollutants" and has developed NAAQS for each of the following six "criteria pollutants" (listed in alphabetical order):¹²²

- Carbon Monoxide.
- *Lead.
- Nitrogen Dioxide.
- Ozone.
- Particulate Matter.
- Sulfur Dioxide.

* It should be noted that lead was the only "criteria pollutant" that was listed as the result of a court order resulting from a lawsuit brought by the Natural Resources Defense Council in 1973 – *NRDC v. EPA*, 475 F.2d 968 (D.C. Cir. 1973). In the face

117. American Meteorological Society (n.d.), *op. cit.*

118. US EPA, OAQP&S (2007), p. 2, *op. cit.*

119. P Goeringer (November 18, 2015). *Zook v. EPA: Does the EPA have a duty to regulate emissions from animal feeding operations?* Blog Post - Maryland Risk Management Education Blog. College Park, MD: University of Maryland Department of Agricultural and Resource Economics. Retrieved 9-12-2026 from: <https://agrisk.umd.edu/post/zook-v-epa-does-the-epa-have-a-duty-to-regulate-emissions-from-animal-feeding-operations>

120. Goeringer (November 18, 2015), *op. cit.*

121. Goeringer (November 18, 2015), *op. cit.*

122. United States Environmental Protection Agency (n.d.). *Criteria air pollutants*. Website. Accessed 9-15-2026 at: <https://www.epa.gov/criteria-air-pollutants>

of industry resistance, the EPA had agreed to wait longer to implement its "health-based regulation to reduce lead content in gasoline."¹²³ The Natural Resources Defense Council and other organizations sued the EPA in federal court seeking a court order instructing the EPA to proceed as originally planned in implementing the listing of lead as a criteria pollutant accompanied by rules eliminating its use in gasoline products – all required by the 1970 Clean Air Act. The circuit court so-ordered.

As a result lead was listed as a "criteria pollutant" and a health-based regulation eliminating lead in gasoline was adopted (eliminating the source of the "criteria pollutant"). But, of course, continued industry resistance in the form of lawsuits, *e.g.* Ethyl Corp. v. EPA, 7 Envir. Rep. (BNA) 1353 (D.C. Cir. Jan. 28, 1975); 541 F.2d 1 (D.C. Cir. 1976) (*affirmed en banc*), *cert. denied*, 426 U.S. 941 (1976), delayed the implementation of the "lead phase-down regulation" eliminating lead in gasoline from taking effect until 1976.¹²⁴

The standards developed for each of the current "criteria pollutants" fall into one of two categories: primary and secondary. Primary standards consist of a "set of limits based on human health" while secondary standards serve to "prevent environmental and property damage."¹²⁵

The 1977 Clean Air Act Amendments AKA 1977 Clean Air Act created a "Clean Air Scientific Advisory Committee (CASAC)" for the purpose of providing

independent advice to the EPA Administrator on the technical bases for EPA's national ambient air quality standards. ... CASAC also addresses research related to air quality, sources of air pollution, and the strategies to attain and maintain air quality standards and to prevent significant deterioration of air quality.¹²⁶

Current CASAC members include the following seven individuals:

Jonathan M. Samet, Chair	University of Southern California
Joseph Brain	Harvard University
Ellis B. Cowling	North Carolina State University
James Crapo	National Jewish Medical and Research Center
H. Christopher Frey	North Carolina State University
Donna Kenski	Lake Michigan Air Directors Consortium

123. K Bridbord & D Hanson (August, 2009). A personal perspective on the initial federal health-based regulation to remove lead from gasoline, p. 1195. *Environmental Health Perspectives*, 117 (8): 1195-1201. doi: 10.1289/ehp.0800534.

124. Bridbord & Hanson (2009), p. 1199, *op. cit.*

125. US EPA, *Plain English Guide* (2007), p. 4, *op. cit.*

126. United States Environmental Protection Agency (n.d.). *EPA Clean Air Scientific Advisory Committee (CASAC)*. Website. Accessed at: <https://web.archive.org/web/20080422014458/http://yosemite.epa.gov/sab/sabpeople.nsf/WebCommittees/CASAC> Later referenced as US EPA CASAC, *op. cit.*

Of particular interest, CASAC created the following number of reports centering on "particulate matter" for the time periods indicated:¹²⁸

1982	1
1986 - 1987	2
1994 - 1996	6
1997 - 2000	7
2001 - 2006	18
2008 - Present	1

More on particulate matter in just a moment, but first the completion of the narrative explaining how the various Clean Air Acts served to amend the existing federal code dealing with clean air that began in 1963.

The 1990 Clean Air Act moved beyond the idea of "criteria pollutants" and completely rewrote the section of the law focused on exposure to toxic air pollutants.¹²⁹ Congress listed 189 "Hazardous Air Pollutants" (HAPs) that needed to be regulated by the Environmental Protection Agency. The newly legislated list of HAPs would be regulated by the National Emissions Standards for Hazardous Air Pollutants (NESHAPs). NESHAPs had been originally codified as a result of the 1970 Clean Air Act; however, the newly created EPA's figurative hands were full dealing with the "criteria pollutants" in terms of identifying, listing, and developing regulatory standards for each, not to mention the problems of getting a new agency started, assembled, creating bureaus and divisions to deal with the multitude of issues that the federal government had become involved with since its original creation in 1970.

The NESHAPs (National Emissions Standards for Hazardous Air Pollutants) serve to regulate the amount each of the listed (originally 189, currently 188) toxics can be emitted by various sectors of the economy. The pollutants designated as "Hazardous Air Pollutants" have been listed because each was either known or suspected by a preponderance of evidence to be a contributing cause of serious health issues. According to the EPA's 2017 definition of "air toxics" (AKA "toxic air pollutants" AKA "hazardous air pollutants"), air toxics consist of

pollutants known to cause or suspected of causing cancer or other serious health problems. Health concerns could be associated with both short-and long-term exposures to these pollutants. Many are known to have respiratory,

127. US EPA CASAC, *op. cit.* Click on link for "the seven members of CASAC."

128. US EPA CASAC, *op. cit.* Click on link for "CASAC advisory activities and reports; then click on the word "reports." Or go directly to:
<https://web.archive.org/web/20081009202403/http://yosemite.epa.gov/sab/sabproduct.nsf/WebCASAC/advisoryreports?OpenDocument>

129. Congressional Research Service (September 13, 2022). *Clean Air Act: A summary of the act and its major requirements*. Washington, DC: Congressional Research Service. Retrieved 9-16-2026 from:
<https://www.congress.gov/crs-product/RL30853>

neurological, immune, or reproductive effects, particularly for more susceptible or sensitive populations such as children.¹³⁰

Another term of interest because it has been used throughout this analysis – ambient – is defined as referring:

to the outdoor air surrounding a person through which pollutants can be carried.¹³¹

Since the NESHAPs primarily govern the "stationary" sources of hazardous air pollutants (HAPs), the EPA divided those sources into various sectors of the American economy as listed below:

- Agriculture, Food and Forestry
- Chemical Production and Distribution
- Generic Chemical Rules
- Electric Utilities
- Energy Engines and Combustion
- Foam, Fiber, Plastic and Rubber Products
- Metals Production
- Mineral Processing
- Oil and Natural Gas
- Petroleum Refineries and Distribution
- Semiconductor Manufacturing
- Solvent Use and Surface Coating
- Sterilizers
- Waste Management Industry

A closer look at the "Agriculture, Food and Forestry" economic sector reveals only one air pollution regulation focused on agricultural production activities. That regulation deals with the "Application of Agricultural Pesticides" and is titled "Control of VOC Emissions From the Application of Agricultural Pesticides."¹³² The careful reader will note that while the industry dealing with human waste management has standards and guidelines to follow regarding hazardous air pollutants, the industry dealing with the more potent animal waste has none.

A final rule governing "mobile" sources of HAPs went into effect on March 29, 2021. 40 CFR

130. United States Environmental Protection Agency (January 19, 2017). *National air toxics assessment – NATA: Glossary of terms*. Webpage. Accessed 9-16-2026 at: https://19january2017snapshot.epa.gov/national-air-toxics-assessment/nata-glossary-terms_.html. Subsequently referenced as EPA Glossary of Terms (2017).

131. EPA Glossary of Terms (2017), *op. cit.*

132. United States Environmental Protection Agency (n.d.). *Clean Air Act standards and guidelines for agriculture, food and forestry*. Webpage. Accessed 9-16-2026 at: <https://www.epa.gov/stationary-sources-air-pollution/clean-air-act-standards-and-guidelines-agriculture-food-and>

Parts 80 and 86 governed air pollutants emitted by motor vehicles and their fuels.¹³³

The final congressional amendments to the Clean Air Act occurred in 2022. Unlike previous amendments, the act was not named the Clean Air Act. Instead, the congressional legislation was a budget reconciliation bill entitled "The Inflation Reduction Act." Signed by President Biden, the act contained several distinct features. First, the act represented America's largest investment to date aimed at the problem of global warming.¹³⁴ Second, the Democratic majority included language that undermined the reasoning of the recent Supreme Court's decision in *West Virginia v. EPA* that had "curbed the E.P.A.'s ability to tackle global warming."¹³⁵ A *New York Times* reporter quoted the Democratic senator from Delaware who was instrumental in getting the law passed:

"The language, we think, makes pretty clear that greenhouse gases are pollutants under the Clean Air Act," said Senator Tom Carper, the Delaware Democrat who led the movement to revise the law. With the new law, he added, there are "no ifs, ands or buts" that Congress has told the federal agencies to tackle carbon dioxide, methane and other heat-trapping emissions from power plants, automobiles and oil wells.¹³⁶

The context of the congressional action was that it served as a response to the legal opinion written by Chief Justice Roberts in *West Virginia v. EPA* that used a "newly labeled doctrine" to restrain the EPA's regulatory actions concerning climate change pollutants. The Court's decision is paraphrased by the *Environmental Health News* below:

[R]ules imposed by EPA or other Executive Branch agencies are subject to judicial review if the rules have major economic or other societal impacts and were not authorized, explicitly and in detail, in the language of Congress's delegation of authority to the agency in question.¹³⁷

133. United States Environmental Protection Agency (n.d.). *Final rule for control of emissions of hazardous air pollutants from mobile sources – 40 CFR Parts 80 and 81*. Accessed 9-16-2026 from: <https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-control-emissions-hazardous-air-pollutants-0>

134. J Carman, M Ballew, M Verner, S Rosenthal, J Kotcher, E Maibach, & A Leiserowitz (June 27, 2024). *Understanding pro-climate voters in the United States*. New Haven, CT: Yale Program on Climate Change Communication. Retrieved 9-16-2026 from: <https://climatecommunication.yale.edu/publications/understanding-pro-climate-voters/>

135. L Friedman (August 22, 2022). Democrats designed the climate law to be a game changer. Here's how. *The New York Times*. Retrieved 9-16-2026 from: <https://www.nytimes.com/2022/08/22/climate/epa-supreme-court-pollution.html>

136. Friedman (August 22, 2022), *op. cit.*

137. J Holdren (July 18, 2022). Op-ed: Reflections on the Supreme Court's decision in *West Virginia v. EPA*. Danger resides in the majority's having invoked a sweeping "Major Questions Doctrine" to justify its decision in this relatively narrow case. *Environmental Health News*. Retrieved 9-16-2026 from: https://www.ehn.org/supreme-court-west-virginia-v-epa?gad_source=1&gad_campaignid=17673658777&gbraid=0AAAAow5yZ7l4gBlznmvPAZbEe6kpZorB&gclid=CjwKCAjw_KjVBhAHEiwAnC0N9DvxVK9GsJWiCQPX5cgYFZerC8GLswBGfYciV9tBbX6ffUrs4RfbwhoC1ikQAvD_BwE

In other words, the reason the Supreme Court curbed EPA's ability to fight climate change was that "Congress had never granted the agency the broad authority to shift America away from burning fossil fuels."¹³⁸ With the passage of the Inflation Reduction Act's amendment of the Clean Air Act, Congress gave "the E.P.A. the authority to regulate greenhouse gases and to use its power to push the adoption of wind, solar and other renewable energy sources."¹³⁹

The third distinct feature of the act was that

the bulk of those billions [in the IRA] goes toward mitigation efforts to reduce the greenhouse gas emissions that drive climate change. Those efforts can largely be broken up into three broad approaches:

- ensuring the United States has the knowledge and resources necessary to develop more clean energy and manufacture more electric vehicles.
- encouraging U.S. industries and businesses across the economy to reduce their greenhouse gas emissions [via tax incentives, grants, etc.].
- encouraging individuals to reduce their greenhouse gas emissions by improving the energy efficiency of their homes and driving cleaner vehicles [via tax incentives, etc.].¹⁴⁰

The remaining distinctive feature of the Inflation Reduction Act's amendments to the Clean Air Act resides in a distinctive feature often overlooked by many observers, a benefit that in turn triggers yet another benefit – the act "will reduce air pollution," which in turn will increase the public's health by the "prevention of air-pollution-related disease and premature death."¹⁴¹

Finally, just simply looking at the titles of the various programs addressed by the Inflation Reduction Act is educational:¹⁴²

- | | |
|---|---|
| • Renewable Energy Production Tax Credits. | • Methane Emissions Tax. |
| • Carbon Capture Tax Credits. | • Energy Efficient Buildings Tax Credits. |
| • Energy Infrastructure Reinvestment. | • Postal Service Clean Fleets. |
| • Transmission Project Financing. | • Domestic Renewable Component Tax Credits. |
| • Alternative Fuel Tax Credits. | • Electric Vehicle Manufacturing Support |
| • Clean Hydrogen Tax Credit. | • Green Bank. |
| • Consumer Tax Credits for Electric Vehicles. | • National Laboratory Research. |

138. Friedman (August 22, 2022), *op. cit.*

139. Friedman (August 22, 2022), *op. cit.*

140. Council on Foreign Relations - Education (December 8, 2022). *The Inflation Reduction Act. What is the IRA? In this free resource, learn what the United States' largest-ever climate change legislation does.* Website. Washington, DC: Council on Foreign Relations. Retrieved 9-16-2026 from: https://www.cfr.org/education/learn/reading/inflation-reduction-act?gad_source=1&gad_campaignid=23819513442&gbraid=0AAAAAD-E15ldEIVGXP6M-hMFs9xMic51d&gclid=CjwKCAjw_KjVBhAHEiwAnC0N9GreL168RB5pC1Eih-SegwqItB7hB4HKYXUjZaqLhuko0J2zaCenFhoCtyMQAvD_BwE

141. S Rajagopalan & PJ Landrigan (June 10, 2023). The Inflation Reduction Act – Implications for climate change, air pollution, and health. *Lancet Regional Health – Americas*, 23: 100522. doi: 10.1016/j.lana.2023.100522.

142. Council on Foreign Relations - Education (December 8, 2022), *op. cit.*

History of the US EPA and Particulate Matter (PM_{2.5})

One can not talk about the series of Clean Air Acts without discussing the evolution of the focus on regulating particulate matter emissions from a variety of sources. Since multiple sources in a variety of locations emit particulate matter, that is probably why it was originally listed as a "criteria pollutant" as discussed previously.

In 1971 the US EPA established the first ever particulate matter standards for the United States. Based on "total suspended particulate matter (TSP)", the initial primary standard was set at

a 24-hour average not to exceed 260 micrograms of particulate matter per cubic meter of air ($\mu\text{g}/\text{m}^3$) more than once per year.¹⁴³

Scientifically, that standard for TSP would be written as $260 \mu\text{g}/\text{m}^3$. The next changes in the National Ambient Air Quality Standards (NAAQS) for PM would take several years as can be seen on the following time table:¹⁴⁴

- In 1979, the EPA began the process of revising the NAAQS for TSP consisting of three drafts of criteria documents, receiving comments, and holding several public meetings.
- In 1984, the final criteria document was issued with the proposed changes to the 1971 NAAQS for TSP.
- In 1987, changes were finalized. These included changing the PM indicator from TSP to PM₁₀ because of research indicating "that health effects were associated with smaller particles." PM₁₀ indicated a particle with a "diameter of 10 μm or less." The new primary standard for a 24-hour average exposure not to be exceeded was $150 \mu\text{g}/\text{m}^3$.

The next round of changes to the NAAQS for particulate matter would come following the 1990 Clean Air Act of 1990. In 1994 the EPA issued drafts of the proposed changes to the existing 1987 particulate matter air quality standards. Following public comment, the EPA issued new documents of proposed changes in 1996 followed by "four public hearings at locations across the nation, in addition to two satellite broadcasts. Following this second round of revisions and hearings, and after examining additional scientific research "showing significant public health effects from fine particles," final NAAQS were issued in 1997 that included standards for PM_{2.5} and which retained the standards for PM₁₀ because the EPA wanted to regulate it as well.¹⁴⁵

The 1997 NAAQS proposals for particulate matter (PM_{2.5} & PM₁₀) also contained changes in the "form of the 24-hour standards," which meant that exceedances of the standard would be

143. R Esworthy, Congressional Research Service (December 15, 2004 – January 10, 2005). *Particulate matter air quality standards: Background and current developments*, p. CRS-6. Washington, DC: Congressional Research Service. Retrieved 9-12-2026 from: <https://www.everycrsreport.com/reports/RL31531.html>
Subsequently cited as Esworthy (2005), p. CRS-#, *op. cit.*

144. Esworthy (2005), p. CRS-6, *op. cit.*

145. Esworthy (2005), p. CRS-6, *op. cit.*

changed from "a one-time expected exceedance" to a "concentration-based percentile form."¹⁴⁶ The new formulation was based on a "three-year average of the 98th [or 99th] percentile of 24-hour PM concentrations," calculated in this manner:

a 99th percentile 24-hour standard indicates that a monitoring station can exceed the standard 1% of the time, or 3.65 days a year, if monitoring occurs every day.¹⁴⁷

As the Congressional Research Service analyst observed:

By changing the form to a concentration-based percentile, EPA allowed more exceedances than were previously permitted under the 1987 standard. Thus, although the level of the PM₁₀ standards was not changed, the change in form had the effect of weakening the PM₁₀ standard by allowing more exceedances.¹⁴⁸

Since the PM_{2.5} standards were new, they were not in actuality weakened. However, one could argue that they were weakened from the beginning in terms of what they would have been had not the form of the standard changed from a "one-time exceedance" to a "concentration-based percentile" format. The one constant was that the level of the standard for particulate matter remained the same, as the following chart compiled by the Congressional Research Service illustrates:¹⁴⁹

	1971	1987	1997
Indicator	<i>Total Suspended Particulate Matter</i>	<i>PM₁₀</i>	<i>PM₁₀ and PM_{2.5}</i>
24-hour Primary NAAQS	260 µg/m ³	150 µg/m ³	PM ₁₀ : 150 µg/m ³ 99th Percentile PM _{2.5} : 65 µg/m ³ 98th Percentile

In 2006, the 24-hour standard for PM_{2.5} was lowered from 65 µg/m³ to 35 µg/m³ where it remains as of this writing.^{150, 151}

The Public Health Service's ATSDR & EPA's Integrated Science Assessments re: Particulate Matter (PM_{2.5}) Exposure and Disease

Let's take a look at some data compiled by a government agency whose non-ideological,

146. Esworthy (2005), p. CRS-7, *op. cit.*

147. Esworthy (2005), p. CRS-7, *op. cit.*

148. Esworthy (2005), p. CRS-7, *op. cit.*

149. Esworthy (2005), p. CRS-7, *op. cit.*

150. United States Environmental Protection Agency (n.d.). *Timeline of particulate matter (PM) National Ambient Air Quality Standards (NAAQS)*. Website. Accessed 9-17-2026 at: <https://www.epa.gov/pm-pollution/timeline-particulate-matter-pm-national-ambient-air-quality-standards-naaqs>

151. United States Environmental Protection Agency (n.d.). *NAAQS table*. Website. Accessed 9-17-2026 at: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

scientific researched work drew the respect of the Chapter 8 authors of the ISU-UI Study Group (2002) report – the Agency for Toxic Substances and Disease Registry aka ATSDR, an agency of the Public Health Service in the US Department of Health and Human Services. First, they reported the ambient air quality standard for PM_{2.5} recommended by the World Health Organization for a 24-hour exposure: 15 µg/m³.¹⁵²

The US EPA's current NAAQS for PM_{2.5} is 35 µg/m³, more than double the ambient air standard for PM_{2.5} set by the WHO. The thoughtful reader will recall reading comparisons of differing methodologies by the WHO's International Agency for Research on Cancer (IARC) and the US Environmental Protection Agency. Perhaps we should look more closely at some of the findings compiled by the US ATSDR from their examination of peer-reviewed, scientific research studies, upon which they based their recommended air quality standard for PM_{2.5}. The chart illustrating some of their findings follows:¹⁵³

SUMMARY OF PM_{2.5} AND HEALTH OUTCOME STUDIES		
Exposure Duration	Endpoint Description	Mean Ambient Concentration Range
Short Term	Hospital Admissions & ED Visits for Asthma, COPD, & Respiratory Infections	4.7 – 24.6 µg/m ³
Short Term	Respiratory Mortality	7.9 – 19.9 µg/m ³
Long Term	Respiratory Mortality	6.3 – 23.6 µg/m ³
Short Term	Heart Failure	5.8 – 18.0 µg/m ³
Long Term	Cardiovascular Mortality	4.1 – 17.9 µg/m ³
Long Term	Coronary Events	13.4 µg/m ³
Long Term	CHD and Stroke (people with pre-existing disease)	13.4 – 23.9 µg/m ³
Long Term	Neurological Cognition	8.5 (5-year avg) – 14.9 µg/m ³
Long Term	Lung Cancer Incidence and Mortality	6.3 – 23.6 µg/m ³
µg/m³ = micrograms per cubic meter		

152. Agency for Toxic Substances and Disease Registry (June, 2024). *Guidance for inhalation exposures to particulate matter*, p. 8. Atlanta, GA: US Department of Health and Human Services, Public Health Service. Retrieved 9-17-2026 from: <https://www.atsdr.cdc.gov/pha-guidance/resources/index.html>. Subsequently cited as ATSDR (2024), *op. cit.*

153. ATSDR (2024), p. 10, *op. cit.*

From examining the preceding data, it would seem that the peer-reviewed, scientific-based research by unbiased professionals favors the WHO standard over the US EPA's ambient air quality standard for particulate matter, that is, if protecting the public health is the overriding objective.

The science-based professionals at ATSDR pointed to two recent "Integrated Science Assessments for Particulate Matter" that had been published by the US EPA.¹⁵⁴ Before we get to those two documents, the reader is possibly wondering what an "Integrated Science Assessment" is. According to the US EPA,

An ISA is a comprehensive evaluation and synthesis of the policy-relevant scientific information that is the scientific foundation for the review (the "air quality criteria") [of NAAQS for the current six-listed "criteria pollutants"].¹⁵⁵

The US EPA continued its explanation of "Integrated Science Assessments" by citing the actual wording contained in the law:

Each ISA is intended to "accurately reflect the latest scientific knowledge useful in indicating the kind and extent of identifiable effects on public health and welfare which may be expected from the presence of [a] pollutant in the ambient air" [42 U.S.C. 7408(b)]. Because the ISA communicates critical science judgments relevant to the NAAQS review, it forms the scientific foundation...

All ISAs are vetted through a rigorous peer review process, including review by the Clean Air Scientific Advisory Committee, public meetings and comment periods as announced in the Federal Register for public participation.¹⁵⁶

The first "Integrated Science Assessments for Particulate Matter" referenced by the ATSDR provided a history of the ISAs that had been developed over the years since they first began. Previous accounts of the 1997 PM₁₀ air quality standards mentioned that they had been "vacated" by the Circuit Court of Appeals for the District of Columbia while at the same time the 1997 PM_{2.5} air quality standards had been upheld, but those accounts never cited the case. The ISA referenced by the ATSDR did – *American Trucking Associations v. U.S. EPA*, 175 F. 3D 1027 (D.C. C. 1999).¹⁵⁷

The 2019 ISA reviewed studies and reports that had been issued between the previous 2009 ISA

154. ATSDR (2024), p. 11, *op. cit.*

155. United States Environmental Protection Agency (n.d.). *What is an Integrated Science Assessment?* Website. Accessed 9-18-2026 at: <https://www.epa.gov/isa/learn-about-isas>. Subsequently cited as US EPA (n.d.), "What is an ISA", *op. cit.*

156. US EPA (n.d.), "What is an ISA", *op. cit.*

157. United States Environmental Protection Agency, Office of Research and Development, Center for Public Health and Environmental Assessment (December, 2019). *Integrated science assessment for particulate matter*, p. P-6. Research Triangle Park, NC: Center for Public Health and Environmental Assessment. Retrieved 9-17-2026 from: <https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter>. Hereafter cited as US EPA, ISA (2019), p. #, *op. cit.*

and through January, 2018 for the 2019 ISA.¹⁵⁸ The 2019 ISA examined "Causality Determinations" for PM exposure to PM_{2.5}, PM_{10-2.5}, and UFP, AND to subsequent health effects, finding that "[Respiratory Effects](#)" for both short-term and long-term exposure to PM_{2.5} were "Likely to be causal"; that "[Cardiovascular Effects](#)" for both short-term and long-term exposure to PM_{2.5} were "Causal"; that "[Metabolic Effects](#)" for both short-term and long-term exposure to PM_{2.5} were "Suggestive of, but not sufficient to infer"; that "[Nervous System Effects](#)" for both short-term and long-term exposure to PM_{2.5} were "Suggestive of, but not sufficient to infer"; that "[Reproductive and Developmental Effects](#)" for both short-term and long-term exposure to PM_{2.5} were "Suggestive of, but not sufficient to infer"; that "[Cancer](#)" for exposure to PM_{2.5} were "Likely to be causal"; and that "[Mortality](#)" for both short-term and long-term exposure to PM_{2.5} were "Causal."¹⁵⁹

The 2019 ISA for particulate matter concluded that the

causality determinations for PM_{2.5} reflect the total body of scientific evidence, building on the conclusions presented in the 2009 PM ISA.¹⁶⁰

In discussing the "Health Effects Evidence," the 2019 ISA for particulate matter announced a "Key Finding":

A large body of scientific evidence spanning many decades clearly demonstrates there are health effects attributed to both short- and long-term PM exposure, with the strongest evidence for a relationship between some health effects and PM_{2.5}.¹⁶¹

Finally, a review of the listed authors and contributors to the 2019 PM ISA found that all involved in the various stages were either government employees or university faculty members (with the exception of one unidentified "reviewer"). There could be found no evidence that corporate interests had a seat at the review table. From the quality of the writing, one could easily infer that all contributors had a strong science background. The number of members for the following listed categories follows:

Executive Direction	11 Government
Scientific Staff	22 Government
Technical Support Staff	19 Government
Authors	32 Government; 24 University
Contributors	6 Government; 2 University
Reviewers	33 Government; 17 University; 1 ?

Time now to turn to the 2022 *Supplement to the 2019 Integrated Science Assessment for Particulate Matter* which examined studies issued after the cut-off date of 2018 for the 2019 ISA

158. US EPA, ISA (2019), p. ES-2, *op. cit.*

159. US EPA, ISA (2019), pp. ES-9 to 11, *op. cit.*

160. US EPA, ISA (2019), p. ES-12, *op. cit.*

161. US EPA, ISA (2019), p. ES-22, *op. cit.*

for Particulate Matter.¹⁶² The introduction stated that the "evaluation of new scientific information in this Supplement," combined with the "evidence presented within the 2019 PM ISA," provided a scientific basis "to support a robust and thorough reconsideration of the 2020 PM NAAQS" by the EPA.¹⁶³ In discussing the overall health effects of PM_{2.5}, the ISA Supplement stated:

Substantial scientific evidence exists across disciplines (*i.e.*, animal toxicology, controlled human exposure, and epidemiology) showing that both short- and long-term PM_{2.5} exposure can result in a range of health effects, from changes in circulating biomarkers to mortality.¹⁶⁴

The report continued by discussing the biological mechanisms leading towards disease caused by exposure to PM_{2.5}, only a more technical term is used by the EPA – "biological plausibility."

Across the broad health effects categories examined in the 2019 PM ISA, the evidence supporting biological plausibility varies, but generally includes modulation of the autonomic nervous system and inflammation as part of the pathways leading to overt health effects.¹⁶⁵

The 2022 Supplement to the 2019 IAS for Particulate Matter expanded on previous discussions of PM_{2.5} as a carcinogen:

PM_{2.5} exhibits various characteristics of carcinogens, as shown in studies demonstrating genotoxic effects (*e.g.*, DNA damage), epigenetic alterations, oxidative stress, and electrophilicity. Further, the carcinogenic potential of PM_{2.5} was demonstrated in an animal toxicological study in which chronic inhalation enhanced tumor formation that was initiated by exposure to urethane.¹⁶⁶

The discussion continued regarding PM_{2.5} exposure as a trigger for lung cancer via a discussion about a specific unnamed study:

Additionally, epidemiologic studies ... encompassing multiple cohorts that are diverse in terms of both geographic coverage and population characteristics have provided evidence of primarily consistent positive associations between long-term PM_{2.5} exposure and lung cancer incidence and mortality, particularly in never smokers (2019 PM ISA, Section 10.2.5.1).¹⁶⁷

162. United States Environmental Protection Agency, Office of Research and Development, Center for Public Health and Environmental Assessment (May, 2022). *Integrated science assessment for particulate matter*. Research Triangle Park, NC: Center for Public Health and Environmental Assessment. Retrieved 9-17-2026 from: <https://www.epa.gov/isa/integrated-science-assessment-isa-particulate-matter> Subsequently cited as US EPA, ISA Suppl. (2022), p. #, *op. cit.*

163. US EPA, ISA Suppl. (2022), p. 1-1, *op. cit.*

164. US EPA, ISA Suppl. (2022), p. 2-3, *op. cit.*

165. US EPA, ISA Suppl. (2022), p. 2-3, *op. cit.*

166. US EPA, ISA Suppl. (2022), p. 2-12, *op. cit.*

167. US EPA, ISA Suppl. (2022), p. 2-12, *op. cit.*

The discussion next pointed to the "biological plausibility" for a connection between exposure to PM_{2.5} and the onset of cancer:

Experimental and epidemiologic evidence of genotoxicity, epigenetic effects, and carcinogenic potential provides biological plausibility for epidemiologic results of lung cancer incidence and mortality.¹⁶⁸

By the way, the study referenced by the 2019 Integrated Science Assessment for Particulate Matter report¹⁶⁹ was a study referenced earlier in this analysis on page 15 as one of the studies laying the groundwork for the Yale University study:

MC Turner, D Krewski, CA Pope III, Y Chen, SM Gapstur, & MJ Thun
(December 11, 2011). Long-term ambient fine particulate matter air
pollution and lung cancer in a large cohort of never-smokers.
American Journal of Respiratory and Critical Care Medicine, 18 (12):
1374-1381. doi: 10.1164/rccm.201106-1011OC.

The Turner *et al.* (2011) study may be one of the few things shared in common between the US Environmental Protection Agency (EPA) and WHO's International Agency for Research on Cancer (IARC) – they both cite the Turner *et al.* (2011) research study, albeit for different reasons. The EPA cites it as justification for lowering the current National Ambient Air Quality Standard for PM_{2.5}, while the IARC cites it as justification for determining that PM_{2.5} is a human carcinogen.

The 2022 IAS PM Supplement to the 2019 IAS PM report concluded its section on the negative relationship between exposure to PM_{2.5} and increased cancer incidence with the following observation:

[H]owever, there was initial evidence that PM_{2.5} exposure may reduce survival in individuals with cancer.¹⁷⁰

Hmmm, wait a minute, the thoughtful reader might say. I recall the previous discussion about the differences between the US Environmental Protection Agency and the International Agency for Research on Cancer. This sounds like the US EPA is similar to the IARC. That could be one response.

Another response might be that there seems to be some kind of disconnect between the Integrated Science Assessment recommendations and the leadership of the Environmental Protection Agency. Evidence for that split would be to note that none of the science-based findings contained in US EPA, ISA (2019) and US EPA, ISA Supplement (2022) have been acted on by the leadership of the US EPA.

168. US EPA, ISA Suppl. (2022), p. 2-12, *op. cit.*

169. US EPA, ISA (2019), p. 10-38, *op. cit.*

170. US EPA, ISA Suppl. (2022), p. 2-13, *op. cit.*

**Exemptions for Agriculture from CERCLA & EPCRA via
US EPA's Rule Making and Congressional Legislation**

Besides the evidence provided previously about the differences between the US EPA and the WHO IARC (pp. 31-38) and that noted in the preceding paragraph, the reader might consider further evidence – the rule-making by the US EPA to exempt agriculture from the reporting requirements of two completely different federal acts: CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) and EPCRA (Emergency Planning and Community Right-to-Know Act. As explained by an Iowa State University Extension bulletin:

EPA has finalized a rule providing a full exemption for reporting air releases of hazardous substances from animal waste at farms to the federal government [CERCLA] and a partial exemption of reporting the releases to state and local governments [EPCRA]. This new rule exempts all farms from reporting air releases under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).¹⁷¹

Although this document has been hidden from current public view by ISU Extension, current information is still available on the US EPA website.¹⁷² Their explanation about the final rule originally published on December 18, 2008 matches the description contained in the ISU Extension Service bulletin cited in the preceding paragraph regarding the CERCLA and EPCRA exemptions. It also further explains the original 2008 rule regarding the partial exemption granted farms under EPCRA:

For EPCRA reporting, the rule exempted reporting of such releases if the farm had fewer animals than a large concentrated animal feeding operation.¹⁷³

However, the US EPA website contained no information about the

U.S. Court of Appeals decision that struck down the EPA's rule that exempted agriculture from the reporting requirements [of CERCLA].¹⁷⁴

The congressional response to the federal circuit court's action was led by two farm-bloc senators

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171. Iowa State University Extension (n.d.). *Animal agriculture and air quality*. Website. Ames, IA: Iowa State University Extension Service. Retrieved 4-20-2012 from: <http://www.extension.iastate.edu/airquality/cerclaepcra.html> NOTE: That URL no longer exists. A search of the ISU Extension website reveals a publication (March, 2003) with the same title, but a different focus – explaining ISU's research and education efforts about the topic.
172. United States Environmental Protection Agency (n.d.). *CERCLA and EPCRA reporting requirements for air releases of hazardous substances from animal waste at farms*. Website. Washington, DC: US EPA. Accessed at: <https://www.epa.gov/epcra/cercla-and-epcra-reporting-requirements-air-releases-hazardous-substances-animal-waste-farms> Subsequently cited as US EPA, CERCLA & EPCRA Reporting (n.d.), *op. cit.*
173. US EPA, CERCLA & EPCRA Reporting (n.d.), *op. cit.*
174. PK Hall (February 15, 2018). Bill introduced to exempt agriculture from CERCLA air emissions reporting. Columbus, OH: Ohio State University, College of Food, Agricultural, and Environmental Sciences. Retrieved 9-19-2026 from: <https://nationalaglawcenter.org/ohio-agricultural-law-blog-bill-introduced-exempt-agriculture-cercla-air-emissions-reporting/>

from Nebraska and Indiana. Senator Deb Fischer, a Republican from Nebraska, introduced S.2421 on February 13, 2018 after which the Senate "referred the bill to the Committee on Environment and Public Works."¹⁷⁵ According to Senator Fischer:

These reporting requirements were designed to apply to industrial pollution and toxic chemicals, not animal waste on a farm or ranch.¹⁷⁶

The US EPA rejoined the conversation at this point and reported the ensuing congressional action taken in response to the US Circuit Court's action in striking down a US EPA rule by passing a bill containing legislative (not EPA rule-making action) action to explicitly exempt agricultural operations from CERCLA reporting requirements for agricultural air emissions.

On March 23, 2018, the Consolidated Appropriations Act (Omnibus Bill) was signed into law. Title XI of Division S of the Omnibus Bill, known as the Fair Agricultural Reporting Method (FARM Act), amended CERCLA section 103(e) to exempt air emissions from animal waste at a farm from reporting under CERCLA.¹⁷⁷

The US Environmental Protection Agency then described the EPA's follow-up to the congressional action:

Due to the FARM Act's legislative amendments to CERCLA, "air emissions from animal waste at a farm" are exempt from reporting under CERCLA. Accordingly, on August 1, 2018, EPA published a final rule revising the CERCLA reporting regulations to incorporate the FARM Act's amendments to CERCLA.¹⁷⁸

For the reader's information, the unnamed circuit court ruling came in *Waterkeeper Alliance v. EPA* (2017).¹⁷⁹ The suit was filed as "Petitions for Review of Final Regulation Issued by the U.S. Environmental Protection Agency" to challenge the Final Rule established in 2008 by the US EPA that exempted agricultural operations of all sizes from reporting requirements under CERCLA and which exempted all such operations (except for large CAFOs) from the reporting requirements of EPCRA.¹⁸⁰ *Amici curiae* (friends of the court) briefs filed for the plaintiffs included the American Lung Association and the American Thoracic Society while the US Poultry and Egg Association acted as an "intervenor-respondent" for the EPA.¹⁸¹

The plaintiffs argued that the

Final Rule ran afoul of the underlying statutes [CERCLA and EPCRA] (and

175. Hall (February 15, 2018), *op. cit.*

176. Hall (February 15, 2018), *op. cit.*

177. US EPA, CERCLA & EPCRA Reporting (n.d.), *op. cit.*

178. US EPA, CERCLA & EPCRA Reporting (n.d.), *op. cit.*

179. *Waterkeeper Alliance et al. v. EPA*, 855 F. 3d 1154 (D.C. Cir. (2017)).

180. *Waterkeeper Alliance et al. v. EPA*, 855 F. 3d 1154 (D.C. Cir. (2017)).

181. *Waterkeeper Alliance et al. v. EPA*, 855 F. 3d 1154, 1155 (D.C. Cir. (2017)).

was therefore outside the EPA's delegated authority.¹⁸²

The three-judge panel for the federal circuit court found that:

The *Final Rule*, by cutting back on CERCLA reporting requirements, had the automatic effect of cutting back on EPCRA reporting and disclosure requirements. It thus deprives Waterkeeper of information, the public disclosure of which would otherwise be required by EPCRA.¹⁸³

The federal circuit court also found that public commenters on the proposed rule "undermin[ed] the EPA's primary justification for the rule –"

namely, that notifications of animal-waste related releases serve no regulatory purpose because it would be 'impractical or unlikely' to respond to such a release.¹⁸⁴

The three-judge circuit court concluded that "[t]he record therefore suggests the potentiality of some real benefits [of the original reporting requirements that agricultural operations report the release of toxic air emissions from animal waste to the federal government *a' la* CERCLA and to state and local governments *a' la* EPCRA].¹⁸⁵

The US Circuit Court of Appeals for the District of Columbia declared its ruling:

Because the EPA's action here can't be justified either as a reasonable interpretation of any statutory ambiguity or implementation of a *de minimis* exception, we grant Waterkeeper's petition and vacate the *Final Rule*. That necessarily moots Pork Producers' challenge to the CAFO carve-out; we therefore dismiss their petition.¹⁸⁶

As the US Circuit Court of Appeals for the District of Columbia overturned the EPA rule exempting CAFOs from reporting toxic air emissions by actions exceeding their authority, so congressional action nullified the federal circuit court's ruling by enacting legislation that explicitly authorized the former EPA rule. Such is the hold exercised by agricultural interests over the nation's legislative authority.

Perhaps a future Congress elected by an awakened electorate will need to re-examine Section 108(a)(1)(A) of the Clean Air Act that

[explicitly leaves the endangerment determination](#) [whether or not a substance is a sufficient danger to the public health as to require its being subsequently placed on the "Hazardous Air Pollution" list whereupon regulatory rules must be developed governing its emission] of Section 108(a)(1)(A) [up to the EPA](#)

182. Waterkeeper Alliance *et al.* v. EPA, 855 F. 3d 1154, 1156 (D.C. Cir. (2017).

183. Waterkeeper Alliance *et al.* v. EPA, 855 F. 3d 1154, 1163 (D.C. Cir. (2017).

184. Waterkeeper Alliance *et al.* v. EPA, 855 F. 3d 1154, 1170 (D.C. Cir. (2017).

185. Waterkeeper Alliance *et al.* v. EPA, 855 F. 3d 1154, 1170 (D.C. Cir. (2017).

186. Waterkeeper Alliance *et al.* v. EPA, 855 F. 3d 1154, 1171 (D.C. Cir. (2017).

Administrator's sole judgment.¹⁸⁷

After all, the Director of the US Environmental Protection Agency is a political appointee. And recent bodies of Congress have based their approval or disapproval of the president's nominees for office on ideological grounds instead of demonstrated abilities and a proven track record illustrating their competence to fulfill the duties of the office. I don't find any evidence that the writers of *The Federalist Papers* ever considered the possibility of a Congress not exercising its duty to serve as a check on unwarranted and unlawful exercises of presidential authority under our constitutional system of checks and balances.

Current Assessment of Particulate Matter (PM_{2.5}) in Iowa

Once again, thoughtful readers might interject with, "Wait a minute. Didn't the US EPA identify PM_{2.5} as a 'criteria pollutant,' and wasn't a NAAQS (National Ambient Air Quality Standard) developed for PM_{2.5}?"

Yes, PM_{2.5} is one of six "criteria pollutants" listed by the EPA.¹⁸⁸ And the National Ambient Air Quality Standard for PM_{2.5} is 35 µg/m³,¹⁸⁹ which is more than double the ambient air standard for PM_{2.5} set by the WHO (15 µg/m³).¹⁹⁰

And the thoughtful reader might respond, "Well, if that's the case, why hasn't the EPA reported exceedances of PM_{2.5} emissions from agriculture, particularly from CAFOs?"

And the response would be, "Perhaps you haven't heard that Congress passed a law exempting agriculture from any of the reporting requirements regarding the release of harmful substances under the federal CERCLA and EPCRA laws." Why monitor an emission that doesn't have to be reported as a violation? As a result, the EPA doesn't have any requirements for states to monitor agricultural air emissions of PM_{2.5}.

Iowa's plan for complying with the federal Clean Air Act requirements established by the US Environmental Protection Commission has only 7 monitors in place that the state operates by which they monitor only the major metropolitan areas according to the EPA rules currently in place:

EPA's population-based monitoring requirements for PM_{2.5} ... apply to metropolitan statistical areas (MSAs) and depend on the population of the

187. Zook *et al.* v. EPA, 52 F. Supp. 3d 69 (D.D.C. 2014), Decision, p. 7.

188. United States Environmental Protection Agency (n.d.). Criteria air pollutants. Website. Accessed 9-15-2026 at: <https://www.epa.gov/criteria-air-pollutants>

189. United States Environmental Protection Agency (n.d.). *NAAQS table*. Website. Accessed 9-17-2026 at: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

190. Agency for Toxic Substances and Disease Registry (June, 2024). Guidance for inhalation exposures to particulate matter, p. 8. Atlanta, GA: US Department of Health and Human Services, Public Health Service. Retrieved 9-17-2026 from: <https://www.atsdr.cdc.gov/pha-guidance/resources/index.html>.

MSA...¹⁹¹

As per current EPA rules, none of the monitors are placed in rural areas where agricultural emissions occur. Instead, they are placed in the major metropolitan areas as shown below:

MSA	Number of Monitoring Sites Required
Omaha-Council Bluffs, NE-IA	3 ***
Des Moines-West Des Moines, IA	2
Davenport-Moline-Rock Island, IA-IL	1 *
Cedar Rapids, IA	1
Iowa City, IA	1
Waterloo-Cedar Falls, IA	1
Sioux City, IA-NE-SD	1 **

* Obligation partially met by Iowa
** Obligation met by Iowa
*** Obligation met by Nebraska

Although Iowa's plan indicates a total of 10 monitors because three of its metropolitan areas sprawl over into neighboring states, Iowa only operates seven monitors.

Since all of the "State and Local Air Monitoring Stations" required by the Clean Air Act and enforced by the US EPA are only located in major metropolitan areas, they are in no position whatsoever to monitor rural agricultural emissions of PM_{2.5} from a host of activities – CAFOs, volatilization of CAFO slurry applied to crop fields, spraying of pesticides & herbicides, applications of anhydrous ammonia to crop fields, operation of diesel equipment for row-crop agriculture, diesel transport of animals, etc.

Contrast that with the 70 state monitors needed to measure air emissions from CAFOs at selected sites according to estimates by the Iowa Department of Natural Resources for implementing the "fake air standards" bill – House File 2523 – that Governor Vilsack vetoed.¹⁹²

And now one has some idea of the inadequacy regarding the EPA monitors' ability to detect PM_{2.5} emissions from CAFOs even if they wanted to.

191. Air Quality Bureau, Iowa Department of Natural Resources (n.d.). *Iowa ambient air monitoring 2024 network plan*, p. 5 No publisher or place of publication listed. Retrieved 10-02-2026 from:

<https://www.iowadnr.gov/environmental-protection/air-quality/monitoring-ambient-air>

192. Fiscal Services Division, Legislative Services Agency (March 31, 2004). *Fiscal note for HF 2523 - Health effects regulation*. No publisher or publishing location identified. Retrieved 6-25-2019 from the Iowa Legislature-Legislation-BillBook website for HF 2523, 80th General Assembly, Second Session at:

<https://www.legis.iowa.gov/legislation/BillBook?ga=80&ba=HF 2523>

Omission of Relevant Iowa-Based Material Pertaining to Environmental Air Quality

Introduction

Given the peer-reviewed, research-based deduction that

Air pollution remains the leading environmental health risk in the United States,¹⁹³

and given the equally peer-reviewed, research-based assertion that

PM_{2.5} -attributable mortality is the largest environmental risk factor in the U.S.,¹⁹⁴

it is difficult to understand the decision by the Iowa Environmental Council and the Harkin Institute people to reduce the discussion of particulate matter to two paragraphs instead of devoting at least one full chapter to the subject in order to help Iowans develop a richer and fuller understanding of particulate matter and its impact on public health. It becomes an even more perplexing decision when one examines the title of the IEC-Harkin (2026) report:

"Environmental Risk Factors ..."

In trying to understand the poor performance in dealing with the cited research by the author(s) of Section 5's short discussion on particulate matter, one thinks of the question posed by Nicholas Carr in his 2008 article in *The Atlantic*:

"Is Google Making Us Stupid?"¹⁹⁵

Perhaps that question provides a clue as to how those mistakes might possibly have been made by the Section 5 writer(s).

In *The Atlantic* article, Carr discussed Marshall McLuhan's work as a media theorist in the 1960s when McLuhan pointed out that media, besides providing "the stuff of thought," also shaped "the process of thought." Reflecting on that thought, Carr next shared his own experience with the internet and how he noticed its impact on his reading and thinking.

And what the Net seems to be doing is chipping away my capacity for concentration and contemplation. My mind now expects to take in information the way the Net distributes it: in a swiftly moving stream of particles. Once I was a scuba diver in the sea of words. Now I zip along the surface like a guy on a Jet Ski.¹⁹⁶

193. GBD 2019 Risk Factor Collaborators (October 17, 2020), *op. cit.* Cited in Bekbulat *et al.* (2025), p. 1648, *op. cit.*

194. Bekbulat *et al.* (2025), p. 1644, *op. cit.*

195. N Carr (July/August, 2008). Is Google making us stupid? What the Internet is doing to our brains. *The Atlantic*. Accessed 8-26-2018 at: <https://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/306868/>

196. Carr (2008), *op. cit.*

Carr subsequently cited a study by researchers at University College London who conducted a study of online research habits among an inter-generational cohort of students. According to Carr, the researchers reported that people

exhibited "a form of skimming activity," hopping from one source to another and rarely returning to any source they'd already visited. They typically read no more than one or two pages of an article or book before they would "bounce" out to another site.¹⁹⁷

Carr noted that the University College London researchers deduced from their study of the observed reading behavior that:

There are signs that new forms of "reading" are emerging as users "power browse" horizontally through titles, contents pages and abstracts going for quick wins.¹⁹⁸

The study's search of the literature on young people's use of computer technology found that the speed of young people's web searching means that little time is spent in evaluating information, either for relevance, accuracy or authority.¹⁹⁹

The actual published report that was cited by Carr in the preceding discussion, "The Google Generation: The Information Behaviour of the Researcher of the Future," found that young people

rely heavily on search engines, view rather than read, and do not possess the critical and analytical skills to assess the information that they find on the web.²⁰⁰

Those deficiencies look similar to the deficiencies already discussed regarding the work of the Section 5 author(s) in their two-paragraph discussion of particulate matter in the IEC-Harkin (2026) report, *Environmental Risk Factors and Iowa's Cancer Crisis*.

Finally, Carr drew attention to the work of Maryanne Wolf, then a developmental psychologist at Tufts University specializing in literacy development and cognitive neuroscience. While at Tufts, Wolf directed the Center for Reading and Language Research and authored the book,

197. Carr (2008), *op. cit.*

198. Carr (2008), *op. cit.*

199. I Rowlands & D Nicholas (January, 2008). *Information behaviour of the researcher of the future*. London: CIBER, University College London. Accessed 8-22-2026 at: https://www.researchgate.net/publication/272476871_GOOGLE_GENERATION_RESEARCH_AT_UNIVERSITY_COLLEGE_LONDON

200. I Rowlands, D Nicholas, P Williams, P Huntington, M Fieldhouse, B Gunter, R Withey, HR Jamali, T Dobrowolski, & C Tenopir (July 6, 2008). The Google generation: The information behaviour of the researcher of the future. *Aslib Journal of Information Management*, 60 (4): 290-310. doi: 10.1108/00012530810887953. Accessed 8-22-2026 at: <https://www.emerald.com/ajim/article-abstract/60/4/290/63382/The-Google-generation-the-information-behaviour-of?redirectedFrom=PDF>

*Proust and the Squid: The Story and Science of the Reading Brain.*²⁰¹ In Carr's view, Wolf worried about "the style of reading promoted by the Net, a style that puts 'efficiency' and 'immediacy' above all else," including deep understanding. According to Carr's paraphrase of Wolf:

When we read online, we tend to become "mere decoders of information." Our ability to interpret text ... remains largely disengaged.²⁰²

As one possible explanation for the inexplicable behavior by the author(s) of the particulate matter discussion, I believe that most readers would agree that the Section 5 writer(s) were certainly "disengaged" from the content of the research study being discussed. As the next sections of this analysis will demonstrate, it's most certain that the Section 5 writer(s) had no knowledge of the deep research base centered on CAFO operations and their harm to the public health. Otherwise the material represented by the following sections would have been included in the IEC-Harkin (2026) report.

201. M Wolf (2007, 2008). *Proust and the squid: The story and science of the reading brain*. New York: Harper Perennial, Paperback Division of Harper Collins Publishers.

202. Carr (2008), *op. cit.*

The Joint ISU-UI CAFO Air Quality Study

The Report

Iowa State University and The University of Iowa Study Group (February, 2002). *Iowa concentrated animal feeding operations air quality study: Final report*. Place of publication not identified.²⁰³

The report resulted from conversations between Governor Tom Vilsack and the presidents of Iowa State University and The University of Iowa in June, 2001, which set in motion the following chain of events. Governor Vilsack asked the two universities to provide assistance to the Iowa Department of Natural Resources (DNR) and the Environmental Protection Commission (EPC) in

addressing public health and environmental concerns arising from air emissions from concentrated animal feeding operations (CAFOs).²⁰⁴

Each president recommended that a particular college at their university be contacted by Jeffrey Vonk, Director of the Iowa DNR. Iowa State recommended the College of Agriculture, and The University of Iowa chose the College of Public Health. Iowa DNR Director Vonk subsequently requested that both colleges "provide guidance"

regarding the impacts of air quality surrounding CFOs [Concentrated Feeding Operations] on Iowans and recommended methods for reducing and/or minimizing emissions. Specifically I am asking your advice and recommendations on how the Department of Natural Resources should address this critically important public policy issue.²⁰⁵

Iowa DNR Director Vonk also posed five questions to be addressed by the ISU-UI Study Group. They appear below:²⁰⁶

- 1a) Based on analysis of peer-reviewed, duplicated, legitimate, published scientific research, is there direct evidence of harm to humans by emissions, byproducts, toxic waste, or infectious agents produced by CFOs?
- 1b) What human research is there to confirm the existence of disease and exactly what are the specific chemical, bacterial, or aromatic causes of such diseases?
- 2) Based on an analysis of peer-reviewed, duplicated, legitimate, and published

203. Iowa State University and The University of Iowa Study Group (February, 2002). *Iowa Concentrated Animal Feeding Operations Air Quality Study: Final Report*. Publisher and location published not listed. Available by accessing the following link to "Air Quality & Farm Operations," DNR website at: <https://www.iowadnr.gov/environmental-protection/air-quality/air-quality-farm-operations>. Then scroll down & click on "Miscellaneous Links." Then click on "Iowa concentrated animal feeding operations air quality study" for the pdf format of the study.

204. ISU-UI Study Group (2001), p. 4, *op. cit.*

205. ISU-UI Study Group (2001), p. 5, *op. cit.*

206. ISU-UI Study Group (2001), pp. 6-15, *op. cit.*

scientific research, what specific substances, including aromatic compounds, do you believe require regulatory action to protect the public?

- 3) Based on an analysis of peer-reviewed, duplicated, legitimate, and published scientific research, what would you recommend as Iowa or National consensus standards for any proposed substances to be regulated as emissions from CFOs?
- 4) What do you think should be done to address any other emerging issues with respect to industrial CFOs in Iowa?
- 5) Finally, I am seeking your recommendations regarding available methods of reducing or minimizing the emissions from CFOs and the impact of those emissions on the ambient air surrounding sites.

Each college dean at the two public universities began to assemble a team that would work to carry out the tasks assigned by representatives of the State of Iowa. Dean Richard Ross, College of Agriculture, Iowa State University added faculty from the College of Veterinary Medicine. Dean James Merchant, College of Public Health, The University of Iowa added faculty from the College of Medicine and from the College of Engineering. According to the foreword authored by the two college deans, the faculty teams

delved into existing research literature, developed a ten-chapter report on the various aspects of these issues and, through a series of meetings, developed responses to Director Vonk's five questions in the form of an Executive Summary ... [which] describes the consensus reached by the study group.²⁰⁷

The two college deans, each from a major public university, concluded with the following observations of the work that was done by the joint ISU-UI Study Group:

The report is based upon the best science available to ensure that ambient air is as free of risk as possible in order to protect health and the quality of life at the highest possible level. These science-based recommendations were generated with the goal of providing helpful guidance to the Iowa Department of Natural Resources and the Environmental Protection Commission. It is hoped that the report will provide a sound basis for the development of appropriate administrative rules that will promote confidence in agricultural production and the quality of life in rural Iowa.²⁰⁸

Well, who could want more? A government wishing to base its public policy on peer-reviewed, scientific research findings that have been published in the public arena of scientific discourse – all designed to protect the public health as well as promote public confidence in agricultural production practices that don't harm the public's health – my goodness!

207. ISU-UI Study Group (2001), p. 4, *op. cit.*

208. ISU-UI Study Group (2001), p. 4, *op. cit.*

Recommendations of the Joint ISU-UI Study Group

What did the ISU-UI Study Group recommend? Did they find any specific substances being emitted from CAFOs that required regulatory action in order to protect the public health? In a word, "Yes!"

The study, *Concentrated Animal Feeding Operations Air Quality Study: Final Report* (February, 2002), recommended that standards for the CAFO air emissions of hydrogen sulfide (H₂S), ammonia (NH₃), and odors be established in order to protect the public health.²⁰⁹ As announced and explained by the ISU-UI Study Group:

By consensus of the entire study group, the following substances should be considered for regulatory action: (1) hydrogen sulfide; (2) ammonia; and (3) odors.

The justification for regulatory action of these substances is based on:

- our assessment of the scientific literature (See Chapters 2.0 – 8.0),
- recommendations by pertinent federal agencies, and
- review of regulations established in other states (See Chapter 9.0).²¹⁰

Regarding the question of what standards should be imposed, the ISU-UI Study Group pointed out that the US EPA had

determined that simultaneous exposure of two substances such as hydrogen sulfide and ammonia (both pulmonary irritants) results in an additive effect. Thus, in order to protect against the adverse effects of such binary mixtures the exposure limit for each should be reduced accordingly [from what was recommended for each toxin as a singular exposure].²¹¹

The ISU-UI Study Group reported that their consensus recommendation (regarding where the measurements of hydrogen sulfide and ammonia should be taken) centered on the property line separating the CAFO property from a "residence or public use area."²¹² The joint university task force offered two considerations for odor measurement locations, one proposing that measurements be taken at "a residence or public use area," and another proposing that the measurements for odor be taken "at the CAFO property line."²¹³ The Donham *et al.* portion of the ISU-UI Study Group assigned to write Chapter 8 of the report on CAFO air emissions recommended the following air quality standards:²¹⁴

209. ISU-UI Study Group (2002), pp. 7-8, *op. cit.*

210. ISU-UI Study Group (2002), p. 7, *op. cit.*

211. ISU-UI Study Group (2002), p. 8, *op. cit.*

212. ISU-UI Study Group (2002), p. 8, *op. cit.*

213. ISU-UI Study Group (2002), p. 8, *op. cit.*

214. KJ Donham, PS Thorne, GM Breuer, W Powers, S Marquez, & SJ Reynolds (February, 2002). "Chapter 8. Exposure limits related to air quality and risk assessment." In ISU-UI Study Group (2002), p. 176, *op. cit.*

Hydrogen Sulfide (H₂S)	70 ppb (parts per billion) at the CAFO property line for a 1-hour time-weighted average (TWA) period and 15 ppb at the residence with the same TWA as the property line measurement. No more than 7 exceedances per calendar year (with notice to the residents and the DNR).
Ammonia (NH₃)	500 ppb at the CAFO property line and 150 ppb at the residence, both for a one-hour TWA. No more than 7 exceedances per calendar year with notice requirement.
Odor	Odor not to exceed 1:7 dilutions at the <u>receptor or public use area</u> . No more than 14 exceedances per calendar year (with notice requirements as mentioned previously. Additional consideration could be given for a 1:15 dilution at the <u>property line</u> .

The ISU-UI Study Group reached consensus on the proposals presented by the sub-group assigned to write the chapter focused on "exposure limits related to air quality and risk assessment," which included both recommendations regarding odor standards.²¹⁵

A Regulatory Anomaly – OSHA Exposure Standards for Toxins

The subgroup for Chapter 8 of the ISU-UI Study Group's *Iowa Concentrated Animal Feeding Operations Air Quality Study: Final Report* (2002) found that the following international and national public health agencies made recommendations regarding PELs (Permissible Exposure Limits) for both hydrogen sulfide (H₂S) and ammonia (NH₃) that could pertain to CAFO air emissions:

- the World Health Organization (WHO);
- the US Environmental Protection Agency (EPA); and
- the US Agency for Toxic Substances and Disease Registry (ATSDR).²¹⁶

Donham *et al.* (2002) explained the reasons behind their confidence in these public health agencies and their PEL findings. The National Academy of Sciences (NAS) conducted a systematic "evaluation of risk assessment processes performed by federal agencies to assure that regulations are based on best judgment and analysis of available scientific knowledge."²¹⁷

According to Donham *et al.* (2002),

The NAS recommends that risk assessment should be separate from policy aspects of risk management to help assure recommendations for protection on the public's health are not compromised by the political process.²¹⁸

According to Donham *et al.* (2002), the EPA "adopted its reference dose concentration

215. ISU-UI Study Group (2002), pp. 8-9, *op. cit.*

216. Donham *et al.* (2002); in ISU-UI Study Group (2002), p. 176, *op. cit.*

217. Donham *et al.* (2002); in ISU-UI Study Group (2002), p. 177, *op. cit.*

218. Donham *et al.* (2002); in ISU-UI Study Group (2002), p. 177, *op. cit.*

guidelines (RfD's) and analogous guidelines for respiratory exposures (RfC's) based on the NAS guidelines" and the ATSDR minimal risk levels (MRLs) determinations are developed through "a method similar to the EPA."²¹⁹

The Donham *et al.* (2002) subgroup of the ISU-UI Study Group must not have felt it necessary to explain why the recommendations of the World Health Organization findings were exemplary since they provided no explanation of the WHO procedures regarding PELs for hydrogen sulfide (H₂S) and ammonia (NH₃). Apparently the WHO is viewed by the scientific field as a rigorously science-based organization [See previous sections of this paper regarding discussion of the IARC, pp. 27-33 and p. 50-51].

However, the Donham *et al.* (2002) subgroup of the ISU-UI Study Group [discounted the US Occupational Safety and Health Agency \(OSHA\) recommendations](#) as a source of meaningful and relevant PELs for CAFO workers or for those living in proximity to CAFOs.²²⁰

Regarding OSHA occupational health exposure regulations, the PELs listed for the hazardous substances found in CAFOs is not highly relevant. The reasons are as follows:

1. The scientific literature documents that endotoxin is one of the most hazardous substances to CAFO workers.²²¹ However OSHA has no PEL standard for endotoxin.
2. The OSHA PEL for PM is based on a non-biologically active (nuisance) dust. However, the PM inside CAFOs is highly biologically active, (high concentrations of microbes, endotoxins, and glucan) and is hazardous at much lower levels than in the 10 mg/m³ published PEL.^{222,223}
3. The PELs are written assuming exposures to one toxic substance. CAFOs result in complex mixed exposures, which lowers the allowable exposure to each individual component of the mixture.^{129,130} Therefore, the OSHA or other recommended limits are not highly relevant. Although NIOSH, ACGIH, and AIHA are more stringent than OSHA, [they are still much higher than research findings indicate they should be to offer adequate worker protection in mixed exposure situations like CAFOs.](#) [Emphasis added]

In other words, higher limits for toxins permit higher health risks to individuals exposed to those

219. Donham *et al.* (2002); in ISU-UI Study Group (2002), pp. 177 & 176 respectively, *op. cit.*

220. Donham *et al.* (2002); in ISU-UI Study Group (2002), p. 173, *op. cit.*

221. R Rylander & RR Jacobs, Editors (1994). *Organic dusts: Exposure, effects, and prevention*. Boca Raton, FL: Lewis Publishers, CRC Press: pp. 219-232.

222. KJ Donham, LJ Scallon, W Popendorf, MW Treuhaft, & RC Roberts (July, 1986). Characterization of dusts collected from swine confinement buildings. *American Industrial Hygiene Association Journal*, 47 (7): 404-410.

223. KJ Donham, SJ Reynolds, P Whitten, JA Merchant, L Burmeister, & WJ Popendorf (1995). Respiratory dysfunction in swine production workers: Dose-response relationships of environmental exposures and pulmonary function. *American Journal of Industrial Medicine*, 27 (3): 405-418.

toxins. It should also be noted that earlier in their discussion, the authors discounted OSHA recommendations for another reason not listed above. The Chapter 8 authors of the ISU-UI Study Group (2002) report previously discussed four sources of "recommendations" for occupational exposure limits. The first three that they listed had no regulatory authority, possessing only the authority to recommend. The last source mentioned – OSHA – also possessed the power to regulate and enforce. According to the authors of Chapter 8, the three recommending authorities developed

science-based recommendations, and [were] not subject to the stakeholder pressures from the administration, industry, and labor, and other constituents groups, as is OSHA.²²⁴

In other words, when it was OSHA making the determination of the exposure limit, what may have begun as a science-based standard got watered down by outside pressures so that protecting individual workers' health and the public health took a back seat to private interests.

Presentation of the ISU-UI Study Group (2002) Report to the EPC²²⁵

At the February 18, 2002 meeting of the Iowa Environmental Protection Commission, DNR Director Jeffrey Vonk introduced the following UI and ISU faculty members to the Commission:

- James Merchant, Dean of the College of Public Health, The University of Iowa.
- Richard Ross, Former Dean of the College of Agriculture, Iowa State University.
- Wendy Wintersteen, Senior Associate Dean, College of Agriculture, Iowa State University.

Professor Merchant began by thanking *Emeritus* Dean Richard Ross from Iowa State for his leadership as the "lead dean" on the joint ISU-UI study. Merchant noted that 27 faculty members from both universities participated in the study. Professor Merchant also drew attention to the fact that the executive summary for the report "represents a consensus" and that "the full report represents the views of the individual authors." Dr. Merchant concluded by drawing attention to the fact that

the report [had been] subjected to peer review by national and international scientists.²²⁶

The EPC meeting minutes for February 18, 2002 also reported that both university deans, Ross and Merchant, answered questions about the report and the study group. The minutes do not record Senior Associate Dean Wintersteen as making any contributions or objections to the presentation by the deans of the two colleges.

224. Donham *et al.* (2002); in ISU-UI Study Group (2002), pp. 165-166, *op. cit.*

225. Environmental Protection Commission (February 18, 2002). *Minutes of the Environmental Protection Commission meeting, February 18, 2002*, p. 42. Accessed 8-27-2026 via e-mail from Renae Girdler, Administrative Assistant, Communication, Outreach & Education Outreach Bureau, Iowa Department of Natural Resources, Des Moines, IA. SEE NOTE: Introduction, "The DNR's Adoption of H₂S & NH₃ ..."

226. Iowa Environmental Protection Commission (February 18, 2002), p. 42, *op. cit.*

Significance of the ISU-UI (2002) Report re CAFO Air Emissions

One must keep in mind the state of the scientific research regarding CAFO air emissions at the time the ISU-UI Study Group (2002) conducted their review of scientific research and authored their report, *Iowa Concentrated Animal Feeding Operations Air Quality Study: Final Report*. While multiple studies existed demonstrating the harmful effects of CAFO air emissions on CAFO workers, on the families of CAFO owner/operators, and on nearby residents, the determination that PM_{2.5} constituted a health hazard resided in the future. The Iowa CAFO air emissions report appeared well before the IARC declared air pollution, particularly PM_{2.5}, to be carcinogenic to humans.

And while it was known that both ammonia (NH₃) and more than 100 VOCs were being emitted from CAFOs at the time the ISU-UI Study Group's research report appeared, it would require future research to demonstrate that ammonia and VOCs also acted as secondary precursors to PM_{2.5}, waiting to be transformed by atmospheric sunlight, water, and other substances into carcinogens.

And while the ISU-UI Study Group's report appeared after the Danish and Dutch peer-reviewed scientific research demonstrating that the use of antibiotics by the CAFO industry for growth promotion also promoted the development of antibiotic resistance in animals^{227, 228} and its transfer to humans.²²⁹ However, the ISU-UI Study Group's report just barely nosed out the first published US scientific research demonstrating connections between the use of antibiotics as a growth promoter for animals and the development of antibiotic resistance in humans.²³⁰

Of course, had not the work of Zahn *et al.* (2001) been censured by the Bush administration's USDA [See subsequent section "A Comparative Look at Two ISU Researchers"], that work demonstrating the presence of drug-resistant bacteria in CAFO air and in CAFO air emissions would have been publicly available to the ISU-UI research team.²³¹ However, although Zahn's research finding was the world's first, and since Zahn's research went unpublished and was therefore unofficial, Zahn's research discovery was not used in any official capacity by the ISU-UI Study Group team. Published and peer-reviewed research on the presence of antibiotic-

227. FM Aarestrup, F Bager, NE Jensen, MMA Meyling, & HC Wegener (January, 1998). Surveillance of antimicrobial resistance in bacteria isolated from food animals to antimicrobial resistance in bacteria isolated from food animals to antimicrobial growth promoters and related therapeutic agents in Denmark. *APMIS*, 106 (1-6): 606-622. doi: 10.1111/j.1699-0463.1998.tb013 91-x.

228. FM Aarestrup, H Kruse, E Tast, AM Hammerum, & LB Jensen (2000). Associations between the use of antimicrobial agents for growth promotion and the occurrence of resistance among *Enterococcus faecium* from broilers and pigs in Denmark, Finland, and Norway. *Microbial Drug Resistance*, 6 (1): 63-70.

229. AE van den Bogaard & EE Stobberingh (May, 2000). Epidemiology of resistance to antibiotics. Links between animals and humans. *International Journal of Antimicrobial Agents*, 14 (4): 327-335. doi: 10.1016/S0924-8579(00)00145-X.

230. DL Smith, AD Harris, JA Johnson, EK Silbergeld, & JG Morris, Jr. (2002, April 30). Animal antibiotic use has a early but important impact on the emergence of antibiotic resistance in human commensal bacteria. *Proceedings of the National Academy of Sciences*, 99 (9): 6434-6439. doi: 10.1073/pnas.082188899.

231. Zahn *et al.* (2001), *op. cit.*

resistant organisms in the interior air of CAFOS^{232, 233} and in CAFO air emissions²³⁴ would not be published in peer-reviewed scientific research journals until two, three, and four years after the work of the ISU-UI Study Group.

And not too long after the *Iowa Concentrated Animal Feeding Operations Air Quality Study: Final Report* was released in 2002, the researchers at the Bloomberg School of Public Health, Johns Hopkins University, released a study demonstrating the health risks incurred while driving down the highway following a truck transporting CAFO animals. The Johns Hopkins researchers recovered drug-resistant bacteria from the interior air and surfaces of the automobiles trailing the CAFO transport.²³⁵

A decade later, immediately preceding the IARC's scientific-based determination in 2013 that PM_{2.5} was a human carcinogen, the Kilburn study (2012) appeared which would lend further credence to the much-later Son *et al.* (2026) study that tied together residency in a CAFO-dense neighborhood and cancer risk. The preceding Kilburn (2012) study discovered that proximity to swine CAFOs impaired human neurobehavioral functions and pulmonary functions.²³⁶ As the reader will recall, evidence was presented earlier demonstrating that the Son *et al.* (2026) study didn't just appear out of thin air, but was built on a body of preceding peer-reviewed, science-based research studies [See preceding discussion in "The Yale University Research Study," pp. 7-16].

Also occurring in 2012, German researchers discovered air-borne drug-resistant organisms 150 meters downwind of a swine CAFO as well as in the soil that was 300 meters downwind of the same swine CAFO.²³⁷ If drug-resistant organisms can be air-borne for these distances, so also can particulate matter, thus providing further credence for the Yale University study by Son *et al.* (2016).

Work led by University of Iowa epidemiologist Tara Smith during the same time period found further evidence of the presence of air-borne MRSA and its deposition on wildlife habitat with

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- 232. A Chapin, A Rule, K Gibson, T Buckley, & K Schwab (2005, February). Airborne multidrug-resistant bacteria isolated from a concentrated swine feeding operation. *Environmental Health Perspectives*, 113 (2): 137-142. doi: 10.1289/ehp.7473.
 - 233. SG Gibbs, CF Green, PM Tarwater, & PV Scarpino (2004, November). Airborne antibiotic resistant and nonresistant bacteria and fungi recovered from two swine herd confined animal feeding operations. *Journal of Occupational and Environmental Hygiene*, 1 (11): 699-706. doi: 10.1080/15459620490515824.
 - 234. SG Gibbs, CF Green, PM Tarwater, LC Mota, KD Mena, & PV Scarpino (2006, July). Isolation of antibiotic-resistant bacteria from the air plume downwind of a swine-confined or concentrated animal feeding operation. *Environmental Health Perspectives*, 114 (7): 1032-1037. doi: 10.1289/ehp.8910.
 - 235. AM Rule, SL Evans, & EK Silbergeld (2008). Food animal transport: A potential source of community exposures to health hazards from industrial farming (CAFOs). *Journal of Infection and Public Health*, 1 (1): 33-39. doi: 10.1016/j.jiph.2008.08.001.
 - 236. KH Kilburn (2012). Human impairment from living near Confined Animal (Hog) Feeding Operations. *Journal of Environmental and Public Health*, 2012: 1-11. doi: 10.1155/2012/565690.
 - 237. J Schulz, A Friese, S Klees, BA Tenhagen, A Fetsch, U Rösler, & J Hartung (August, 2012). Longitudinal study of the contamination of air and of soil surfaces in the vicinity of pig barns by livestock-associated methicillin-resistant *Staphylococcus aureus*. *Applied and Environmental Microbiology*, 78 (16): 5666-5671. doi: 10.1128/AEM.00550-12.

her team's discovery of MRSA's presence in Central Iowa wildlife.²³⁸ Professor Smith also provided expertise for a following study, which found that residential proximity (within a one-mile radius) to CAFOs increased ("nearly tripled") the human health risk of being colonized by MRSA.²³⁹ These two studies involving Dr. Smith bookended a study coming out of Johns Hopkins University which found that residential proximity to fields on which CAFO waste slurry had been applied also increased the human risk factor of being colonized by MRSA.²⁴⁰

Just in case the reader thinks that being colonized by MRSA isn't really that bad, a team of researchers from the University of Chicago, the NorthShore University HealthSystem based in Evanston, and Ohio State University investigated that very possibility. They found that MRSA colonization detected upon hospital admission constituted a "significant risk factor for future MRSA *infection*." [Emphasis added]²⁴¹

But primarily, the ISU-UI Study Group's research report served as an immediate precursor to:

- the legislative authority for the DNR to establish ambient air standards for CAFO air emissions;
- the legislative authority for the DNR to regulate CAFO air emissions of hydrogen sulfide (H₂S), ammonia (NH₃), and odor; and
- the subsequent adoption of ambient air standards for the CAFO air emissions of hydrogen sulfide (H₂S), ammonia (NH₃), and odor by the Iowa Environmental Protection Commission for the Department of Natural Resources to regulate and enforce on behalf of the State of Iowa.

As troubling as the future nullification of those ambient air standards by the Iowa Legislature would be, the future action by the Iowa Environmental Council and the Harkin Institute to ignore this past Iowa-based research study and subsequent scientific, peer-reviewed research about the harms caused by CAFO air emissions would be equally troubling. The joint study, *Environmental Risk Factors and Iowa's Cancer Crisis*, by the IEC and the Harkin Institute both troubled and disappointed by not reporting the need to regulate agricultural air emissions that was clearly demonstrated by the Bekbulat *et al.* (2025) study.

238 SE Wardyn, LK Kaufman, & TC Smith (October, 2012). Methicillin-resistant *Staphylococcus aureus* in central Iowa wildlife. *Journal of Wildlife Diseases*, 48 (4): 1069-1073. doi: 10.7589/2011-10-295.

239. M Carrel, ML Schweizer, MV Sarrazin, TC Smith, & EN Perencevich (February, 2014). Residential proximity to large numbers of swine in feeding operations is associated with increased risk of methicillin-resistant *Staphylococcus aureus* colonization at time of hospital admission in rural Iowa veterans. *Infection Control and Hospital Epidemiology*, 35 (2): 190-193. doi: 10.1086/674860.

240. JA Casey, FC Curriero, SE Cosgrove, KE Nachman, & BS Schwartz (November, 2013). High-density livestock operations, crop field application of manure, and risk of community-associated methicillin-resistant *Staphylococcus aureus* infection in Pennsylvania. *JAMA Internal Medicine*, 173 (21): 1980-1990. doi: 10.1001/jamainternmed.2013.10408.

241. JP Ridgway, LR Peterson, EC Brown, H Du, C Hebert, RB Thomson, Jr., KL Kaul, & A Robicsek (November 20, 2013). Clinical significance of methicillin-resistant *Staphylococcus aureus* colonization on hospital admission: one-year infection risk. *PLoS One*, 8 (11): e79716. doi: 10.1371/journal.pone.0079716.

Immediate Reaction by Agricultural Interests Towards ISU Faculty Members of the Joint Task Force and the Task Force Findings

Retrospective vision is always 20/20. Looking back after a quarter century of seeing Big Ag flex its muscle to kill initiatives which threatened its ability to do what they wanted to do and not what somewhat else told them, we shouldn't be surprised. But 25 years ago, genuflecting to Big Ag was still in its infant stage in terms of public awareness compared to what happens today.

Immediately following the release of the Iowa CAFO Air Quality Study, the **Iowa Farm Bureau** demanded that Iowa State send the ISU researchers who worked on the report to their office in Des Moines "to get beat up," according to a University of Iowa study group member.

It was like, the next morning: "You be here tomorrow." They were livid.²⁴²

So much for the tradition of "independent research" at an institution of higher learning in Iowa. Two journalists described the current situation after criss-crossing the country interviewing scores of university researchers:

[A]cademia writ large is supposed to be independent. Scientists at public universities work for the taxpayers. Their research is supposed to be independent.

But over the past 30 years, as public funding for university research has dried up, private industry money has poured in. And with industry money comes industry priorities. Agribusiness has funded research that has advanced its interests and suppressed research that undermines its ability to chase unfettered growth... [I]nterviews with researchers across the US revealed stories of industry pressure on individuals, university deans and state legislatures to follow an agenda that prioritises business over human health and the environment.²⁴³

Later, in a meeting with state legislators, Wendy Wintersteen, Senior Associate Dean for the College of Agriculture at Iowa State University (later to become president of ISU), told the legislators that "her university was backing away from the report." The journalists revealed that Wintersteen had declined an offer to be interviewed for their story, "US academics feel the invisible hand of politicians and big agriculture."²⁴⁴ The journalists summarized what they found the current situation to be in higher education in the "Land of the Free":

Academic freedom appears increasingly conditional. But that's not the premise on which public research universities were founded. They are supposed to

242. K Cox & C Brown (January 31, 2019). US academics feel the invisible hand of politicians and big agriculture. As universities rely more on industry for funds, researchers taking a stand on health or environment say they are sidelined, p. 3. *The Guardian*. Accessed 2-07-2019 from: <https://www.theguardian.com/environment/2019/jan/31/us-academics-feel-the-invisible-hand-of-politicians-and-big-agriculture>.

243. Cox & Brown (January 31, 2019), p. 1, *op. cit.*

244. Cox & Brown (January 31, 2019), p. 3, *op. cit.*

prioritise the public interest. Arguably, ag-friendly universities have left that behind in favour of research that benefits their agribusiness benefactors.²⁴⁵

What happened next should have come as no surprise to those who carefully read the previous section of this analysis [See the previous section, "The National Pork Producers Promulgate a False Narrative," pp. 19-22]. An article in the *National Hog Farmer*, an industry-sponsored trade publication, cited an "anonymous" source from a single member of the ISU-UI Study Group saying that the report's "Executive Summary" did not represent any consensus by the study group's members.²⁴⁶ This despite assertions by multiple study group members that the Executive Summary "is really a consensus piece"²⁴⁷ and that "the collaborators [of the ISU-UI Study Group] had reached a consensus on the executive summary" and had "agreed on every word."²⁴⁸

What seems apparent is that the pork industry took a half-truth and tried to make it represent the entirety. The reader will recall that the sub-group assigned to write Chapter 8 of the ISU-UI Study Group (2002) study focused on possible substances that required regulatory oversight to protect the public health. The subgroup of Donham *et al.* (2002) unanimously agreed that hydrogen sulfide (H₂S), ammonia (NH₃), and odor needed to be regulated. They also unanimously agreed on what those standards should look like for hydrogen sulfide (H₂S) and ammonia (NH₃).

However, they failed to reach consensus on odor in terms of what the standard should be and where it should be measured, but they did reach consensus on agreeing to send BOTH proposals to the larger group. And the larger group did agree to include both proposals for odor in the final report. To recap what happened: The ISU-UI Study Group reached agreement on the hydrogen sulfide (H₂S) standard and where it should be measured; the ISU-UI Study Group reached agreement on the ammonia (NH₃) standard and where it should be measured; the ISU-UI Study Group failed to reach consensus ONLY on the single item of the odor standard and where it should be measured, but they [did reach consensus on sending both proposals for an odor standard forward](#) [See previous subsection, "Recommendations of the Joint ISU-UI Study Group," pp. 66-68].

So, either the reporter for the industry publication or "an anonymous member of the ISU-UI Study Group" gave impetus to the effort to turn a "half-truth" – the lack of consensus regarding what the odor standard should be while ignoring the consensus reached on H₂S, NH₃, and the agreement to send forward BOTH odor proposals – into a larger, false truth that the Executive Summary did not represent consensus.

Given the state of agribusiness influence on academic research as public dollars diminished and

245. Cox & Brown (January 31, 2019), p. 4, *op. cit.*

246. J Spiekerman-Carrothers (May 15, 2002). Iowa universities' air quality report causes a stir. *National Hog Farmer*. Accessed 6-14-2018 at: https://www.nationalhogfarmer.com/mag/farming_iowa_universities_air

247. Spiekerman-Carrothers (May 15, 2002), *op. cit.*

248. Cox & Brown (January 31, 2019), p. 3, *op. cit.*

as corporate dollars representing agribusiness influence rushed in to fill the vacuum in funding, and given the Iowa Farm Bureau's hostile reaction to the ISU-UI Study Group's (2002) report (accompanied by their unilateral demand to Iowa State administrators and their subsequent brow-beating of ISU researchers), and given the record of what happened next in this saga, should the "beating up" of university researchers who didn't toe the agri-business line, but instead fulfilled their obligations to the public interest be a surprise to anyone?

The Passage of Legislation Authorizing the DNR to Regulate CAFO Air Emissions – SF 2293

Navigating the Iowa Legislature's Website

NOTE 1: Accessing the House & Senate Journals is a multi-step process that may not be readily apparent. I've broken it down for the reader so you should be able to access them if you so wish.

- Go to: <https://www.legis.iowa.gov/legislation>
- On the bar at the top running from left to right, click on "Legislation."
- On the menu at the left-hand side of the page, click on "Senate & House Journals."
- On the main menu "Senate & House Journals," you should see a list for "Index List Archives" with choices for "Senate" or "House." Click on the one you want.
- You'll now be on the page for "Senate Journal Index." Directly underneath that heading you'll see a lighter-colored bar with the most recent legislative session listed. To the right of the wording, you'll see a "down" arrow. Click on that and scroll down to the General Assembly and Session you're interested in. Click on the entry you want and you'll be taken to a listing of Journals for that General Assembly and Session.

NOTE 2: Accessing the legislative bill involves other steps, which have been listed below.

- Go to: <https://www.legis.iowa.gov/legislation/BillBook>
- On the menu at the left titled "Bill Information." The first entry is "GA:" (General Assembly) with a down arrow you click on to scroll down to the General Assembly you want.
- Now that you have the GA you want, use the scroll down menu for either the Senate or the House to select the bill you wish. OR, you can simply use the "Name" function and type in the bill number you wish, *e.g.*, SF2293.
- Once you have the bill, you'll see information about the bill called "Bill History." To view the entire history, click on "Show All." Scroll down to the bottom to begin at the beginning of the bill's history. Each legislative action will list the journal page describing what action was taken in greater detail. To the right of the "Bill History," in the center of your computer screen, if you wish to see the final bill, there's a button to push.

Legislative Action²⁴⁹

With the study having been presented on February 18th to the Environmental Protection Commission, the governing body of the Iowa DNR, the ball was now in the Iowa Legislature's court of play. A week later, on February 25th, an unnumbered bill was introduced to the Iowa Senate (SJ 390). An unnamed committee reported to the Senate on the same day that the bill had received their approval.

A full month later the bill was referred to the Senate Agriculture Committee on March 25, 2002 (SJ 793). The following day the as-yet-numberless bill was sent to a subcommittee consisting of Senators Angelo, Behn, Fraise, Gaskill, & Kibbie (SJ 818). Another two weeks went by before the report from the Agriculture Committee was presented on April 9th as "recommending amendment and passage" (SJ 1056). The following day, April 10th, witnessed the filing of the recommended bill as amended by the Agriculture Committee – S-5437 (SJ 1056).

The next few days witnessed a flurry of activity with amendments to S-5437 being filed, withdrawn, defeated, adopted, and ruled out of order. The following chart presents some idea of legislative activity in both legislative chambers:

<u>Legislative Actions Taken</u>	<u>Senate</u>	<u>House</u>
Amendments Filed	35	10
Amendments Withdrawn	10	3
Amendments Defeated	13	7
Amendments Adopted	8	0
Amendments Ruled Out of Order	3	0

On April 10th the Senate passed S-5437 by a vote of 37-13 (SJ 1097) and sent it to the House. The following day (April 11th) the House officially received the message containing S-5437 and conducted the first reading of the proposed legislation. On April 12th the House substituted the Senate version (S-5437) for the House version (HF 2468). Later during the same day the House voted to approve S-5437 by an 81-13 vote. That same day the Iowa Legislature sent SF 2293 to Governor Vilsack whereupon the governor signed the legislation into law.

The Contents of SF 2293

What exactly did SF 2293 do? Many pages of the bill were devoted to definitions. The section in which we're interested begins on page 14 of the bill under the heading:

249. State of Iowa Legislature, 79th General Assembly, 2nd Regular Session (2002). *The bill book, bill history*. Des Moines, IA: Iowa Legislature. Accessed 9-05-2026 from: <https://www.legis.iowa.gov/legislation/BillBook?ga=79&ba=SF 2293> NOTE: Specific information regarding dates as well as links to material is contained in the bill history of SF 2293. References to Iowa Senate activities are contained in the Senate Journal (abbreviated as SJ & the page number in the minutes) while the Iowa House actions are recorded in the House Journal (abbreviated as HJ & the page). These journals are grouped according to the particular General Assembly and its session number being referenced.

Sec. 23. NEW SECTION. 455B.166. DEPARTMENT OF NATURAL RESOURCES -- DEVELOPMENT OF COMPREHENSIVE PLANS AND PROGRAMS FOR AIR QUALITY.²⁵⁰

The bill defined "airborne pollutant" as referencing "hydrogen sulfide, ammonia, or odor." Subsequently the bill directed the DNR to

conduct a comprehensive field study to monitor the level of airborne pollutants emitted from animal feeding operations in this state, including but not limited to each type of confinement feeding operation structure.²⁵¹

Following the field study's completion, the act stated that the DNR

may develop comprehensive plans and programs for the abatement, control, and prevention of airborne pollutants originating from animal feeding operations... The comprehensive plans and programs may be developed if the baseline data from the field study demonstrates to a reasonable degree of scientific certainty that airborne pollutants emitted by a confinement feeding operation are present at a separated location at levels commonly known to cause a material and verifiable adverse health effect.²⁵²

Here's where it became interesting because the legislation differentiated between "plans and programs" and an "air quality standard" and also stated that enforcement of any air quality standard couldn't occur before December 1, 2004:

The department [the DNR] may adopt any comprehensive plans or programs in accordance with chapter 17A prior to implementation or enforcement of an air quality standard, but in no event shall the plans and programs provide for the enforcement of an air quality standard or emission limitation prior to December 1, 2004.²⁵³

The new Sec. 23.3(b) stated that any standard for CAFO air emissions of hydrogen sulfide (H₂S), ammonia (NH₃), and odor needed to

be based on distances measured from a confinement feeding operation structure to a separated location.²⁵⁴

Previously the act had defined what a "separated location" meant:

"Separated location" means a location or object from which a separation

250. State of Iowa Legislature, 79th General Assembly, 2nd Regular Session (2002). *SF 2293: An act relating to animal agriculture*. Des Moines, IA: Iowa Legislature. Accessed 9-05-2026 from: <https://www.legis.iowa.gov/legislation/BillBook?ga=79&ba=SF 2293> Hereafter referenced as "SF 2293."

251. SF 2293, p. 14, Lines 15-19.

252. SF 2293, p. 14, Lines 21-31.

253. SF 2293, p. 14, Lines 31-37.

254. SF 2293, p. 14, Lines 40-42.

distance is required under section 455B.162, other than a public thoroughfare.²⁵⁵

Iowa Code 455B.162 Animal feeding operations---new construction and expansion's explanation of "separation distance" as

the minimum separation distance in feet required between an animal feeding operation structure and a residence not owned by the owner of the animal feeding operation, or a commercial enterprise, bona fide religious institution, or an educational institution.²⁵⁶

In common language, "separated location" refers to a dwelling, business, church, or school that is separate from a CAFO and is not owned by the CAFO's proprietor.

Getting back to SF 2293, Sec. 23.3(b) also stipulated that in enforcing the air pollution standards for CAFOs,

"[T]he department shall take all initial measurements at a separated location."²⁵⁷

By definition, this excludes measurements taken at the property line of the CAFO owner which was one of the locations recommended by the ISU-UI Study Group (2002) report, the other recommendation being "the residence."²⁵⁸

Sec. 23.3(b) also authorized the DNR to take "measurements at the property line of the separated location" should the department need to conduct an investigation following a departmental determination of a violation.²⁵⁹ This authorization recognized that the rights of adjacent property owners to be free from abusive practices by a neighboring CAFO owner are not limited to the adjacent property-owner's residence, but includes all of their property as determined by the location of the property line.

A new section, Sec.24 of 455.167 CIVIL PENALTY established that violations of CAFO air emissions standards would be

subject to a civil penalty which shall be established, assessed, and collected in the same manner as provided in section 455B.127.²⁶⁰

SF 2293 also contained a provision giving legal status to rules adopted by the Environmental Protection Commission and to orders from the Department of Natural Resources in implementing and enforcing the new CAFO air emission standards.

Any provision referring generally to compliance with the requirements of this chapter as applied to animal feeding operations also includes compliance with

255. SF 2293, p. 14, Lines 12-14.

256. Iowa General Assembly (n.d.). *455b.162 Animal feeding operations---new construction and expansion*. Accessed at: <https://www.legis.iowa.gov/DOCS/IACODE/1997/455B/162.html>

257. SF 2293, p. 14, Lines 43-45.

258. ISU-UI Study Group (2002), p. 176, *op. cit.*

259. SF 2293, p. 14, Lines 48-50.

260. SF 2293, p. 15, Lines 21-24.

requirements in rules adopted by the commission [the EPC] pursuant to this section, orders issued by the department [the DNR] as authorized under this chapter, and the terms and conditions applicable to permits or manure management plans under this subpart.²⁶¹

The remainder of the text of SF 2293 dealt with public notice of CAFO applications by county board of supervisors & opportunities for the public and the county supervisors to comment on the application, the Master Matrix for planning & approval decisions of CAFO applications (designed to ensure that "no CAFO owner gets left behind," according to John Logsdon and other Winneshiek County supervisors at numerous meetings in a parody of the federal education law, the No Child Left Behind Act), a new subsection focused on manure management plans, amendments regarding separation distances for CAFO structures, authorizing the DNR to develop construction design standards for formed manure storage structures, and other related matters.

Finally, SF 2293 concluded by including the texts and fates of proposed amendments to SF 2293 during the Iowa Senate's consideration of the bill as well as the name(s) of the state senator(s) submitting the amendment. Without conducting a detailed analysis, a surface examination would indicate that many of the proposed amendments to SF 2293 that were defeated or withdrawn were submitted by Democratic senator(s). An exception to that generalization would be the amendment proposed by Republican Senators King, Sexton, Houser, & Drake (S-5473) that would have permitted CAFO structures to be sited on land that was "part of a one hundred year floodplain."²⁶² That amendment was withdrawn and another amendment (S-5477) was proposed by Senator Steve King for the same purpose. That amendment was defeated.²⁶³

The Iowa DNR's Adoption of Hydrogen Sulfide (H₂S) and Ammonia (NH₃) CAFO Air Emissions Standards

Introduction

NOTE: Although the author of this analytic report was able to obtain the cited documents from the Iowa Department of Natural Resources in 2019, they are no longer publicly available on their current website. The public can currently access the public minutes of the Environmental Protection Commission, the governing body for the Iowa DNR, but only for as far back as the meetings in 2024-26.

First, due to the fact that the Iowa DNR no longer provides public electronic access to documents older than 2024, the reader will not be able to fact-check my analysis by independently accessing the public minutes of the Environmental Protection Commission for the time-period these events occurred. Should anyone wish to verify that what I am reporting is indeed accurate, they may contact the Iowa DNR via e-mail at: "dnr.records.request@dnr.iowa.gov", and departmental personnel will send you the documents you request.

261. SF 2293, p. 16, Lines 1-8.

262. SF 2293, p. 24 of Senate Clip Sheet, Lines 10-11.

263. SF 2293, p. 25 of Senate Clip Sheet, Lines 1-30.

Second, the minutes of the critical meeting of the Environmental Protection Commission on April 21, 2003 contain a historical review of pertinent actions pertaining to the adoption of ambient air standards for Iowa that was developed by the DNR's Environmental Services Division and were presented to the commission and attending public by Wayne Gieselman, the administrator for that division.²⁶⁴ Most of the events I will be describing are contained in that historical record presented to the EPC members at their public meeting on April 21, 2003. Unfortunately the majority of citations will refer to different pages of that single document instead of referencing the public documents for specific EPC meetings occurring prior to April 21, 2003 since those documents are not readily available to the public at this time, but must be requested.

Finally, it should be noted that the ambient air standards were proposed and adopted as "Administrative Rules" authorized by legislative action by the 79th General Assembly (2001-2002). The development of administrative rules establishing air quality standards and regulations for CAFO air emissions followed by public hearings on the proposed rules and regulations occurred during the interim period between the release of the ISU-UI Study Group (2002) report in February and the beginning of the steps taken to put ambient air standards regarding hydrogen sulfide (H₂S) and ammonia (NH₃) in place through the administrative rule-making process. The process is well worth examining as an exercise in democratic government.

**Release of the
2002 ISU-UI
Study Group
Report**

**Legislation Enacted Permitting
the DNR to Adopt Air Quality
Rules for CAFO Air Emissions to
Protect the Public Health**

**Administrative Rule Adopted
by the EPC re Ambient Air
Standards for CAFO Air
Emissions of H₂S & NH₃**

According to the history presented by Wayne Gieselman, Administrator of the Environmental Services Division of the Iowa DNR at the EPC's meeting on April 21, 2003:

In the final days of the 2002 legislature, Senate File 2293 was passed that created new Iowa Code section 459.207. This section provides additional instructions to the department regarding the implementation of air quality standards related to animal feeding operations.²⁶⁵

Actually, the references to Iowa Code sections without anchoring them in any informative context provide little meaningful information to us common citizens. However, JUSTIA U.S. Law provides some assistance in traveling the maze of Iowa Code references as they provide a list of all the "Section" headings under each particular "Chapter" reference with each heading serving as a live-button link to the actual text of each section. It turns out that multiple chapters exist, each with their own listing of "Sections" in the Iowa Code that pertain to natural resources

264. Environmental Protection Commission (April 21, 2003). *Minutes of the Environmental Protection Commission meeting, April 21, 2003*, p. 5. Accessed & retrieved 4-08-2019 from: <https://www.iowadnr.gov/About-DNR/Boards-Commissions/Environmental-Protection-EPC>

265. Environmental Protection Commission (April 21, 2003), p. 6, *op. cit.*

and agriculture. For example, :

- Iowa Code Title XI - Natural Resources.²⁶⁶
- Iowa Code Title XI - Natural Resources, Chapter 455A - Department of Natural Resources.
- Iowa Code Title XI - Natural Resources, Chapter 455B - Jurisdiction of Department of Natural Resources.
 - Iowa Code Title XI - Natural Resources, Chapter 455B - Jurisdiction of Department of Natural Resources, Section 133 - Duties.²⁶⁷
- Iowa Code Title XI - Natural Resources, Chapter 455E - Groundwater Protection.
- Iowa Code Title XI - Natural Resources, Chapter 459 - Animal Agriculture Compliance Act.
 - Iowa Code Title XI - Natural Resources, Chapter 459 - Animal Agriculture Compliance, Section 459.207 - Animal feeding operations – Airborne pollutants control.²⁶⁸

The authority for the Environmental Protection Commission to develop and adopt administrative rules regarding air pollution resides in Iowa Code section 455B.133:²⁶⁹

1. Develop comprehensive plans and programs for the abatement, control and prevention of air pollution in this state...
2. Adopt, amend, or repeal rules pertaining to the evaluation, abatement, control, and prevention of air pollution...
3. Adopt, amend, or repeal ambient air quality standards for the atmosphere of this state on the basis of providing air quality necessary to protect the public health and welfare and to reduce emissions contributing to acid rain pursuant to Tit. IV of the federal Clean Air Act Amendments of 1990.
4. Adopt, amend, or repeal emission limitations or standards relating to the maximum quantities of air contaminants that may be emitted from any air contaminant source. The standards or limitations adopted under this section shall not exceed the standards or limitations promulgated by the administrator of the United States environmental protection agency or the requirements of the federal Clean Air Act as amended through January 1, 1991.

NOTE: The preceding #4 highlighted in blue was not a part of the Iowa Code revision of Senate File 2293 enacted in 2002. This was added in 2003 (or later) following the legislative annulment of the administrative rule approved by the

266 JUSTIA U.S. Law (n.d.) *2025 Iowa Code*. Accessed 8-28-2026 from: <https://law.justia.com/codes/iowa/title-xi/>

267. JUSTIA U.S. Law (n.d.). *2025 Iowa Code*. Accessed 8-28-2026 at: <https://law.justia.com/codes/iowa/title-xi/chapter-455b/section-455b-133/>

268. JUSTIA U.S. Law (n.d.). *2025 Iowa Code*. Accessed 8-28-2026 at: <https://law.justia.com/codes/iowa/title-xi/chapter-459/>

269. JUSTIA U.S. Law (n.d.) *2025 Iowa Code*. Accessed 8-28-2026 at: <https://law.justia.com/codes/iowa/title-xi/chapter-455b/section-455b-133/>

EPC centered on ambient air quality standards for hydrogen sulfide (H₂S) and ammonia (NH₃) CAFO air emissions.

A Wrinkle Uncovered in the Iowa Code: The Non-Existence of Federal Standards for CAFO Air Emissions Renders the Second Sentence of Iowa Code section 455B.133(4) Moot

The Zook et al. v. EPA Lawsuit by Winneshiek County Residents

And though the agri-business community may be pleased with the highlighted portion, it's irrelevant. It is superfluous because neither the Clean Air Act nor the Environmental Protection Agency contain any standards regulating any CAFO air emissions – not for hydrogen sulfide (H₂S) or ammonia (NH₃), a secondary precursor to PM_{2.5} – and certainly not for methane (CH₄), a greenhouse gas, nor for PM_{2.5} (a carcinogen) nor for any of the 100+ Volatile Organic Compounds that are secondary precursors to carcinogenic PM_{2.5} nor for the antibiotic-resistant organisms that pose a public health threat.

The fact that neither the Clean Air Act nor the Environmental Protection Agency had standards regulating the CAFO air emissions of hydrogen sulfide (H₂S) or ammonia (NH₃) was confirmed by the 2014 decision of a federal district court for the District of Columbia in *Zook et al. v. EPA* (2014).²⁷⁰ In 2013, four Winneshiek County residents (Sam Zook, Birgitta Meade, Michelle McLain-Kruse, & Annette Laitinen) filed a federal lawsuit in the US District Court for the District of Columbia under the citizen suit provision of the federal Clean Air Act in 2013. The lawsuit sought a federal court order directing the EPA to

- designate air pollutants from AFOs, including ammonia and hydrogen sulfide, as criteria pollutants and to develop "ambient air quality standards for them."
- list AFOs as "stationary sources of air pollution" because they "endanger public health and welfare."²⁷¹

A committee of four Northeast Iowa residents coordinated the lawsuit endeavor: Bob Watson, a wastewater specialist, spearheaded the effort by identifying possible plaintiffs, recruiting attorney Wally Taylor to serve as legal counsel, and organizing fund-raising efforts; Larry Stone, a retired columnist and nature writer from the *Des Moines Register* assisted; Dick Janson, a retired public school educator, collected the 177 research studies supporting the legal effort; and John Hall, a retired newspaper editor, organized publicity.

Each plaintiff had standing to sue as either they or their children suffered constant exposure to CAFO air emissions by virtue of either being employed at, having attended, or having children attend the North Winneshiek K-5 school in rural northern Winneshiek County. North Winneshiek was surrounded by CAFOs and had actually served as one of two schools in a

270. *Zook et al. v. EPA*, 52 F. Supp. 3d 69 (D.D.C. 2014).

271. *Zook et al. v. EPA*, 52 F. Supp. 3d 69 (D.D.C. 2014), Plaintiffs' Brief.

research study examining the health effects inflicted by exposure to nearby CAFO air emissions.²⁷² The North Winneshiek K-5 school in NE Iowa served as the study school since it was situated within a half-mile distance from a CAFO while the control school was situated in East Central Iowa at a distance greater than 10 miles from the nearest CAFO. The study found that

children in the study school had a significantly increased prevalence of physician-diagnosed asthma [than did the children in the control school].²⁷³

Getting back to the lawsuit filed against the US EPA, US District Court Judge Richard J Leon ruled that the Clean Air Act

explicitly leaves the endangerment determination [whether or not a substance is a sufficient danger to the public health as to require its being subsequently placed on the "Hazardous Air Pollution" list] of Section 108(a)(1)(A) up to the EPA Administrator's sole judgment.²⁷⁴

The judge continued to lay the judicial groundwork for his next judicial determination:

In the absence of an affirmative determination made by EPA that particular AFO air pollutants endanger public health or welfare and result from multiple sources, there is no mandatory duty to include those pollutants on the Section 108(a)(1) list.²⁷⁵

According to Judge Leon:

Plaintiffs in this case do not allege, nor could they, that EPA already had determined that AFO pollutants satisfy the criteria in Section 108(a)(1)(A) and (B)... Therefore, there is no nondiscretionary duty that would allow plaintiffs to bring a claim under Section 304 to order EPA to list those pollutants under Section 108(a)(1).²⁷⁶

"In addition," Judge Leon continued:

the requirements under Sections 108(a)(2) and 109 for EPA to establish air quality criteria and NAAQS apply only to those pollutants listed under Section 108(a)(1). Thus, there is no nondiscretionary duty to issue such standards for pollutants EPA has not found to fulfill Section 108(a)(1)'s discretionary criteria.²⁷⁷

Next, Judge Leon determined that "the same reasoning and conclusion [just discussed also] apply

272. ST Sigurdarson & JN Kline (June, 2006). School proximity to concentrated animal feeding operations and prevalence of asthma in students. *Chest*, 129 (6): 1486-1491. doi: 10.1378/chest.129.6.1486.

273. Sigurdarson & Kline (2006), p. 1486, *op. cit.*

274. Zook *et al.* v. EPA, 52 F. Supp. 3d 69 (D.D.C. 2014), Decision, p. 7.

275. Zook *et al.* v. EPA, 52 F. Supp. 3d 69 (D.D.C. 2014), Decision, p. 8.

276. Zook *et al.* v. EPA, 52 F. Supp. 3d 69 (D.D.C. 2014), Decision, p. 8.

277. Zook *et al.* v. EPA, 52 F. Supp. 3d 69 (D.D.C. 2014), Decision, p. 8.

to plaintiffs' request that I order EPA to list AFOs as stationary sources [of air pollution] under Section 111."²⁷⁸

For those readers that don't experience legal reasoning on a regular basis, the foregoing may have been difficult to follow. Fortunately, we have an explanation in plain English that explains what transpired when *Zook et al.* (2014) entered Judge Leon's federal district courtroom. Julian Harrell, an environmental trial lawyer with Taft, set the stage by explaining events prior to the filing of the lawsuit:

Animal feeding operations (AFOs), which include ... CAFOs, emit a host of chemicals into the air, including ammonia, hydrogen sulfide, particulate matter and volatile organic compounds ("AFO emissions"). Air emissions studies have found a correlation between AFO emissions and potential negative health impacts...

Yet, despite knowledge of these studies, the United States Environmental Protection Agency has not made a finding that AFO emissions can "reasonably be anticipated to endanger public health or welfare." Therefore, the agency has not added AFO emissions to the list of pollutants under Section 108 of the Clean Air Act and has not established limits ... for the maximum allowable concentrations of AFO emissions.²⁷⁹

The Taft environmental law attorney described the filing of the lawsuit:

Several residents of Winneshiek County, Iowa, who – as it turns out – teach at, have attended or have children that attend a school that was the focus of one of the studies, sued the EPA to force the agency to regulate AFO emissions. They argued that the [Clean Air Act] places a "nondiscretionary duty" on the agency to regulate AFO emissions and to designate AFOs as stationary sources [of air pollution].²⁸⁰

Trial attorney Harrell explained the judge's decision:

[T]he United States District Court for the District of Columbia disagreed and held that the CAA does not impose a nondiscretionary duty on the EPA to regulate emissions from AFOs or to designate AFOs as emissions sources. Due to the lack of a statutory authority, the court dismissed the complaint for failure to state a claim for which relief could be granted under Federal Rule of Civil Procedure 12(b)(6).²⁸¹

An overlooked factor in US District Court's ruling is that Judge Leon accepted the findings of all

278. *Zook et al. v. EPA*, 52 F. Supp. 3d 69 (D.D.C. 2014), Decision, p. 9.

279. J Harrell (July 17, 2014). Clean Air Act does not require EPA to regulate emissions from animal feeding operations. *Environmental Law Insight*. Retrieved 2-24-2015 from: <http://taftlaw.com/news/publications/detail/1160-clean-air-act-does-not-require-epa-to-regulate-emissions-from-animal-feeding-operations>

280. Harrell (July 17, 2014), *op. cit.*

281. Harrell (July 17, 2014), *op. cit.*

177 peer-reviewed research studies as true. In the "Factual Background" portion of his ruling, the federal district court judge stated that "a number of scientific studies and reports have documented negative impacts from AFO air emissions." Judge Leon specifically listed four of the harmful CAFO air emissions: "ammonia, hydrogen sulfide, particulate matter, and volatile organic compounds." Following his listing, the federal court judge attached a footnote, which reads as follows:

For the purposes of analyzing this motion to dismiss under Federal Rule of Civil Procedure 12(b)(6), I take all of the factual allegations in the Complaint as true.²⁸²

The Zook *et al.* (2014) plaintiffs appealed to the Circuit Court of Appeals for the District of Columbia, whereupon a three-judge panel was assigned to hear the appeal.

Since the plaintiffs filed the appeal, they are now called "appellants." However the original plaintiffs still referred to themselves as plaintiffs in the legal brief arguing that the Circuit Court should grant the appeal. It's somewhat confusing to lay people. Briefly, the attorneys for Zook *et al.* argued that:²⁸³

1. The court must accept as factual the scientific evidence of the 177 research studies proving the harms to public health caused by the CAFO air emissions of hydrogen sulfide and ammonia since the District Court for the District of Columbia had so stated.
2. "The aforementioned studies conclusively prove that ammonia and hydrogen sulfide and animal feeding operations must be listed as criteria pollutants and stationary sources [of pollution], respectively."
3. As a result of this knowledge, the EPA has a "non-discretionary duty to list the specific pollutants and stationary source..." under the authority of §§ 108 and 109 of the Clean Air Act that say the EPA has a duty to
list pollutants that may reasonably be anticipated to endanger public health and welfare, and to establish ambient air quality standards for such pollutants.
4. By unlawfully ignoring the factual evidence contained in the 177 scientific research studies that the hydrogen sulfide and ammonia emitted from CAFOs create an "endangerment to public health and welfare," the EPA's actions constitute an "unreasonable delay in carrying out [its] duty." Such an action provides grounds for a citizen lawsuit, according to 42 U.S.C. § 7604.

The three-judge panel (Rogers, Tatel, & Srinivasan) forming the Circuit Court of Appeals for the District of Columbia upheld the decision of the District Court for the District of Columbia. In their ruling the three-member federal Circuit Court of Appeals pointed out:

282. Zook *et al.* v. EPA, 52 F. Supp. 3d 69 (D.D.C. 2014), Decision, p. 4.

283. Brief for Zook *et al.*, Zook *et al.* v. EPA, 611 F. App'x 725 (D.C. Cir. 2015).

But scientific evidence alone – even if the EPA is aware of the evidence – cannot give rise to a mandatory duty to regulate.²⁸⁴

The Circuit Court of Appeals concluded:

Because the plaintiffs are wrong in asserting that the Administrator has a nondiscretionary duty to list these pollutants and sources without the agency having made the prerequisite determinations, they do not state a claim for relief under the citizen-suit provision, and the district court properly dismissed their complaint.²⁸⁵

An appeal was submitted to the US Supreme Court, but the Court denied *certiorari*.²⁸⁶ An observer of the lawsuit articulated the argument that was made by the *Zook et al.* plaintiffs regarding the intent of the Clean Air Act, but which was an argument that failed court scrutiny due to the existing language of the current Act:

The purpose of the Clean Air Act is to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population. It is EPA's duty to fulfill this purpose. If EPA simply refuses to regulate air pollution from AFOs in spite of all the evidence, it is failing to carry out its duty. At present, the protection of the public from air pollution from AFOs is woefully inadequate, they say, citing Johns Hopkins University on the "gaps" in CAFO regulation and associated health risks.²⁸⁷

The John Hopkins University study referenced above was:

JP Fry, LI Laestadius, C Grechis, KE Nachman, & RA Neff (February, 2014). Investigating the role of state permitting and agriculture agencies in addressing public health concerns related to industrial food animal production. *PLoS One*, 9 (2): e89870. doi: 10.1371/journal.pone.0089870.

The Current US EPA Status re: Regulating CAFO Air Emissions

The reference in the Iowa Code to air quality standards in the federal Clean Air Act governing CAFO air emissions notwithstanding, the US Clean Air Act, with one exception that was immediately removed [see below], never contained any regulations or standards governing CAFO air emissions. Since the federal court's final determination that neither hydrogen sulfide (H₂S) nor ammonia (NH₃) had been listed by the EPA as "Hazardous Air Pollutants," neither pollutant has been so determined and listed in the years intervening between the 2014 federal court decision in *Zook et al.* and the present.

284. *Zook et al. v. EPA*, 611 F. App'x 725, 726 (D.C. Cir. 2015).

285. *Zook et al. v. EPA*, 611 F. App'x 725, 726 (D.C. Cir. 2015).

286. *Zook, et al. v. EPA*, 577 U.S. 958 (2015), *cert. denied*.

287. A. Lacey (February 12, 2015). Advocates claim EPA violating air law duty by not issuing CAFO rules, pp. 31-32. *Inside EPA's Clean Air Report*, XXVI (4): 1-38.

According to the federal point of view, since no EPA finding has been made that any of the CAFO air emissions present a danger to the public health and welfare, and since no EPA finding has been made that CAFOs constitute a source of those dangerous emissions, there exists no legal justification for placing any of the CAFO air emissions on the EPA's "Hazardous Air Pollution" list. As a result there exists no legal authority to regulate those dangerous CAFO air emissions from the federal point of view.

An examination of current listings of "Hazardous Air Pollutants" by the US EPA reveals that NONE of the hazardous CAFO air emissions are listed.²⁸⁸ To the careful reader who recalls the previous section of this analysis, "The US Environmental Protection Agency (EPA) and the IARC," this current state of affairs will come as no surprise. What is surprising is that hydrogen sulfide (H₂S) was originally listed by Congress in the original Clean Air Act as one of the 189 hazardous air pollutants to be regulated [CAA, section 112(b)(1)]. However, a note under the heading "HAP Delisting History," informs us that

Hydrogen sulfide was added to the original list inadvertently but removed by Congress with Presidential approval in 1991.²⁸⁹

Currently only 188 pollutants are listed by the US EPA as "Hazardous Air Pollutants." Also of interest is the procedure mandated by the Clean Air Act for the EPA to follow after a substance is listed as a HAP:

CAA section 112(c) directs the EPA to first identify and list source categories that emit HAP and then to set emission standards for those listed source categories under CAA section 112(d). Standards promulgated under CAA section 112(d) are commonly referred to as National Emission Standards for Hazardous Air Pollutants (NESHAP).²⁹⁰

So both the federal court case, *Zook et al. v. EPA* (2014) plus a current examination of the EPA web site confirms that neither the Clean Air Act nor the US EPA listed any of the substances contained in CAFO air emissions as pollutants nor have ambient air standards been developed for any of those same substances in CAFO air emissions (with the exception of PM_{2.5} from which agriculture has been exempted, as discussed previously). As a result the following portion of Iowa Code section 455B.133(4) is rendered moot by the absence of such limiting standards:

The standards or limitations adopted under this section shall not exceed the standards or limitations promulgated by the administrator of the United States environmental protection agency or the requirements of the federal Clean Air Act as amended through January 1, 1991.

288. United States Environmental Protection Agency (n.d.). *Initial list of hazardous air pollutants with modifications*. Website. Accessed 9-13-2026 at: <https://www.epa.gov/haps/initial-list-hazardous-air-pollutants-modifications>.

289. United States Environmental Protection Agency (n.d.). *Amendments to the list of Hazardous Air Pollutants (HAP) of section 112(b) of the Clean Air Act (CAA)*. Website. Accessed 9-13-2026 at: <https://www.epa.gov/haps/amendments-list-hazardous-air-pollutants-hap-section-112b-clean-air-act-caa>

290. *Ibid.*

EPC & DNR Activities Implementing the Administrative Rule-Making Process

March 18, 2002 EPC Meeting

At the March 18, 2002 meeting of the EPC, Mike Valde, the Division Administrator of the DNR's Environmental Protection Division, presented the initial stages of a plan being developed that will be "based on recommendations included in the ... Iowa Confined Animal Feeding Operations Air Quality Study (Final Report)" that was previously presented to the EPC members at their February meeting. According to Mr. Valde, the plan will include the following:²⁹¹

- 1) A schedule for adopting rules related to ambient air quality standards for hydrogen sulfide, ammonia, and odor,
- 2) An ambient air quality monitoring strategy,
- 3) An estimate of the resources necessary to implement the plan.

A member of Iowa Citizens for Community Improvement, Larry Ginter, voiced concerns about having "to wait two years before the Department can enforce the clean air standards." DNR Director Vonk responded to the concern by stating

that once the standard is set through the rulemaking process the Department would do its best within its resources to respond to complaints. In the meantime there will need to be monitors to determine whether or not there are exceedances to the standards.²⁹²

July 22, 2002 EPC Meeting

The Business of the Meeting Pertaining to Rulemaking

At the July 22, 2002 EPC meeting, Division Administrator for the Environmental Services Division of the DNR, Wayne Gieselman, presented information about preparations for a "Notice of Intended Action" (NOIA) regarding rulemaking for establishing an "Ambient Air Sampling Manual."²⁹³ According to Mr. Gieselman:

- the manual would contain a variety of details that would enable the DNR to determine "compliance with hydrogen sulfide and ammonia standards after December 1, 2004."
- A "Technical Advisory Group" had been formed "to assist with determining monitoring instrumentation and methodology for the confined animal feeding operations (CAFO) comprehensive field study mandated in Iowa Code Section

291. Environmental Protection Commission (March 18, 2002). *Minutes of the Environmental Protection Commission meeting, March 18, 2002*, pp. 22-23. Accessed 8-27-2026 via e-mail from Renae Girdler, Administrative Assistant, Communication, Outreach & Education Outreach Bureau, Iowa Department of Natural Resources, Des Moines, IA. SEE NOTE: Introduction, "The DNR's Adoption of H₂S & NH₃ ..."

292. Environmental Protection Commission (March 18, 2002), p. 23, *op. cit.*

293. Environmental Protection Commission (July 22, 2002). *Minutes of the Environmental Protection Commission meeting, July 22, 2002*, pp. 22-23. Accessed 8-27-2026 via e-mail from Renae Girdler, Administrative Assistant, Communication, Outreach & Education Outreach Bureau, Iowa Department of Natural Resources, Des Moines, IA. SEE NOTE: Introduction, "The DNR's Adoption of H₂S & NH₃ ..."

455B.166."

- The Technical Advisory Group had met twice at the Air Quality Bureau – on June 11 and on June 25.
- Iowa Code Sections 455B.133(3) & 455B.133(4) provided statutory authority for the Environmental Protection Commission "to establish ambient air quality standards and emissions standards on the basis of providing air quality necessary to protect the public health and welfare."

At the same July, 2002 meeting of the Iowa Environmental Protection Commission, the agenda provided a public comment period, which proved to be interesting. First, Bob Uetz, Chair of Iowans for Community Improvement, spoke.²⁹⁴ He observed that the ISU-UI Study Group (2002) report recommended two measurement sites for measuring CAFO emissions – "at the property line, and at the residence or public use area." Mr. Uetz thought "just measuring at the residence is not adequate."

Lisa Davis Cook, EPC member, explained that the difference between the proposed rules and the rules recommended by the ISU-UI Study Group (2002) report had been explained to her.

According to Ms. Davis Cook:

[T]he Department has omitted the fence line standard recommended by the university study because it was precluded by legislation. In addition the Legislation [sic] mandates that enforcement could not take place until 2004.²⁹⁵

DNR Director Jeff Vonk referenced the 2002 legislation, SF2293, that provided authorization for the Iowa DNR to proceed with implementing air quality standards for CAFO air emissions as well as engaging in the rulemaking process for developing new rules to be incorporated in the Iowa Administrative Code. According to Director Vonk:

SF 2293 is landmark legislation that is very comprehensive and provides clear guidance to the Department as to what direction to take.²⁹⁶

**Remarks by the Agricultural Sector and Applying
Critical Thinking, "Crap-Detecting," & Fact-Checking Principles**

Craig Hill, Vice President of the Iowa Farm Bureau Federation, also spoke. Mr. Hill questioned

whether the Department of Natural Resources has the legal authority to move forward with this rulemaking prior to conducting a field study that would show excessive hydrogen sulfide and ammonia emission levels from an animal feeding operation are present at a residence, church, business or school.²⁹⁷

Perhaps Mr. Hill was not present when Mr. Gieselman informed the EPC members of their legal

294. Environmental Protection Commission (July 22, 2002), p. 35, *op. cit.*

295. Environmental Protection Commission (July 22, 2002), p. 36, *op. cit.*

296. Environmental Protection Commission (July 22, 2002), p. 36, *op. cit.*

297. Environmental Protection Commission (July 22, 2002), pp. 37-38, *op. cit.*

authority to establish air quality standards for CAFO air emissions and to engage in appropriate rulemaking as authorized by Iowa Code Sections 455B.133(3) & 455B.133(4) [See previous discussion in this section].

While Mr. Hill had previously announced he was speaking on behalf of "the Responsible Air Quality Coalition," [as if the ISU-UI Study Group was opposed to "Responsible Air Quality," as if all of the peer-reviewed science-based research reports cited by the CAFO air quality study were irresponsibly opposed to "Responsible Air Quality, as if the legislators who enacted SF2293 were opposed to "Responsible Air Quality, as if the Environmental Protection Commission was opposed to "Responsible Air Quality] he next spoke about the fact that SF2293 "came about through somewhat of a secretive process" since the Iowa Farm Bureau Federation had not been "included in the meetings [developing the legislation], so they were not aware of what was being proposed until the final days." As if the Iowa Farm Bureau deserved the special treatment he was mentioning – a hand in developing statutory authority that would regulate CAFO air emissions endangering the public health.

And, of course, the supposedly "citizens' group," which Mr. Hill announced he was speaking for, the **Responsible Air Quality Coalition**, was not a citizens' group, but in reality a front group for a coalition of "nine farm groups in Iowa."²⁹⁸

Apparently the group never registered as either a business or as a non-profit with the [Iowa Secretary of State Office](#) since both a computer search of their listings and a phone call with one of their employees on September 3, 2026 failed to find a listing for the **"Responsible Air Quality Coalition."**

A phone call to the [Iowa Ethics and Campaign Disclosure Board](#) produced a call-back saying their records didn't contain any information about the **"Responsible Air Quality Coalition."** I subsequently received an email from their office confirming they couldn't find any information about the group, but also explaining that the [IECDB](#) doesn't have "digital registration records from 2002."²⁹⁹ Mr. Lee attached a spread sheet containing data for "our registered committees and entities." He also reported that he had examined the records maintained by the [Iowa Legislature](#) for lobbyist registrations, but stated he was unable to find any record of the **"Responsible Air Quality Coalition."**³⁰⁰ Penultimately, in his e-mail Mr. Lee provided links to the Iowa Legislature's "Lobbyists Reports" site as well as to the [IECDB's](#) "Web Reporting System" and to the "State Archives" website, which is part of the State Historical Society of Iowa's website.³⁰¹ And finally, Mr. Lee provided an explanation about who has to register and who doesn't have to register with the [Iowa Ethics and Campaign Disclosure Board](#).

298. Associated Press (July 25, 2002). Citizens' group fighting proposed air quality standards. *Post Bulletin* [Rochester, MN]. Retrieved 9-02-2026 from: <https://www.postbulletin.com/news/citizens-group-fighting-proposed-air-quality-standards>

299. Alexander Lee, Ethics Counsel, Iowa Ethics and Campaign Disclosure Board (September 8, 2026). Personal communication.

300. A Lee (September 8, 2026), *op. cit.*

301. A Lee (September 8, 2026), *op. cit.*

All state and local committees in Iowa are required to register with the [Iowa Ethics and Campaign Disclosure Board](#) after accepting over \$1,000 in contributions or making over \$1,000 in expenditures for qualifying express advocacy activities in a given calendar year. This would exclude federal committees (e.g. a campaign committee for a U.S. Senate candidate) and any groups which are under the \$1,000 threshold.³⁰²

Phone calls to the [Iowa Legislature](#) regarding lobbyist registrations for legislative lobbying and for executive lobbying went unanswered. E-mails were sent to Charlie Smithson (Iowa Senate lobbying) and to Meghan Nelson (Iowa House lobbying), both at the [Iowa Legislature](#), regarding the group. Charlie Smithson sent back a helpful reply which permitted me (and will permit the reader as well) to access both the Senate & House Journals for the 79th General Assembly, 2nd Session as well as for the 80th General Assembly, 1st Session (or for any GA session).³⁰³ Even though I received no reply to my inquiry regarding legislative lobbying registrations and for executive lobbying registrations from either Mr. Smithson or Meghan Nelson at the [Iowa Legislature](#), I did receive that information from Mr. Lee at the [Iowa Ethics and Campaign Disclosure Board](#).

Finally, a woman named Cindy at the [Iowa Farm Bureau Federation](#) called back to follow up on an earlier phone conversation. She reported checking with some people in the office about the group. She was unable to find anything out about the "[Responsible Air Quality Coalition](#)" and was advised to tell me to check with the Iowa Environmental Council. Besides not being a citizens' advocacy group, besides being an industry-advocacy group in disguise as a citizens' advocacy group, the "[Responsible Air Quality Coalition](#)" appears never to have existed a quarter-century ago except for some musty old minutes of an EPC meeting that no longer exist as an online resource and a vague newspaper entry in an out-of-state medium-sized-media outlet.

For a point of comparison, the Iowa Environmental Council, a nonprofit group consisting of multiple environmental organizations in Iowa is currently registered with the Iowa Secretary of State's office. According to their filings, they renamed their former group (Concerned Citizen's Council) to reflect its current name (Iowa Environmental Council) on February 16, 1995.³⁰⁴ If the group "[Responsible Air Quality Coalition](#)," a group similar in nature to the Iowa Environmental Council, had registered with the Secretary of State's Office, their records would be there. They are not.

The surprise speaker (at least to this author) was Dr. Dwaine S. Bundy, ISU professor in the Department of Agricultural and Biosystems Engineering, who served as a participant in the ISU-

302. Alexander Lee, Ethics Counsel, Iowa Ethics and Campaign Disclosure Board (September 11, 2026). Personal communication.

303. Charlie Smithson, Iowa Legislature (September 10, 2026). Personal communication.

304. Iowa Secretary of State, Business Entity Search (n.d.). *Business entities results: Iowa Environmental Council*. Accessed 9-11-2026 at: <https://sos.iowa.gov/search/business/search.aspx>; conducted search for "Iowa Environmental Council"; clicked on entry for "Iowa Environmental Council" whose legal name was "Concerned Citizens's [sic] Council" with Business No. of 144245; clicked on "144245; accessed history of the organization by clicking on the heading "Filings"; then selected filing titled "Name Amendment."

UI Study Group. Dr. Bundy helped co-author two chapters of the ISU-UI Study Group (2002) report – "Chapter 4. Emissions and Community Exposures from CAFOs"³⁰⁵ and "Chapter 6.3 Human Health Effects."³⁰⁶ However, Professor Bundy did not author the chapter dealing with exposure limits to toxins – "Chapter 8. Exposure Limits Related to Air Quality and Risk Assessment"³⁰⁷ – a topic on which he centered his remarks to the EPC members and public attending the July 22, 2002 meeting of the Iowa Environmental Protection Commission.³⁰⁸

It was surprising to encounter Dr. Bundy in this other role, that of water carrier for Industrial Agriculture, a role that discarded scientific objectivity in favor of gratifying the desires of a for-profit economic sector. And what exactly was it that Professor Bundy opposed in this new role? Remember the OSHA standards that were dismissed by the authors of Chapter 8 in discussing exposure limits to toxins – the OSHA standards that were found faulty by peer-reviewed science-based research, the OSHA standards that failed to account for exposures to multiple toxins simultaneously, the OSHA standards that failed to equal the EPA standards that did account for simultaneous exposure to multiple toxins and did consider the synergistic effects of simultaneous exposure to multiple toxins [See previous section, "A Regulatory Anomaly"]? Dr. Bundy spoke in favor of the OSHA standards.

How did he explain that preference? By misrepresenting the evidence through taking a truth, or in some cases two, and then adding a falsehood that distorts what really was discussed or examined. Let's examine the first example. According to Dr. Bundy, the proposed limits for CAFO air emissions of hydrogen sulfide (H₂S) and ammonia (NH₃) by the ISU-UI Study Group

were based on the assumption that both hydrogen sulfide and ammonia would be present **at equal toxic levels**.³⁰⁹

That is false. The authors of Chapter 8 in the ISU-UI Study Group (2002) report did discuss the fact that both hydrogen sulfide and ammonia were present in CAFO air emissions. However, the authors of Chapter 8 discussed the exposures to CAFO air emissions in terms of "complex mixed exposures, which lowers the allowable exposure to each individual component of the mixture."³¹⁰ The mixture was never discussed in terms of each toxic substance being present in "equal toxic levels." Instead the mixture discussed in the ISU-UI Study Group (2002) report was "complex." So, Dr. Bundy took a truth (the discussion of hydrogen sulfide and ammonia) and combined it with a lie [being present together in equal amounts] to misrepresent the work of the university faculty members in the ISU-UI Study Group writing Chapter 8.

Second, let's examine another direct example of distorting the evidence via the trick of combining a truth or two with a falsehood. According to Dr. Bundy's statement to the EPC as

305. ISU-UI Study Group (2002), p. 45, *op. cit.*

306. ISU-UI Study Group (2002), p. 121, *op. cit.*

307. ISU-UI Study Group (2002), p. 164, *op. cit.*

308. Environmental Protection Commission (July 22, 2002), pp. 37-38, *op. cit.*

309. Environmental Protection Commission (July 22, 2002), p. 36, *op. cit.*

310. Donham *et al.* (2002); In ISU-UI Study Group (2002), p. 173, *op. cit.*

recorded in the EPC minutes for their meeting of July 22, 2002, Dr. Bundy

believed that the method used by OSHA, which involves a simple calculation, would be the more appropriate method because some livestock and poultry management systems may generate more of one toxic gas and **essentially none of the other**.³¹¹

While it is true that the calculations of the OSHA method are simpler compared to the EPA method which treats "mixed exposures" [involving differing toxins] as "additive," and while it is true that different types of CAFOs may generate differing levels of toxins, it is NOT TRUE that there exists a single CAFO in the world that generates "essentially none," especially with regard to hydrogen sulfide (H₂S) and ammonia (NH₃).

And what Dr. Bundy omits is the caution uttered by the authors of Chapter 8 that the additive approach used by the EPA and other organizations may not be sufficient. According to the university faculty researchers who authored Chapter 8:

There may be instances when the effects of two substances are greater than additive, defined as a synergistic interaction. If synergy is present, then mixed exposures are even more hazardous than if the effects were merely additive. Such a relationship between NH₃ in CAFOs has been defined by Cumro and Donham, (in press).³¹²

The Donham *et al.* (2002) research cited above was indeed published. According to the study's abstract:

Synergy of simultaneous dust and ammonia exposures in a working environment raises the question of redefining exposure limits for organic dust and ammonia when workers are exposed simultaneously to these substances.

Control of both dust and ammonia in livestock facilities is extremely important. Lack of control of both these contaminants will increase the risk of respiratory dysfunction to all exposed to this environment, including workers and veterinarians.³¹³

**A Comparative Look at Two ISU Researchers Working on CAFOs –
Dwaine Bundy & James Zahn**

The differing choices made by Drs. Bundy and Zahn revealed two different research pathways – one path guaranteeing research funding and safe employment, the other path leading to being silenced and exiled from the world of academia.

The average person is probably wondering what to make of all the preceding material. One

311. Environmental Protection Commission (July 22, 2002), p. 36, *op. cit.*

312. Donham *et al.* (2002); In ISU-UI Study Group (2002), p. 174, *op. cit.*

313. KJ Donham, D Cumro, & S Reynolds (2002). Synergistic effects of dust and ammonia on the occupational health effects of poultry production workers. *Journal of Agromedicine*, 8 (2): 57-76. doi: 10.1300.J096v08n02_09.

knows to be wary of talk from a corporate spokesperson for any private interests^{314, 315, 316, 317, 318, 319} such as the Farm Bureau, which has a long history of resisting government regulation that protects the public's well-being by carving out special exemptions for agricultural operations, e.g.

- receiving special designation as a "nonpoint source of pollution" by the US Clean Water Act;
- being exempted from the age and hour limits placed on industry by the 1938 US Fair Labor Standards Act;
- being explicitly exempted by the FARM Act of 2018 from having to report hazardous air emissions from animal waste under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act);
- not being explicitly declared exempt by statutory language, but for practical purposes being exempt via the statutory definition of "major source" as most, but not all, agricultural operations fall below the size required to be a "major source," and are thus rendered "exempt" from most of the Clean Air Act's "regulatory programs."³²⁰

But university professors at public universities with their salaries and benefits provided for by taxpayer dollars?

It turns out that Dr. Bundy specialized in "odors" from agriculture.^{321, 322} However, the groundbreaking work in that field had already been accomplished by James Zahn, a researcher who shared a joint appointment with the National Swine Research Center, USDA Agricultural Research Service (ARS-USDA), Ames, Iowa, and the Department of Microbiology at Iowa State. Dr. Zahn's leadership produced three critical research studies that:

- 1) identified 27 malodorous VOCs emitted from swine waste that were responsible for the odor;³²³

314. R Carson (1962, repr. 1994). *Silent spring*. Boston: Houghton Mifflin.

315. N. Goodwin, Author & Producer (1992). *The American Experience: Rachel Carson's silent spring*, DVD. Boston: WGBH/PBS.

316. JB Judis (2000). *The paradox of American democracy: Elites, special interests, and the betrayal of the public trust*. New York: Routledge.

317. D Michaels (2008). *Doubt is their product: How industry's assault on science threatens your health*. New York: Oxford University Press.

318. N Oreskes & EM Conway (2010). *Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming*. New York: Bloomsbury Press.

319. C Gillam (2017). *Whitewash: The story of a weed killer, cancer, and the corruption of science*. Washington, DC: Island Press.

320. The National Agricultural Law Center (n.d.). *Clean Air Act: An overview*. Website. Fayetteville, AR: The National Agricultural Law Center. Accessed 8-30-2026 at: <https://nationalaglawcenter.org/overview/caa/>

321. A Beeler & R Hitchcock (July 5, 2001). Prof sniffs out hog odors. *Iowa State Daily*. Retrieved 8-29-2026 from: <https://iowastatedaily.com/204932/news/prof-sniffs-out-hog-odors/>

322. Author not listed (2013). Dr. Dwaine Bundy. *Ames Tribune*. Retrieved 8-29-2026 from: <https://www.amestrib.com/obituaries/piow0518051>

323. JA Zahn, JL Hatfield, YS Do, AA DiSpirito, DA Laird, & RL Pfeiffer (November, 1997). Characterization of volatile organic emissions and wastes from a swine production facility. *Journal of Environmental Quality*, 26 (6): 1687-1696. doi: 10.2134/jeq1997.00472425002600060032x.

- 2) developed a VOC odorant standard focused on 19 malodorous VOCs that mimicked human olfactory properties of swine manure that could be used as a tool for air quality regulators to identify sites representing potential nuisance problems;³²⁴ and
- 3) developed data presenting evidence that the air concentration of non-methane VOCs could be used to predict odor intensity associated with swine CAFO manure storage systems. This use of chemical methods in odor analysis provided a more objective assessment than did subjective human evaluations and proved to be more accurate than the human evaluations.³²⁵

Unlike Dr. Bundy, Dr. Zahn ventured beyond "odors" from agriculture and broke yet more new ground. He led a study that was the first scientific research study in the world to find

significant levels of antibiotic resistant bacteria in the air near hog confinement operations in Iowa and Missouri.³²⁶

An abstract of the study appeared in the *Journal of Animal Science*³²⁷ before the Bush administration's USDA ordered the study to be pulled. Dr. Zahn also presented the abstract of the study and discussed the study's findings at a professional conference prior to being muzzled by the USDA, according to Johns Hopkins researchers at the Bloomberg School of Public Health in their 2005 study. Despite the study being banned by the Bush administration, the researchers were sufficiently impressed by Zahn's work that they cited his study's abstract in conjunction with the following comments:

In abstract form within conference proceedings, Zahn *et al.* (2001) reported on the presence of tylosin and tylosin-resistant bacteria in the air released from three mechanically ventilated swine CAFOs. Their study indicated that tylosin-resistant bacteria, primarily *Cornebacterium*, accounted for 80% of total culturable bacteria detected. **These results provided the first evidence of airborne antibiotic-resistant bacteria in swine CAFOs.** [Emphasis added]³²⁸

The Zahn *et al.* (2001) study, although prevented from being published by the Bush USDA and

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324. JA Zahn, AA DiSpirito, YS Do, BE Brooks, EE Cooper, & JL Hatfield (January, 2000). Correlation of human olfactory responses to airborne concentrations of malodorous volatile organic compounds emitted from swine effluent. *Proceedings of the Water Environment Federation*, 2000 (3): 22-42. doi: 10.2175/193864700785303574.
 325. JA Zahn, JL Hatfield, YS Do, & AA DiSpirito (January, 2000). Air pollution from swine production facilities differing in waste management practice. *Proceedings of the Water Environment Federation*, 2000 (3): 609-634. doi: 10.2175/193864700785302944.
 326. Union of Concerned Scientists (March, 2004). *Scientific integrity in policymaking: An investigation into the Bush Administration's misuse of science*. Cambridge, MA: Union of Concerned Scientists. Currently available at: <https://www.ucs.org/resources/scientific-integrity-policy-making>
 327. JA Zahn, J Anhalt, & E Boyd (2001). Evidence for transfer of tylosin and tylosin-resistant bacteria in air from swine production facilities using sub-therapeutic concentrations of tylosin in feed [Abstract]. *Journal of Animal Science*, 79: 189.
 328. A Chapin, A Rule, K Gibson, T Buckley, & K Schwab (February, 2005). Airborne multidrug-resistant bacteria isolated from a concentrated swine feeding operation. *Environmental Health Perspectives*, 113 (2): 137-142. doi: 10.1289/ehp.7473.

receiving recognition for such a pioneering example of scientific research, was also verified by another source. While writing about a then-current research study³²⁹ from the Hannover School of Veterinary Medicine reporting on the detection of airborne antibiotics inside swine CAFOs in Germany, science writer Ben Harder interviewed Dr. Zahn and wrote about his work in the article about the German scientists' research findings regarding air inside of CAFO buildings:

At scientific meetings, he [Zahn] has presented data, gathered in pig confinement facilities in the U.S. heartland, indicated that tylosin – and even tylosin-resistant bacteria – can spread through the air. The drug also turns up in air expelled from these facilities by exhaust fans, he adds.³³⁰

Harder also spoke with a University of Iowa researcher, at the time serving on several National Academy of Sciences committees, about the implications of exposure to airborne antibiotic-resistant bacteria and wrote:

The new study "makes clear the potential for [antibiotic] exposure via inhalation," says [pulmonary toxicologist Peter Thorne at the University of Iowa in Iowa City](#). Besides posing dangers specifically to farmworkers, airborne dust may spread antibiotic resistance, creating a more general public health concern, he says. Exposing bacteria in the human body to small, steady doses of antibiotics is an ideal way to promote drug resistance, Thorne and the German researchers agree.³³¹

And prior to that the Zahn study was cited in the ISU-UI Study Group (2002) research study that provided the basis for Iowa's adoption of ambient air standards for CAFO air emissions of hydrogen sulfide (H₂S) and ammonia (NH₃).³³²

And some years later, the Bush administration's muzzling of Dr. Zahn did not prevent subsequent researchers from citing his work in their published research. A team of researchers from the university communities of Iowa City, Minneapolis, Ames, and Uppsala, Sweden did just that. The reader will recall discussion of the Burkholder *et al.* (2006) study and how it was written in the aftermath of the Conference on Environmental Health Impacts of Concentrated Animal Feeding Operations: Anticipating Hazards – Searching for Solutions hosted by the University of Iowa in 2004. As the Burkholder *et al.* (2006) report emanated from one of the conference workgroups, so too did the Gilchrist *et al.* (2007) study. The Gilchrist *et al.* (2007) researchers cited the USDA-banned Zahn *et al.* (2001) study's abstract in support of the following statement:

Using a medicated feed containing tylosin (a macrolide antibiotic), Zahn *et al.*

329. G Hamscher, HT Pawelzick, S Sczesny, H Nau, & J Hartung (October, 2003). Antibiotics in dust originating from a pig-fattening farm: A new source of health hazard for farmers? *Environmental Health Perspectives*, 111 (13): 1590-1594. doi: 10.1289/ehp.6288.

330. B Harder (July 5, 2003). Suspended drugs: Antibiotics fed to animals drift in the air, p. 6. *Science News*, 164 (1): 5-6. Retrieved 7-21-2018 from: [205.208.116.24](#)

331. Harder (July 5, 2003), p. 6, *op. cit.*

332. ISU-UI Study Group (2002), p. 17, *op. cit.*

(2001) compared swine CAFOs [using tylosin in the feed] with CAFOs using a nonmedicated feed and observed a 3-fold higher concentration of tylosin-resistant bacteria in the exhaust air from the CAFOs [using feed containing the antibiotic tylosin].³³³

If readers wish to know more about Dr. Zahn, the monitoring of his behavior by ISU & the Iowa Pork Producers, and the strict prohibitions placed on Zahn's public speaking and publishing by the USDA, the following sources may help:

P Beeman (December 1, 2002) Ag scientists feel the heat. *Des Moines Register*.

Retrieved from the Institute for Agriculture & Trade Policy website at:

<https://www.iatp.org/news/ag-scientists-feel-the-heat>

Cox K & Brown C (2019, January 31). US academics feel the invisible hand of politicians and big agriculture. *The Guardian*. Retrieved 2-07-2019 from <https://www.theguardian.com/environment/2019/jan/31/us-academics-feel-the-invisible-hand-of-politicians-and-big-agriculture>.

J Lee (May 11, 2003). Neighbors of vast hog farms say foul air endangers their health. *The New York Times*. Retrieved 7-21-2018 from:

<https://www.nytimes.com/2003/05/11/us/neighbors-of-vast-hog-farms-say-foul-air-endangers-their-health.html>

Union of Concerned Scientists (March, 2004). *Scientific integrity in policymaking: An investigation into the Bush Administration's misuse of science*. Cambridge, MA: Union of Concerned Scientists. Currently available at:

<https://www.ucs.org/resources/scientific-integrity-policy-making>

While Dr. Zahn ventured beyond odors to research other harmful CAFO air emissions, Dr. Bundy remained primarily focused on CAFO odors, some of his research being funded by the Iowa Pork Producers Association, some not.^{334, 335, 336} Dr. Bundy has his own archival page with

333. MJ Gilchrist, C Greko, DB Wallinga, GW Beran, DG Riley, & PS Thorne (February, 2007). The potential role of concentrated animal feeding operations in infectious disease epidemics and antibiotic resistance, p. 314. *Environmental Health Perspectives*, 115 (2): 313-316. doi: 10.1289/ehp.8837.

334. J Lorimor, D Bundy, S. Mickelson, & S Melvin (December 15, 1998). *Evaluating land waste application machinery to meet odor and environmental objectives*. Unpublished report. Accessed 8-30-2026 at: <https://porkcheckoff.org/research/evaluating-land-waste-application-machinery-to-meet-odor-and-environmental-objectives/>

335. L Koppolu, RK Koelsch, DD Schulte, C Powers, & D Bundy (July, 2005). A new application for fine ground rubber in the control of odors from livestock manure storage structures. *Conference presentations and white papers: Biological systems engineering*. 15. Accessed 8-30-2026 at: https://www.researchgate.net/publication/228613619_A_New_Application_for_Fine_Ground_Rubber_in_the_Control_of_Odors_from_Livestock_Manure_Storage_Structures

336. Y Chen, DS Bundy, & SJ Hoff (1999). Development of the relationship between odor intensity and threshold dilution ratio for swine units. *Journal of the Air & Waste Management Association*, 49 (9): 1082-1088. doi: 10.1080/10473289.1999.10463882.

the Pork Checkoff Board listing all of his research.³³⁷ Apparently Dr. Bundy chose to be oblivious to the harmful air emissions being emitted from CAFOs 24 hours per day, seven days each week for several months at a time. After being a member of the ISU-UI Study Group, it's difficult to imagine that he never heard or read about the hydrogen sulfide (H₂S), ammonia (NH₃), and other toxic substances contained in CAFO air emissions and their harmful impact on human health. Some of those harmful CAFO air emissions Dr. Bundy chose to ignore – as did the IEC-Harkin (2026) report – include:

Methane (CH₄)	A greenhouse gas whose emissions are to be reduced by nations signing the Montreal Protocol. Also in high concentrations, it acts as an asphyxiant by displacing oxygen and making it impossible to breathe.
Hydrogen Sulfide (H₂S)	A toxin.
Ammonia (NH₃)	A toxin. Also a secondary precursor to PM _{2.5} , which is a carcinogen.
VOCs	100+ Volatile Organic Compounds (VOCs), some of which are toxins, some of which are secondary precursors of carcinogenic PM _{2.5} .
Particulate Matter (PM_{2.5})	Declared to be a carcinogen by the International Agency for Cancer Research, World Health Organization.
Endotoxins	Air pollutants that cause adverse health effects to those exposed to CAFO air emissions. Endotoxins are a "pro-inflammatory agent of microbial origin" and is "a constituent part of [CAFO] particulate matter [PM ₁₀]..." ³³⁸
Antibiotics	Frequent exposure to antibiotic doses develops antibiotic resistant organisms.
Antibiotic-Resistant Organisms	They make it impossible for antibiotics to fight disease.

337. Pork Checkoff (n.d.). *Investigator: Dr. Dwaine Bundy*. Web page accessible only to members. Clive, IA: National Pork Board. Title page only accessed at:

<https://www.porkcheckoff.org/research/investigator/dwaine-bundy/>

338. MMT de Rooij, LAM Smit, HJ Erbrink, TJ Hagenaaars, G Hoek, NWM Ogink, A Winkel, DJJ Heederik, & IM Wouters (November, 2019). Endotoxin and particulate matter emitted by livestock farms and respiratory health effects in neighboring residents. *Environment International*, 132: 105009. doi: 10.1016/j.envint.2019.105009.

A Deeper Look Into Critical Thinking, "Crap Detecting," & Fact-Checking

Dr. Bundy's choice in choosing to focus on researching odors while ignoring the real health threats contained in CAFO air emissions reminds one of the title of an article written by Canadian educator John McPeck:

Stalking beasts, but swatting flies.³³⁹

Serving as an education professor at the University of Western Ontario in Canada, John McPeck battled the notion that critical thinking meant applying systems of logic to an issue. McPeck dismissed this idea. In *Critical Thinking and Education*,³⁴⁰ McPeck argued that critical thinking about a subject requires knowledge of that field. McPeck also argued that critical thinking required the disposition and willingness to engage in "reflective skepticism" about a subject in which the individual possesses sufficient knowledge to assess statements made by individuals about that field.³⁴¹

McPeck's work, in turn, reminds one of the term coined by Ernest Hemingway in 1954 – "[crap detector](#)." When living in Cuba and talking about writers and writing with his visitor from the mainland (the executive editor of *The Atlantic* magazine), Hemingway observed:

Every man should have a built-in automatic [crap detector](#) operating inside him
.... You reject everything that is not or can't be completely true."³⁴²

The original term coined by Hemingway in 1954 didn't gain much traction until the late 1960s, a decade during which the nation witnessed the Civil Rights campaign as it drew back the curtain that concealed the apartheid state of America, the assassinations of three American leaders – President Kennedy, Martin Luther King, Jr., & Robert Kennedy – and experienced the disillusionment caused by government lies and distortions regarding US involvement in the Vietnam War prior to Watergate. At that point two educators/writers took up Hemingway's term, "crap detector" and featured it in their new book, *Teaching As a Subversive Activity*.³⁴³

Postman and Weingartner argued that students should be taught to examine statements and accounts in order to challenge misconceptions, the manipulation of narratives by the media, corporations, and government for distortions, lies, and omissions of pertinent data/events. The goal of education should be that all learners

339. JE McPeck (Winter, 1984). Stalking beasts, but swatting flies: The teaching of critical thinking. *Canadian Journal of Education / Revue canadienne de l'éducation*, 9 (1): 28-44. Available at: <https://www.jsto.org/stable/1494418>.

340. McPeck (1981). *Critical thinking and education*. New York: St. Martins Press.

341. McPeck (1981), p. 7-9, *op. cit.*

342. R Manning (August, 1965). Hemingway in Cuba: Robert Manning, the executive editor of *The Atlantic*, looks back on his 1954 visit with the Nobel Prize-winning author, p. 104. *The Atlantic*. Accessed 8-29-2026 at: <https://www.theatlantic.com/magazine/archive/1965/08/hemingway-in-cuba/399059/>

343. N Postman & C Weingartner (1969). *Teaching as a subversive activity*. New York: Dell Publishing.

develop built-in shockproof crap detectors as basic equipment in their survival kits.³⁴⁴

For those offended by the term "crap," an alternative term would be "reflective deliberation." The two educators wanted students to be like the boy in Hans Christian Andersen's 1837 story who not only saw that the Emperor had no clothes, but was also willing to articulate that reality.³⁴⁵

The current iteration of "Crap Detecting" and Critical Thinking is being developed and refined by the [Stanford History Education Group \(SHEG\)](#) in Palo Alto, California in response to research they conducted. Discussing the current Internet, SHEG's leaders pointed out:

Determining who's behind information and whether it's worthy of our trust is more complex than a true/false dichotomy. For every social issue, there are websites that blast half-true headlines, manipulate data, and advance partisan agendas.

... [Many] conceal their backing, portraying themselves as grassroots efforts when, in reality, they're front groups for commercial or political interests... Understanding where information comes from and who's responsible for it are essential in making judgments of credibility.³⁴⁶

SHEG's leaders described the current world of teenagers that they encountered in conducting their research:

The Internet dominates young people's lives. ...Today's students are more likely to learn about the world through social media than through traditional sources like print newspapers. It's critical that students know how to evaluate the content that flashes on their screens.³⁴⁷

SHEG's leadership team then reported their research findings:

Unfortunately, our research at the Stanford History Education demonstrates they don't. Between January 2015 and June 2016, we administered 56 tasks to students across 12 states. We collected and analyzed 7,804 student responses. Our sites for field-testing included middle and high schools in inner-city Los Angeles and suburban schools outside of Minneapolis. We also administered tasks to college-level students at six different universities.... Overall, young people's ability to reason about information on the Internet can be summed up in

344. Postman & Weingartner (1969), p. 220, *op. cit.*

345. HC Andersen (1837). *Kejserens nye klæder* (The emperor's new clothes). In HC Andersen (1837). *Eventyr, fortalte for Børn* aka *Fairy tales told for children*. Copenhagen: CA Reitzel. NOTE: Best children's picture book version: Caldecott Medal winner Virginia Lee Burton's version. Creative version set in ancient provincial China: *The emperor's new clothes, a tale set in China told by DEMI*.

346. S McGrew, T Ortega, J Breakstone, & S Wineburg (Fall, 2017). Bigger than fake news: Civic reasoning in a social media environment, pp. 4-5 *American Educator*, pp. 4-9, 39. Retrieved 9-09-2022 from: https://www.aft.org/ae/fall2017/mcgrew_ortega_breakstone_wineburg.

347. McGrew *et al.* (Fall, 2017), p. 5, *op. cit.*

two words: *needs improvement*.³⁴⁸

The SHEG researchers next discussed the implications of their research findings:

Our findings show that many young people lack the skills to distinguish reliable from misleading information. If they fall victim to misinformation, the consequences may be dire. Credible information is to civic engagement what clean air and water are to public health. If students cannot determine what is trustworthy – if they take all information at face value without considering where it comes from – democratic decision-making is imperiled. The quality of our decisions is directly affected by the quality of information on which they are based.³⁴⁹

What to do? The SHEG researchers next spent time observing real-life fact checkers in action to see how they went about their business. From these observations, the SHEG team extrapolated "the most powerful strategies employed by fact checkers" and then analyzed "how educators can adapt them to help our students become savvy web users."³⁵⁰ They identified three of what they considered to be the most powerful strategies that could be adapted for classroom use:³⁵¹

- Teach students to read laterally.
- Help students make smarter decisions from search results.
- Teach students to use Wikipedia wisely.

Reading laterally means using the 4 principles of SIFT developed by Michael Caulfield, a professor of digital literacy at Washington State University, who was influenced by Sam Wineburg, the founder of SHEG, and Sarah McGrew, Co-director of the Civic Online Reasoning project at SHEG.³⁵²

Stop.

Don't spend a lot of time on the website. Remember, you're trying to determine if the site is a reliable source of information. SHEG personnel provided an analogy: What good would come out of reading Hitler's *Mein Kampf* in its entirety before one determined it was a racially biased source? Get on to other websites to get more information about the original site.

Investigate the source.

One of the investigative sites SHEG recommends is Wikipedia because of its standards of verifiability and the reader's ability to follow Wikipedia's entry links to reliable sources. Also available on Wikipedia are "Talk" pages, *i.e.* "the tab hiding in

348. McGrew *et al.* (Fall, 2017), p. 5, *op. cit.*

349. McGrew *et al.* (Fall, 2017), p. 7, *op. cit.*

350. McGrew *et al.* (Fall, 2017), p. 8, *op. cit.*

351. McGrew *et al.* (Fall, 2017), p. 8, *op. cit.*

352. C Warzel (February 18, 2021). Don't go down the rabbit hole. Critical thinking, as we're taught to do it, isn't helping in the fight against misinformation. *The New York Times*. Retrieved 8-20-2022 from: <https://www.nytimes.com/2021/02/18/opinion/fake-news-media-attention.html>

plain sight next to the 'Article' tab."³⁵³

Find better coverage.

Conduct Google searches using terms found in the original claim and in the information you located using Wikipedia, etc.

Trace claims, quotes and media to the original content source.

This can be accomplished by using links you have obtained from the previous steps and by conducting google searches containing terms from the claims, quotes, and media you're source-tracing which will provide more links until you arrive at the original content source.

At first glance, the preceding information may seem a bit complicated. Fortunately, we're in luck as a mystery writer phrased it in a more familiar manner. Tony Hillerman, former President of the Mystery Writers of America and author of a series of novels featuring Navajo Nation policemen Joe Leaphorn and Jim Chee, put this all in a simpler context as explained by a former oil-well wildcatter in the American West:

... you don't make money in the mineral lease racket without being skeptical, and if you ain't to start with, you get that way damn quick. You leave your trust at home in the closet. Your basic idea is that everybody is out to skin you, and you're always looking and listening for a sign of it.

.... Gamblers call it "looking for tells." Little things that another gambler might do that tip you off... You can see by this [his mountain-top mansion with an expansive view] I was good at reading tells. And when the money started coming in, and people could see it was, then I got to practice on another bunch. People who wanted to get to me and get some of it.³⁵⁴

Some nations, primarily those bordering Russia, have taken critical thinking, "crap-detecting," and fact-checking to an entirely different level. For example, in Finland ALL high school students undergo training in evaluating claims, detecting bias, and determining truth/falseness of material. According to an investigative journalist,

Finland has become one of the world's leaders in disinformation education.³⁵⁵

In the US, however, local school districts will determine if their students receive training in spotting fake news and misinformation. And in a few cases, states will mandate coursework in "media literacy education" – in 2022, for instance, 14 states had such mandates in place, but the content of what was offered as coursework in each state varied.³⁵⁶

Meanwhile, to the south of Finland across the Gulf of Finland lies Estonia, who also shares a

353. McGrew *et al.* (Fall, 2017), p. 9, *op. cit.*

354. T Hillerman (2002). *The wailing wind*, p. 115 New York: Harper-Collins Publishers.

355. JC Kang (March 7, 2022). Fighting disinformation can feel like a lost cause. It isn't. The right lessons can teach us all how to spot it. *The New York Times*. Retrieved 9-18-2022 from:
<https://www.nytimes.com/2022/03/07/opinion/fighting-disinformation-education.html>

356. Kang (March 7, 2022), *op. cit.*

border with Russia. Following a series of cyberattacks and political turmoil, Estonia mandated "media literacy education for all of its public school students" in 2010.³⁵⁷

Elementary and middle school students are taught ... how online content is created and how statistics can be manipulated. In high school, lessons about social media, trolls, the difference between fact and opinion and criteria for good sources help students become more critical thinkers.³⁵⁸

And further south of both Finland and Estonia lies Lithuania, who also shares a common border with Russia. Lithuania has taken the issue of misinformation to a much higher level than public education of its youth. At this year's meeting of GlobalFact, an annual conference on fact-checking and misinformation that was held in Vilnius, Lithuania, the Lithuanian Minister of National Defense stated that Lithuania now treats

'cognitive warfare' as a real domain of conflict as real as land, sea, air, space, and cyber.³⁵⁹

Vidmantas Verbickas, Lithuanian Vice Minister of Foreign Affairs, explained to the GlobalFact attendees:

Authoritarian regimes keep looking for the weak spots of an open society. They exploit the algorithms of social media platforms and create large botnets to manipulate and control public discourse. They are leveraging AI tools to create and distribute disinformation online. We cannot afford to allow our adversaries to transform the digital space into a tool of narrative control.³⁶⁰

A senior official of the Lithuanian Defense Ministry, Ieva Gajauskaitė, further explained:

Such [disinformation] attacks amount to a "weaponization of critical thinking" because they push people to question everything, and thus believe nothing.³⁶¹

The methods and techniques of disinformation being used against the European nations on Russia's western border were more fully explained by a faculty member of the Higher School of Police in Szczytno, Poland. According to Marcin Konieczny, fake news occurs as a media message that:³⁶²

- "is based on disinformation;"

357. Kang (March 7, 2022), *op. cit.*

358. Kang (March 7, 2022), *op. cit.*

359. L Jacobson (June 17, 2026). Lithuania sees itself as a nation on the front lines of the misinformation war. At GlobalFact, Lithuanian leaders argued that resilience against misinformation is now a core part of national defense. *Poynter*. Retrieved 9-04-2026 from: <https://www.poynter.org/fact-checking/2026/lithuania-misinformation-national-defense-cognitive-warfare/>

360. Jacobson (June 17, 2026), *op. cit.*

361. Jacobson (June 17, 2026), *op. cit.*

362. M Konieczny (July, 2022). Demaskuok – The Lithuanian system to counter disinformation, pp. 19-20. *De Securitate et Defensione O Bezpieczenstwie i Obronnosci*, 8 (1): 17-29. doi: 10.34739/dsd.2022.01.02. Retrieved 9-04-2026 from: https://www.researchgate.net/publication/362625355_Demaskuok_-_The_Lithuanian_System_to_Counter_Disinformation

- "contains real information that is distorted or [taken] out of context" or combined with a lie;
- "intensively manipulates facts that are to arouse emotions" in order "to create social attitudes;"
- "misleads recipients in order to gain financial, political, or propaganda benefits."

How do the Lithuanians combat the disinformation onslaught? Although government agencies and the Lithuanian parliament are heavily engaged, and although public awareness initiatives have been launched, Lithuanian authorities realized the importance of "bottom-up initiatives, such as the 'movement of elves.'"

This group [of Lithuanian elves] consists mainly of Lithuanian volunteers focused on identifying and combating the Russian trolls. Their main task is to expose fake online accounts to prevent the spread of false information.³⁶³

As the reader can see, different levels exist where the abilities to think critically, detect crap, and engage in fact-finding are required, all with varying levels of consequences for failure to do so. Here in the center of the Midwest, Iowans have experienced a variety of harms resulting from distorted messages from corporate and business entities – tobacco companies, chemical producers of pesticides and herbicides, fossil fuel companies denying the existence of climate change, and the agricultural sector's campaigns against having their harmful practices regulated in the public interests of healthy air and clean water.

So, the question yet remains in the US:

[H]ow do we create a more disinformation-resistant public in a country with such rampant inequality?³⁶⁴

How do we develop citizens who won't be roped in by the disinformation campaigns waged by corporate (and government, in some instances) interests in which the monetary interests of the few outweigh both the health and well-being of the many as was done previously by the Pesticide, Tobacco, and Big Oil interests? The current SHEG leadership has some ideas:

[What is needed] is a more comprehensive approach that teaches kids how to assess not only the reliability of the specific information they've found online but also who published it and for what purpose. In doing this, students are looking at the whole ecosystem in which the information resides, which improves their ability to question things that may seem to come from sources that look reputable enough.³⁶⁵

363. K Dudzinska (May 23, 2019). *The Lithuanian model in the fight against disinformation*. Website. Warsaw, Poland: Polish Institute of International Affairs (PISM). Retrieved 9-05-2026 from: https://pism.pl/publications/The_Lithuanian_Model_in_the_Fight_against_Disinformation_-_~:

364. Kang (March 7, 2022), *op. cit.*

365. Kang (March 7, 2022), *op. cit.*

The investigative journalist described what happened when SHEG professionals followed their own prescriptive advice:

When Dr. Breakstone and his group incorporated these lessons into a 12th-grade civics course, they found almost immediate improvement in the students' ability to think critically about that information.³⁶⁶

And isn't that what most of us wish for – an informed and discerning citizenry that resists having the wool pulled over their eyes? Sufficient evidence has thus far been presented to the reader about the need for us all to be critical thinkers, "crap-detectors," and fact-finders when it comes to evaluating claims from both corporate and government sources. This is particularly true when it comes to determining which government sources are acting on behalf of the public interests and which government institutions have been co-opted politically to act on behalf of private commercial interests while serving in a public capacity.

April 21, 2003 EPC Meeting

The Reports, Public Participation, & the Vote to Adopt Ambient Air Quality Standards for Hydrogen Sulfide (H₂S) and Ammonia (NH₃) to Protect the Public Health & Welfare of Iowans

Instead of foot-slogging our way through the intervening meetings between July 22, 2002 and the April 21, 2003 meeting wherein the Environmental Protection Commission adopted the proposed ambient air standards for hydrogen sulfide and ammonia, I propose that we board a figurative jet plane and fly directly to the decisive meeting. I'm sure the reader is already aware of the rigors of administrative rule making and of the need to deconstruct the statements by agricultural interests opposed to ambient air standards for CAFO air emissions of hydrogen sulfide and ammonia, so I don't think there's anything to be gained by slogging through that morass. A Ph.D. thesis could be written about the EPC activities that led to the final adoption of the ambient air standards for hydrogen sulfide and ammonia, which is something we don't need to engage in for our purposes.

The April 21st meeting marked the final public hearing regarding the adoption of ambient air quality standards for CAFO emissions of hydrogen sulfide (H₂S) and ammonia (NH₃). The meeting began with a report listing the major rule-making activities that had been conducted by the DNR and the EPC during the past year.

According to Wayne Gieselman, Administrator of the Environmental Services Division in the Iowa Department of Natural Resources:

Public hearings on the standards were held in Spencer, Mason City, Atlantic, Davenport, and Des Moines. Responses to the oral and written comments received at these hearings and written comments received during the public

366. Kang (March 7, 2022), *op. cit.*

comment period are provided in the attached responsiveness summary.³⁶⁷

After presenting information about the formation of a "Technical Advisory Group (TAG) consisting of stakeholders and experts in the field of ambient air monitoring" that had been "formed to assist with determining monitoring instrumentation and methodology" for a comprehensive field study that the new Iowa Code section 459.207 (created by SF 2293) mandated, Mr. Gieselmann informed EPC members that:

The Environmental Protection Commission has statutory authority to establish ambient air quality standards on the basis of providing air quality necessary to protect the public health and welfare pursuant to Iowa Code section 455B.133(3).³⁶⁸

Jim McGraw, Iowa DNR, presented the Air Quality Standards to the EPC members, saying:

For the first time in state history, state-only (Iowa) ambient air quality standards are being proposed in order to protect the public health and welfare. Based on the recommendations in the Iowa Concentrated Animal Feeding Operations Air Quality Study, the department has proposed ambient air quality standards for hydrogen sulfide and ammonia. These ambient air quality standards are applicable off the property of any source.³⁶⁹

The proposed ambient air standards for hydrogen sulfide (H₂S) and ammonia (NH₃) submitted to the EPC for adoption were:³⁷⁰

Pollutant	Standards	Averaging Time	Not to be exceeded
Hydrogen Sulfide	15 ppb	1 hour	more than 7 times per year, averaged over 3 years
Ammonia	150 ppb	1 hour	more than 7 times per year, averaged over 3 years

Just a reminder of what the ISU-UI Study Group (2002) study actually recommended for ambient air quality standards for hydrogen sulfide (H₂S) and ammonia (NH₃).³⁷¹

367. Environmental Protection Commission (April 21, 2003). *Minutes of the Environmental Protection Commission meeting, April 21, 2003*, p. 6. No publisher listed. Retrieved 4-08-2019 from: <https://www.iowadnr.gov/About-DNR/Boards-Commissions/Environmental-Protection-EPC>. Currently unavailable to the public on the IDNR website. SEE NOTE: Introduction, "The DNR's Adoption of H₂S & NH₃ ...", and following paragraph, p. 101 of this analysis.

368. Environmental Protection Commission (April 21, 2003), p. 7, *op. cit.*

369. Environmental Protection Commission (April 21, 2003), p. 7, *op. cit.*

370. Environmental Protection Commission (April 21, 2003), p. 10, *op. cit.*

371. KJ Donham, PS Thorne, GM Breuer, W Powers, S Marquez, & SJ Reynolds (February, 2002). "Chapter 8. Exposure limits related to air quality and risk assessment." In ISU-UI Study Group (2002), p. 176, *op. cit.*

Hydrogen Sulfide (H₂S)	70 ppb (parts per billion) at the CAFO property line for a 1-hour time-weighted average (TWA) period and 15 ppb at the residence with the same TWA as the property line measurement. No more than 7 exceedances per calendar year (with notice to the residents and the DNR).
Ammonia (NH₃)	500 ppb at the CAFO property line and 150 ppb at the residence, both for a one-hour TWA. No more than 7 exceedances per calendar year with notice requirement.

And what did SF 2293 (or the new Iowa Code section 22.3(b) say about where the measurements should take place? As reported earlier (about 40 pages ago), the Iowa Legislature stated that any standard for CAFO air emissions of hydrogen sulfide (H₂S) and ammonia (NH₃) needed to "be based on distances measured from a confinement feeding operation structure to a separated location,"³⁷² which was defined by SF 2293 as "a location or object from which a separation distance is required..."³⁷³ Existing Iowa Code 455B.162 "Animal feeding operations---new construction and expansion" defined "separation distance" as

the minimum separation distance in feet required between an animal feeding operation structure and a residence not owned by the owner of the animal feeding operation, or a commercial enterprise, bona fide religious institution, or an educational institution.³⁷⁴

In other words, the ISU-UI Study Group proposed two standards each for both hydrogen sulfide (H₂S) and ammonia (NH₃), the standards differing in terms of where the measurement should take place – the CAFO property line and a residence existing outside of the CAFO property's area of operation. The Iowa Legislature excluded any measurements being taken at the CAFO property line and limited measurements to any residence outside of the CAFO's property area. After all, if the measure is intended to protect the public health and welfare, public airspace begins at the property line enclosing the CAFO's property, not on the property of the CAFO owner/operator.

The reader might well be wondering why all of this is necessary. The answer is simple – because of distortions, omissions, and outright lies contained in the words of spokespeople for agricultural interests opposing the hydrogen sulfide (H₂S) and ammonia (NH₃) ambient air quality standards for CAFO air emissions. Keep the preceding paragraph in mind.

Following the presentation by the Iowa DNR at the EPC meeting of April 21, 2003 and prior to the EPC vote on the proposed standards, the EPC scheduled a time for "public participation"

372. SF 2293, p. 14, Lines 40-42.

373. SF 2293, p. 14, Lines 12-14.

374. Iowa General Assembly (n.d.). *455b.162 Animal feeding operations---new construction and expansion*. Accessed at: <https://www.legis.iowa.gov/DOCS/IACODE/1997/455B/162.html>

during which time the public could speak as well as EPC members and DNR personnel.³⁷⁵

Who spoke? Sixteen people attended the EPC meeting. Their status and numbers are listed below:

ICCI members	6
Municipal Utilities	3
Agricultural - ISU & Farm Bureau	2
ISU-UI Study Group professors	2
Citizens in Favor	2
Citizens in Opposition	1

Chris Gruenhagen represented the Iowa Farm Bureau Federation. He complained that the proposed standards didn't "follow the joint university report recommendation" and that the standards were "not based on the best scientific research available." He specifically pointed out that the proposed standards didn't include the "university's suggested standard" for the CAFO property line.

Wendy Wintersteen, Senior Associate Dean, College of Agriculture, Iowa State University also spoke against the proposed ambient air standards for CAFO emissions of hydrogen sulfide (H₂S) and ammonia (NH₃). She used the same talking points as the Iowa Farm Bureau spokesperson, but the way in which she did it makes it more complex to deconstruct. According to ISU Associate Dean for the College of Agriculture Wintersteen (later to be named president of Iowa State University):

...[I]t is very clear that the regulations proposed are not in accordance with the committee's recommendations for two reasons. First, hydrogen sulfide health based standard at a CAFO property line is 70 parts per billion according to the report. The proposed implementation plan specifies an in seeming level of 15 parts per billion. ISU and University of Iowa air quality report clearly stated that it is recommended that hydrogen sulfide measured at a CAFO property line not exceed 70 parts per billion.

The second point is that the ammonia health based standard of the property line is 500 parts per billion according to the report. The proposed implementation plan specifies an exceedence [sic] level of 150 parts per billion.³⁷⁶

Two University of Iowa professors, both members of the ISU-UI Study Group who authored various sections of *Iowa Concentrated Animal Feeding Operations Air Quality Study: Final Report*, also spoke at the IEC meeting of July 21, 2003 – Peter S. Thorne, a pulmonary toxicologist, a National Academy of Science member, and Professor in the College of Public Health – and David Osterberg, Professor in the College of Public Health.

Dr. Thorne spoke about confusions people were making. For example, that odor was being

375. Environmental Protection Commission (April 21, 2003), pp. 12-18, *op. cit.*

376. Environmental Protection Commission (2003, April 21), pp. 12-13, *op. cit.*

confused with toxicity, that the notion that odor "constituted a "proper level of toxicity is erroneous." He specifically referred to hydrogen sulfide and ammonia as being "in and of themselves ... toxics." His greatest concern was that the earliest a CAFO in the State of Iowa "could be found in violation of standards would be 2007."³⁷⁷

Dr. Osterberg pointed out to the members of the EPC that Iowa's northern neighbor, Minnesota, already had a hydrogen sulfide standard of "30 parts per billion, which should not be violated more than twice in a five day period."³⁷⁸

In response to a comment by an EPC member about not knowing "how many facilities won't meet the standard" and a remark that the EPC "wanted to choose the standards that were health-based, Bryan Bunton with the Iowa DNR, pointed out that if approved, Iowa

would be the twenty-eighth state to have a hydrogen sulfide standard and the eleventh state to have an ammonia standard."³⁷⁹

Mr. Bunton also drew attention to the fact that whereas most other states allow only "one or two" exceedances, Iowa "has proposed to allow 7 exceedances before a violation occurs."³⁸⁰ Bunton also noted that while Iowa's levels "are more stringent than most states," Iowa's proposed standards "are not the most stringent compared to other states with one-hour averaging periods."³⁸¹ Mr. Bunton concluded with an observation that "[b]oth New Mexico and New York have levels more stringent than ours."³⁸²

Since the proposed ambient air standards were contained in a publication titled *Ambient Air Quality Standards and Sampling Manual*, the motion to approve by EPC member Darrell Hanson included the title. The motion was approved 6-2 with one member abstaining. The breakdown follows.³⁸³

EPC Members Voting to Adopt Ambient Air Quality Standards

Darrell Hanson (R)	Manchester	Representing the Public Sector
Gary C. Priebe (D)	Algona	Representing the Farming Sector
James Kelly Tobin (D)	New Market	Representing the Farming Sector
Jerry Peckumn (R)	Jefferson	Representing the Farming Sector
Lisa Davis-Cook (D)	West Des Moines	Representing the Public Sector
Kathryn Murphy (D)	Le Mars	Representing the Public Sector

377. Environmental Protection Commission (2003, April 21), p. 15, *op. cit.*

378. Environmental Protection Commission (2003, April 21), p. 16, *op. cit.*

379. Environmental Protection Commission (2003, April 21), p. 19, *op. cit.*

380. Environmental Protection Commission (2003, April 21), p. 19, *op. cit.*

381. Environmental Protection Commission (2003, April 21), p. 19, *op. cit.*

382. Environmental Protection Commission (2003, April 21), p. 19, *op. cit.*

383. Environmental Protection Commission (2003, April 21), p. 21, *op. cit.* NOTE: EPC members public data was communicated 4-10-2019 via e-mail from Jerah Sheets, Executive Officer, Iowa Department of Natural Resources. Home community information for the EPC members was obtained from various Iowa Senate Journals; specific listings from: RH Janson (July 27, 2019). *Air quality regulation of CAFO air emissions: The dismantling of public policy by private interests*, p. 43. Unpublished manuscript.

EPC Members Voting Against the Ambient Air Quality Standards

Lori Glanzman (R)	Mount Pleasant	Representing the Business Sector
Rita Venner (D)	Breda	Representing the Public Sector

EPC Member Absent and Not Voting

Terry Townsend (R)	Newton	Representing Manufacturing
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Deconstructing the Public Comments Made by the Iowa Farm Bureau and ISU Dean of Agriculture Wendy Wintersteen

Now, about those comments by agricultural interests during the "Public Portion" of the April 21, 2003 meeting of the Iowa Environmental Protection Commission... As the agricultural sector's claims are deconstructed, the reader needs to keep in mind four simple facts:

- First, the [ISU-UI Study Group \(2002\) report recommended two standards](#) – one measured at the CAFO property line, and another measured at "a residence or public use area."
- Second, the Iowa Legislature in [SF 2293 negated the standard that was proposed for measurement at the CAFO property line](#), leaving only the measurement for the standard proposed for a "residence" that by definition meant a residence not owned by the CAFO owner/operator.
- Third, the [EPC and the DNR obeyed the legislative mandate eliminating the standard for the CAFO property line](#) and recommended the standard proposed by the ISU-UI Study Group (2002) report – a "residence or public-use area."
- Fourth, the ISU-UI Study Group (2002) report [cited several hundred peer-reviewed, scientific-based research reports](#) that supported its findings and recommendations. The report also [cited unbiased scientific research-based reports](#) issued by the World Health Organization, the American Medical Association, the US Centers for Disease Control and Prevention, the Minnesota Environmental Quality Board, Dutch Expert Committee on Occupational Standards, *etc.*

Referencing the [Iowa Farm Bureau spokesperson's comments](#) stating that the EPC standards didn't follow the "joint university report recommendation" is a half-truth at best because the EPC's proposed standard was identical to the standard proposed by the ISU-UI Joint Study Group for measurements at a "residence." That's the first "Lie of Omission." The Farm Bureau criticism also omitted the fact that the CAFO property-line standard was eliminated by the Iowa Legislature in SF 2293 – that's the second "Lie of Omission." A half-truth based on one lie of omission combined with a second lie of omission – that's the Iowa Farm Bureau at work for Industrial Agriculture.

The [Farm Bureau's argument](#) that the proposed EPC standards aren't "based on the best scientific research available" is simply ludicrous when examining that remark in light of the several hundred peer-reviewed, scientific-based research reports that the ISU-UI Joint Study Group cited for its findings and recommendations, not to mention the multiple unbiased scientific research-

based reports also cited.

Examining Iowa State University Agriculture Dean Wintersteen's remarks requires that her comments be immediately available to the reader in order to fully follow the analysis taking place:

the regulations proposed are not in accordance with the committee's recommendations for two reasons. First, hydrogen sulfide health based standard at a CAFO property line is 70 parts per billion according to the report. The proposed implementation plan specifies an in seeming level of 15 parts per billion. ISU and University of Iowa air quality report clearly stated that it is recommended that hydrogen sulfide measured at a CAFO property line not exceed 70 parts per billion.

Regarding Agriculture Dean Wintersteen's criticism of the proposed standards as not being in accord with the ISU-UI Joint Study Group's recommendations, she followed the Iowa Farm Bureau's approach and completely omits:

- a) the fact that two standards were proposed by the ISU-UI Joint Study Group;
- b) the fact that the CAFO property line measurement was explicitly eliminated by the Iowa Legislature in SF 2293; and
- c) the fact that the EPC's proposed standard is identical to the standard for the "residence" measurement recommended by the ISU-UI Joint Study Group (2002).

That makes three lies of omission by the ISU Dean of Agriculture. Dean Wintersteen also attempts to spread confusion regarding her criticism of the proposed EPC regulation by referencing the CAFO property line standard of 70 parts per billion proposed by "the report" and the EPC proposed standard of 15 parts per billion without mentioning that the 15 parts per billion standard: a) referenced a different location for measurement than the CAFO property line; and b) makes it seem as if the 15 parts per billion was substituted "willy nilly" by the EPC. She compares two different levels (15 v. 70 parts per billion) in trying to influence the listener to assume they're the same, thus making the lower standard level appear to be arbitrary and capricious, when in fact it's not. And, of course, all done utilizing the Farm Bureau's approach of taking a half-truth and making it seem like the full truth while at the same time omitting critical information.

To recap the techniques employed by Dean Wintersteen in her comments to the Environmental Protection Commission – the ISU Dean of Agriculture told three (3) lies of omission and misdirected attention via an improper comparison in order to create a false illusion of impropriety on the part of a government agency proposing an administrative rule designed to protect the public health and welfare of Iowans. Not a bad day's work for a public employee shilling for private interests in order to defeat a measure designed to protect the public health and welfare of the Iowans paying her salary with their tax dollars.

Caveat emptor, as the Romans and medieval scholars used to say – *Buyer Beware*, when listening to agricultural spokespersons when they make claims and criticize those who stray from the "truths" of the Agricultural Gospel as preached by the Iowa Farm Bureau.

The Iowa Legislature's Nullification of the CAFO Air Emission Standards

Introduction

Two Iowa Farm Bureau members led the legislative charge to nullify the EPC's adoption of ambient air quality standards that would regulate CAFO air emissions of hydrogen sulfide (H₂S) and ammonia (NH₃) – Representative Sandra Greiner (R), a farmer from Washington County and member of the Iowa Farm Bureau, the Iowa Pork Producers, the Iowa Corn Growers, and the Iowa Soybean Association – and Senator Jeff Angelo (R), a media consultant from Union County and member of the Iowa Farm Bureau and the Iowa Cattlemen's Association.³⁸⁴ At the time 14 members of the Iowa Senate were members of the Iowa Farm Bureau while Iowa House contained 30 Iowa Farm Bureau members. Other farm production associations were well represented in the Iowa Legislature as well: the Iowa Pork Producers, the Iowa Cattlemen's Association, the Iowa Corn Growers Association, the Iowa Soybean Association, and the Iowa Dairy Association.

Legislative Actions Taken by the Iowa House

Two days after the Iowa DNR's Environmental Protection Commission adopted the ambient air quality standards for hydrogen sulfide (H₂S) and ammonia (NH₃) in order to protect the public health and welfare of all Iowans, Representative Greiner (R) introduced a bill to nullify the EPC's actions – House Joint Resolution 10 (HJR 10).³⁸⁵ The bill was referred to the House Committee on Environmental Protection which created a subcommittee for the bill to be chaired by Representative Greiner who was joined by Representatives Jane Greiner (D), a retired school teacher, and James Kurtenbach (R), an ISU professor of accounting. The formation of the subcommittee wasn't noted until the House Journal for Friday, April 25th.³⁸⁶ The following day (Thursday, April 24, 2003), the full Committee on Environmental Protection recommended that the "Committee Bill (formerly House Journal Resolution 10)" be passed (that action again waited to be reported in the House Journal for Friday, April 25 -- somewhat confusing).³⁸⁷ On Friday, April 25th, the House Journal made reference to the House Committee on Environmental Protection's introduction of House Joint Resolution 11, a "joint resolution nullifying amendments to administrative rules of the environmental protection commission," to the full House membership and having its first reading.³⁸⁸

The House would take no further action on HJR 10 – a bill designed to defeat the public health measures adopted via an administrative rule as authorized by the Iowa Legislature's SB 2293 – until April 30th, a day after the Iowa Senate completed its work on a similar bill.

384. Public information regarding individual Representatives and Senators in the Iowa Legislature during the session meeting in April, 2003 was obtained 4-30-2019 from:

<https://www.legis.iowa.gov/legislators/informationOnLegislators/historicalInformation>

385. State of Iowa House Journal, Wednesday, April 23, 2003, p. 1261.

386. State of Iowa House Journal, Friday, April 25, p. 1461.

387. State of Iowa House Journal, Friday, April 25, p. 1462.

388. State of Iowa House Journal, Friday, April 25, p. 1460.

Legislative Actions Taken by the Iowa Senate

Three days after the EPC adopted ambient air quality standards that would act to regulate CAFO air emissions of hydrogen sulfide (H₂S) and ammonia (NH₃) in order to protect the public health and welfare of Iowans, Iowa Farm Bureau member Senator Jeff Angelo, Chair of the Senate Commerce Committee, introduced Senate Study Bill (SSB) 1206 on Friday, April 25th to the Commerce Committee.³⁸⁹ The Commerce Committee changed the bill's title to Senate Joint Resolution (SJR) 5 and approved it, 11-3 (9 of the 11 "yes" votes were Republican while all 3 of the "no" votes were Democrats).^{390, 391} Fast-tracking the bill, SJR 5 was introduced the same day to the full Senate, had its first reading, and was "placed on calendar."³⁹² And it was still the first day for SJR 5 aka SSB 1206.

The following Monday, April 28th, the Iowa Senate approved the bill nullifying the newly adopted ambient air quality standards designed to regulate CAFO air emissions of hydrogen sulfide (H₂S) and ammonia (NH₃) in order to protect the public health and welfare of Iowans. The Senate vote was 30-19.³⁹³ The senator who introduced the original bill, Jeff Angelo, was listed as being absent. All but 2 of the 30 votes to nullify the newly adopted ambient air standards were cast by Republicans. All 19 of the "no" votes were cast by Democrats.³⁹⁴

The Final Legislative Denouement of SJR 5 – the Nullification of Newly Adopted Ambient Air Quality Standards for Hydrogen Sulfide & Ammonia CAFO Air Emissions Designed to Protect the Public Health and Welfare of Iowans

Two days after the Iowa Senate passed SJR 5, Representative Sandra Greiner "asked and received unanimous consent" to replace the House bill (HJR 11) with SJR 5. Following consideration, Representative Greiner moved for a final reading and a subsequent vote on nullifying the ambient air quality standards for hydrogen sulfide and ammonia.

SJR 5 was approved by the House on a vote of 68-30 (Butka & Wendt, absent or not voting).³⁹⁵ All but 13 of the 68 votes to nullify the ambient air quality standards were cast by Republicans. Not a single Republican House member voted against nullifying. All 30 votes against the bill to nullify the ambient air quality standards were cast by Democrats.³⁹⁶

On May 1, 2003, the legislative leadership – Mary Kramer, President of the Senate, and

389. Bill History for Senate Joint Resolution 5 (Senate Study Bill 1206), The Iowa Legislature webpage. Retrieved 6-29-2019 from: <https://www.legis.iowa.gov/legislation/billTracking/billHistory?billName=SJR%205&ga=80>

390. State of Iowa Senate Journal, Thursday, April 24, 2003, p. 1087.

391. Public Information re: individual legislators was available in 2019 on the following web site: <https://www.legis.iowa.gov/legislators/informationOnLegislators/historicalInformation>

392. State of Iowa Senate Journal, Thursday, April 24, 2003, p. 1089.

393. State of Iowa Senate Journal, Monday, April 28, 2003, pp. 1135-1136.

394. Public Information re: individual legislators was available in 2019 on the following web site: <https://www.legis.iowa.gov/legislators/informationOnLegislators/historicalInformation>

395. State of Iowa House Journal, Wednesday, April 30, p. 1535-1536.

396. Public Information re: individual legislators was available in 2019 on the following web site: <https://www.legis.iowa.gov/legislators/informationOnLegislators/historicalInformation>

Christopher Rants, Speaker of the House – signed SJR 5 into law and sent to the Iowa Secretary of State.³⁹⁷ The official title of SJR 5 was:

A Joint Resolution Nullifying Amendments to Administrative Rules of the Environmental Protection Commission of the Department of Natural Resources Relating to Ammonia and Hydrogen Sulfide Ambient Air Regulations and Providing an Effective Date.³⁹⁸

The bill itself was relatively simple as it contained only 3 brief sections. It is copied in below:

BE IT RESOLVED BY THE GENERAL ASSEMBLY OF THE STATE OF IOWA:

Section 1. The amendments to 567 Iowa administrative code, rule 28.1, adopted on April 21, 2003, are nullified.

Section 2. 567 Iowa administrative code, rule 28.2, adopted on April 21, 2003, is nullified.

Section 3. EFFECTIVE DATE. [This Joint Resolution, being deemed of immediate importance, takes effect upon enactment.](#)³⁹⁹

A Surprising Consequence of a Constitutional Amendment

A reader knowledgeable about Iowa government and the procedures that need to be followed is probably asking, "Why didn't the bill go to the governor for a signature before being sent to the Secretary of State?" While that is the normal procedure for most bills, it was not the normal procedure for any legislation that nullified an "administrative rule." The exception for nullification of an administrative rule was carved out by a voter-adopted amendment to the Iowa Constitution in 1984. Adopted to serve as a check on administrative "over-reach" of constitutionally allocated duties and responsibilities via executive branch agencies developing rules beyond the legislative will, the 38th Amendment to the Iowa Constitution removed the executive branch from any involvement in legislative nullification of adopted "administrative rules." The 38th Amendment is now contained in the Iowa Constitution as Article III, Section 40, "Nullification of Administrative Rules," and reads:

The general assembly may nullify an adopted administrative rule of a state agency by the passage of a resolution by a majority of all of the members of each house of the general assembly.

The voters probably didn't envision legislative "over-reach." The adoption of ambient air quality standards regulating CAFO air emissions of hydrogen sulfide (H₂S) and ammonia (NH₃) by the Environmental Protection Commission:

- was authorized by recently passed legislation – SF 2293.
- followed all of the required steps for administrative rule-making in terms of developing a health-based rule (the protection of the public health and welfare) being

397. State of Iowa Senate Journal, Thursday, May 1, 2003, p. 1223.

398. State of Iowa Senate Journal, Monday, April 28, 2003, p. 1135.

399. State of Iowa Senate Journal, Monday, April 28, 2003, p. 1135.

based on the most recent scientific evidence, of providing adequate notice and opportunity for public input, and in terms of transparency.

- did not "over-reach" its authority or exceed the legislative mandate contained in SF 2293.

The fault lay elsewhere rather than with the Environmental Protection Commission and the Iowa Department of Natural Resources.

A Governor's Veto Message Against Legislation with Subpar Air Quality Standards

What Was Offensive About House File 2523 That Required a Governor's Veto?

According to the "Bill History" for House File 2523, the bill to ostensibly regulate air quality was introduced to the full House on March 9, 2004, in the 2nd Session of the 80th General Assembly. The House Journal noted only that the bill was presented by the Committee on Environmental Protection, was read for the first time, and subsequently placed on the calendar.⁴⁰⁰

For many readers, this action will raise a host of red flags. "Why would the same legislature that nullified ambient air quality standards in their first session now introduce legislation proposing to regulate air quality?" many readers might ask. Perhaps paying heed to an ancient proverb will provide answers – "The devil is in the details." Maybe so. Let's take a look.

Thoughtful readers will recall that the 80th Iowa General Assembly was controlled by Republicans in both the House and the Senate chambers. Those same readers will call to mind the fact that in their first session, no Republican legislator in either the House or the Senate chamber voted against the bill to abolish the EPC's newly adopted ambient air quality standards for hydrogen sulfide (H₂S) and ammonia (NH₃). All Republicans in both the House and the Senate voted to nullify the legally adopted ambient air quality standards for hydrogen sulfide (H₂S) and ammonia (NH₃) that were designed to protect the public health and welfare of Iowans.

It will help readers to know that the Chairperson for the House Environmental Protection Committee during the 80th General Assembly was Representative Sandra Greiner, the same legislator who led the fight in the Iowa House during the first session of the 80th General Assembly to eliminate the EPC's newly adopted ambient air quality standards for hydrogen sulfide (H₂S) and ammonia (NH₃).⁴⁰¹ In the second session of the 80th Iowa General Assembly, Representative Greiner continued to serve as the Chair of the House Environmental Protection Committee. Now, instead of abolishing ambient air quality standards for hydrogen sulfide (H₂S) and ammonia (NH₃), this same Republican-controlled committee was proposing standards to

400. State of Iowa House Journal, March 9, 2004, p. 565.

401. On the Iowa Legislature's web page for House File 2523 (2nd Session, 80th General Assembly) at [https://www.legis.iowa.gov/legislation/BillBook?ga=80&ba=HF 2523](https://www.legis.iowa.gov/legislation/BillBook?ga=80&ba=HF%202523), go to the tab across the top of the page listing "Committees & Schedules." Click on that and you will find yourself on a page listing all of the committees for both the House and Senate. Simply click on "Environmental Protection" and you'll obtain a full list of committee members.

regulate air quality. Yet another red flag was raised by this failing – this writer was unable to locate any minutes recording the committee votes for and against the bill while it was still in committee prior to its introduction to the full House. "What, ho?" one might ask. Readers might wonder if the game being played is similar to the chicanery employed by the riverboat gambler hiding a pea under a thimble. First the pea is shown – in our case, ambient air quality standards to regulate hydrogen sulfide (H₂S) and ammonia (NH₃) emissions from CAFOs. Then it is hidden and attention is misdirected by the swift manipulation and concealment of the three shells – in our case by presenting the standards as if they were truly standards capable of protecting the public health, but concealing the fact that the proposed standards are not health-based standards recommended by peer-reviewed, scientific-based research studies.

The proposed standards coming out of the Republican-controlled House Committee for Environmental Protection were lax indeed. Readers might recall ISU Agriculture Dean Wendy Wintersteen's arguments for the CAFO property line standards that were originally proposed by the ISU-UI Study Group (2002) report, but eliminated by the EPC in its newly adopted rule (2003). The new legislative endeavor resurrected those same previously ignored standards and put them front and center for hydrogen sulfide (H₂S). Instead of being limited to the CAFO property line, the new standard served as the short-term limit to be measured, not at the CAFO property line, but instead at properties outside of the CAFO's boundaries. And the regulatory limit had to be in excess of 70 parts per billion not for the original 24-hour period, but for "two consecutive" weeks.⁴⁰² The "long-term minimal risk level" for hydrogen sulfide (H₂S) was 30 ppb for a "duration of twelve consecutive months."⁴⁰³ Perhaps the following charts will provide greater clarity for the sake of comparative analysis.

H₂S Standards Proposed By ISU-UI Study Group	H₂S Standards Adopted By the EPC	H₂S Standards Proposed By HF 2523
70 ppb at the CAFO property line. 15 ppb at the residence. No more than 7 exceedances per calendar year for 1-hour-time- weighted average period	15 ppb at the residence. No more than 7 exceedances per year, averaged over 3 years.	70 ppb at the residence for two consecutive weeks for the short-term minimal risk level. 30 ppb at the residence for twelve consecutive months for the long-term risk level.

Once again, thoughtful readers will recall the two six-month operating cycles of swine CAFOs. At the end of the first cycle, the hogs are removed and sent to market after which the pit is emptied and its contents applied to farm fields. And the next younger set of pigs will begin occupancy, but their output of waste will be much lower than that of the hogs recently sent to market. As a result, there will be an interruption in the cycle of emissions, which will render the

402. 80th Iowa General Assembly, 2nd Session, House File 2523, p. 6, Lines 12-16.

403. 80th Iowa General Assembly, 2nd Session, House File 2523, p. 6, Lines 22-26.

situation as highly unlikely to continue emissions at a break-point level. The level of emissions will lower temporarily following the end of each six-month cycle making it highly unlikely that the continuous "duration of twelve consecutive months" will ever happen. However, agricultural interests can say that they set standards for emissions and thus CAFO air emissions are regulated. No matter that the claim by agricultural interests, while technically true, is in reality false as the proposed regulations were never designed to protect the health of Iowans by regulating agricultural air emissions according to a scientifically-based health standard recommended by peer-reviewed research studies.

With regards to ammonia (NH₃), the Republican-controlled committee's proposed short-term air quality standard was simply off the charts. The chart information provided below will permit readers to make their own comparative analyses.

NH₃ Standards Proposed By ISU-UI Study Group	NH₃ Standards Adopted By the EPC	NH₃ Standards Proposed By HF 2523
500 ppb at the CAFO property line for a 1-hour-time-weighted average period. 150 ppb at the residence for a 1-hour-time-weighted average period.	150 ppb at the residence for a 1-hour-weighted average period. No more than 7 times per year, averaged over 3 years.	1,700 ppb at the residence for two consecutive weeks for the short-term minimal risk level. 300 ppb at the residence for 12 consecutive months for the long-term minimal risk level.

Not content with proposing ambient air quality standards that had no hope of protecting the public health and welfare of Iowans under false pretenses, the Republican majority made a direct assault on federalism via a two-pronged attack. First, House File 2523 explicitly prohibited the Environmental Protection Commission from adopting any ambient air standards that were lower than "the requirements of the federal Clean Air Act [as amended in 1991] or stricter than any "regulations promulgated by the United States environmental protection agency."⁴⁰⁴ Second, House File 2523 prohibited the Environmental Protection Commission from adopting, amending, or repealing "an ambient standard for which the United States environmental protection agency has not promulgated a standard."⁴⁰⁵

Federalism under which states serve as laboratories of experimentation in order "to meet changing and economic needs" was essential to the American concept of constitutional democracy, according to Supreme Court Justice Brandeis.⁴⁰⁶ According to another Supreme Court dignitary, Justice Felix Frankfurter:

The states need the amplest scope for energy and individuality in dealing with the myriad problems created by our complex industrial civilization... The very

404. 80th Iowa General Assembly, 2nd Session, House File 2523, p. 11, Lines 27-34.

405. 80th Iowa General Assembly, 2nd Session, House File 2523, p. 1, Lines 16-18.

406. *New State Ice v. Liebman*, 285 U.S. 262, 311 (1932).

notion of our federalism calls for the free play of local diversity in dealing with local problems.⁴⁰⁷

Supreme Court Justice Sandra Day O'Connor offered additional thoughts about the importance of federalism to the citizenry of the United States. According to Justice O'Connor:

This federalist structure of joint sovereigns preserves to the people numerous advantages. It assures a decentralized government that will be more sensitive to the diverse needs of a heterogeneous society; ... it allows for more innovation and experimentation in government; and it makes government more responsive by putting the States in competition for a mobile citizenry...⁴⁰⁸

Supreme Court Justice used a metaphor derived from 20th century physics to describe both the importance and the uniqueness of American federalism:

Federalism was our Nation's own discovery. The Framers split the atom of sovereignty. It was the genius of their idea that our citizens would have two political capacities, one state and one federal...⁴⁰⁹

America's unique system of federalism, a cornerstone of American constitutional democracy, became the victim of an attack by the Republican majority in the Iowa House (and the Iowa Senate) as they attempted to prevent any serious regulation of their economic activity, regardless of the harms it inflicted on the public health and welfare of Iowans. As will be shown, Governor Vilsack cited the attack on federalism (without mentioning it by name) in his message to the Legislature explaining his veto of House File 2523.

Before moving to Governor Vilsack's veto message, one other aspect of House File 2523 requires attention – the portion of the law giving CAFO owners either a six-month or twelve-month "grace period" during which the CAFO owner can not be assessed any fines or financial penalties for being in violation of the emissions ordinance. Neither will the CAFO owner be judged by the DNR for being in violation of the emissions ordinance during the free pass for either six or twelve months after being initially cited.

Once the DNR investigates a complaint, finds a violation of the short-term minimal risk levels for either hydrogen sulfide (H₂S) or ammonia (NH₃), and issues a written notice to bring emissions into compliance, the offending CAFO owner/operator has 180 days to take corrective action and cannot "be in violation of state law for failing to comply with the notice during its effective period" [the 180 days beginning with the date of issuance].⁴¹⁰ For "any other violation of a minimal risk level," *i.e.*, long-term minimal risk levels, the owner has a full year to reduce the offending levels of CAFO ambient air emissions of hydrogen sulfide (H₂S) and/or ammonia

407. F Frankfurter (1930). *The public and its government*, pp. 48, 49. New Haven, CT: Yale University Press.

408. Gregory v. Ashcroft, 501 U.S. 452, 458 (1991).

409. U.S. Term Limits v. Thornton, 514 U.S. 779, 841 (1995).

410. 80th Iowa General Assembly, 2nd Session, House File 2523, p. 11, Lines 10-13.

(NH₃).⁴¹¹ Finally, the law explicitly exempts the CAFO owner from being "subject to the imposition of penalties based on a violation during that period [either the six-month 180-day period for a short-term violation or the 12-month full-year period for a long-term minimal risk level violation]."⁴¹²

That summarizes the actions taken by women and men elected to office by their constituents, obviously feeling free of any negative consequences flowing from their actions in putting the needs of an industrial-scale enterprise to operate freely without any meaningful restrictions on their activities despite their harm to the public health and welfare of their neighbors.

Governor Vilsack's Veto Message to the Iowa Legislature

Governor Vilsack vetoed House File 2523. Although the Republicans had a majority in both the House (54-46) and the Senate (29-21), they fell short of the required two-thirds vote to override a gubernatorial veto.⁴¹³ Immediately following his introductory sentence, the governor wasted no time in detailing the many wrongs he found in the bill.

Although House File 2523 was touted as the "air quality bill" by legislators, the fact is that the Minimal Risk Levels established in this bill fail to adequately protect the health of Iowans.⁴¹⁴

Governor Vilsack then explained the trickery involved in presenting such a false facade:

The levels established in the bill misrepresent the Center for Disease Control's recommendations by allowing exposures for longer time periods than recommended and by failing to required [sic] immediate responses to exceedances of those standards.⁴¹⁵

The Iowa governor compared the faulty standards contained in House File 2523 to the standards of neighboring agricultural states.

The health levels in this bill for hydrogen sulfide and ammonia are many times less protective of health than those imposed in surrounding states where livestock agriculture continues to thrive. [Missouri, Minnesota, and Nebraska](#) all have standards that allow violations at most for two days out of any five, and generally not more than twice a year. This bill would require fourteen consecutive days of violations under one provision before exceeding the standard. Setting such a lenient standard, as designated in this bill, does not address the problem and threatens to undermine the credibility of the livestock industry in Iowa.

411. 80th Iowa General Assembly, 2nd Session, House File 2523, p. 11, Lines 13-16.

412. 80th Iowa General Assembly, 2nd Session, House File 2523, p. 11, Lines 23-26.

413. Iowa Legislative Service Bureau (n.d.). *Members of Iowa General Assemblies, 1981-2014*. No publisher information or location of publisher given.

414. State of Iowa House Journal, Wednesday, April 14, 2004, p. 1399.

415. *Ibid.*

[Emphasis added]⁴¹⁶

Governor Vilsack next cited the violations of federalism contained in House File 2523, but does so in a manner that doesn't mention the word itself. However, his words echo the thoughts of multiple Justices of the US Supreme Court presented previously regarding federalism's importance.

This bill would also relinquish authority for establishing and amending ambient air quality standards to the federal government. This approach is problematic because it prevents the Environmental Protection Commission from developing an ambient standard to address issues that may be unique to Iowa and may not compel the Environmental Protection Agency (EPA) to take action.⁴¹⁷

In much the same manner as an educator explaining a concept that had been previously presented in class, but a concept with which the students still needed more time to work with in order to fully understand, Governor Vilsack continued to explain why federalism mattered from the state's point of view.

It is appropriate for states to maintain this authority given the unique circumstances states face and given the problems with a one-size-fits-all approach that is often pursued by the EPA. Without ambient standards, it is impossible to appropriately balance the need to protect public health with the practical and financial burdens of requiring emissions controls.⁴¹⁸

Governor Vilsack contrasted the work of the current 80th General Assembly with the work of the previous 79th General Assembly regarding "consensus work" in building a "balanced policy" that would protect "human health" while still maintaining "a strong livestock industry."

Just two years ago, the legislature worked with my administration on a balanced policy regulating livestock confinements, including air quality. I am disappointed in the legislature's unwillingness to continue that consensus work this year by refusing my offer to develop a regulatory standard that protects human health. At a time when Iowans should be coming together to solve difficult problems, majority legislators have chosen to drive a political wedge in this already divisive issue.⁴¹⁹

The Iowa governor concluded his veto message with a proposal for moving forward involving the Department of Natural Resources, the Environmental Protection Commission, and a recommendation put forward by the Department of Public Health:

I direct the [DNR] to move forward with establishing an administrative standard, monitoring, and developing best management practices. I believe the Department of Public Health has developed a balanced recommendation for hydrogen sulfide

416. State of Iowa House Journal, Wednesday, April 14, 2004, p. 1400.

417. State of Iowa House Journal, Wednesday, April 14, 2004, p. 1400.

418. *Ibid.*

419. *Ibid.*

at 30 ppb over a 60-minute average, allowing for seven exceedences [sic] on an annual basis. An air quality standard at this level will protect the health of Iowans and maintain a healthy livestock industry, and I urge the Environmental Protection Commission to give serious consideration to this recommendation.⁴²⁰

EPILOGUE

A Reflective Moment

In light of the evidence presented thus far, perhaps the current Iowa governor and the Iowa Cancer Registry would like to re-evaluate their claim that the major responsibility for Iowa's high cancer rates resides primarily in the personal choices made by Iowans about drinking and smoking. Neither the Son *et al.* (2026) study nor the Food and Water Watch report represent singular research efforts. Both are undergirded by multiple peer-reviewed, scientific-based research reports. Perhaps Governor Reynolds and the Iowa Cancer Registry might wish to consider that their silence about agriculture's contribution to Iowa's cancer crisis via agricultural emissions of PM_{2.5} could be viewed as "aiding and abetting" a major player in promoting Iowa's cancer crisis.

And perhaps the leaders of the Iowa Environmental Council and the Harkin Institute might wish to reconsider their decision to omit consideration of PM_{2.5} as a major environmental contributor to Iowa's cancer crisis and thereby through their decision provide a free pass for the agricultural sector to continue in its role of being Iowa's largest contributor of PM_{2.5} emissions into the public's ambient airspace. Both entities did not act in the public interest, particularly regarding a known carcinogen.

An Abbreviated Review

The reader has been exposed to much information in this analysis. However, several salient points exist that the reader would do well to keep in mind.

- PM_{2.5} is carcinogenic to humans.
- Agricultural emissions of PM_{2.5} in Iowa are currently the largest source of PM_{2.5}.
- Lung cancer is the leading cause of cancer deaths in Iowa.
- Exposure to PM_{2.5} in outdoor air is the second leading cause of lung cancer.
- Lung cancer deaths increased by nearly 30% (2007-2023) while smoking decreased, but air pollution increased.
- Long-term exposure to PM_{2.5} increases the risk of lung cancer through inflammatory damage, reactive oxygen species production, and oxidative DNA damage.
- Chronic exposure to pollutants contained in CAFO air emissions has been linked to inflammation, oxidative stress, and immunosuppression which may contribute to

420. State of Iowa House Journal, Wednesday, April 14, 2004, p. 1400.

cancer development.

- Particulate matter can provoke systemic inflammation and facilitate the delivery of carcinogenic compounds into the lungs.
- Fine particulate (PM_{2.5}) and sulfur oxide-related pollution are associated with all-cause, lung cancer, and cardiopulmonary mortality.
- Swine CAFOs expel two secondary precursors of carcinogenic PM_{2.5} (ammonia & VOCs), endotoxins (a pro-inflammatory agent attached to PM₁₀), toxic hydrogen sulfide, & the greenhouse gas methane along with other harmful substances.
- Agriculture has not been required to meet any federal or state air quality standards, and as a result, their PM_{2.5} emissions increased along with their PM_{2.5} -attributable mortality.
- Iowa leads the nation in having the largest percentage of its counties being designated as "high-spray" counties in terms of application rates of glyphosate, a level 2 carcinogen.
- Recent research from Yale University revealed a correlation between residency in a "high-CAFO density" area and higher rates of cancer incidence.
- Recent research from Food & Water Watch revealed a correlation between residency in a county with high rates of glyphosate application and subsequent diagnoses of non-Hodgkin lymphoma, a cancer.
- According to the Director of the Iowa Cancer Registry, "Iowa has shown the least progress of all states in reducing lung cancer incidence."

The reader also received information about:

- the Clean Air Act, US EPA Enforcement, and a Winneshiek County Citizens' Lawsuit.
- the Clean Air Act, CERCLA, EPCRA, and Agricultural Exemptions.
- the differences between rulings by national regulatory agencies (the US EPA) subject to political influence and rulings by international agencies (WHO & IARC) subject only to the body of scientific evidence provided by peer-reviewed, scientific-based research.
- the machinations employed by Industrial Agriculture to obscure, distort, and omit basic facts illustrating that it is in fact an industry similar to its predecessors – the chemical industry, the tobacco industry, and the fossil fuel industry – and needs to be regulated in order to protect the public health, our shared ambient air quality, and the public waters.
- techniques that can be used to deconstruct statements and claims by Industrial Agriculture – critical thinking, Hemingway's "crap-detecting," the work by SHEG (the Stanford History Education Group), and the efforts by both citizens and governments in the Baltic countries bordering Russia to combat Russian misinformation – in order to ascertain what's being distorted, omitted, and obscured by spokespersons for

Industrial Agriculture.

- mistakes made by the Iowa Cancer Registry in its 2026 *Cancer in Iowa* report.
- how the author(s) of Section 5 of the IEC-Harkin (2026) report distorted and misused every single source that was cited in a two-paragraph discussion about particulate matter.
- swine CAFO operations and the transformation of Iowa agriculture.
- preceding air quality efforts in Iowa, *i.e.*, the ISU-UI CAFO air quality study, Senate File 2293, the rule-making process by the Iowa Environmental Protection Commission in developing and adopting ambient air quality standards for CAFO emissions of hydrogen sulfide (H₂S) and ammonia (NH₃), the nullification of those adopted standards by the Iowa Legislature, and a subsequent attempt by the Republican legislative majority to implement "fake-standards" for air quality that was vetoed by Governor Vilsack.

I wonder what really triggered the state effort under Governor Vilsack's leadership to investigate and deal substantively with the matter of air quality degradation caused by CAFOs. As the reader will recall, Governor Vilsack attributed it to the number of citizen complaints he'd received. But I wondered if that was all there was to it. Was there anything else that might have precipitated Governor Vilsack's request to the presidents of The University of Iowa and Iowa State University? Most readers have heard of the "Butterfly Effect:"

the notion that a butterfly stirring the air today in Peking can transform storm systems next month in New York.⁴²¹

Did something else precede the citizen complaints about CAFOs or did something else occur that acted in conjunction with the citizen complaints to stir Governor Vilsack's interest in the matter? Perhaps it might have been a conference organized by Professor Peter Thorne, a UI professor and member of the National Academy of Science. The National Institute of Environmental Health Sciences and the University of Iowa's Environmental Health Sciences Research Center served as co-sponsors of the "town meeting" that was held in Des Moines in 2001 to discuss the issues of

environmental impacts and health hazards from nearby concentrated animal feeding operations (CAFOs).⁴²²

Professor Thorne summarized who participated and what transpired at the town meeting held in Des Moines:

This town meeting gave producers, concerned citizens, and regulators the opportunity to discuss the issues. Many areas of discord were identified, and a

421. J Gleick (1987). *Chaos: Making a new science*, p. 8. New York: Penguin Books.

422. PS Thorne (February, 2007). Environmental health impacts of concentrated animal feeding operations: Anticipating hazards – Searching for solutions, p. 296. *Environmental Health Perspectives*, 115 (2): 296-297. doi: 10.1289/ehp.8831.

need for better translation of science to polity was recognized.⁴²³

It is not too difficult to imagine that Governor Vilsack was not only aware of the "town meeting" being held in the city that served as the seat of state government in Iowa, but also was kept fully informed about what transpired.

While the 2001 meeting did result in a subsequent international conference being hosted by the University of Iowa's Environmental Health Sciences Research Center (EHSRC) that was attended by environmental science experts from the US, Canada, Denmark, Sweden, and the Netherlands, it takes no great imaginative leap to think that the 2001 "town meeting" played a role in helping stimulate Governor Vilsack's subsequent request to the university presidents in Ames and Iowa City for assistance in dealing with CAFOs in Iowa.

423. PS Thorne (February, 2007), p. 296, *op. cit.*

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