

# Truth of the Matter

## Claims On Air, Odor Don't Pass the Smell Test

*Odor is not what anti-agriculture advocates say*

**N**ORTH CAROLINA IS HOME to more than 2,000 pig farms, but many of the people who live in our state have never set foot on a farm. Unfortunately, that has allowed opponents of animal agriculture to fuel misperceptions and distortions with outlandish claims about our farms — particularly about odor.

It can be frustrating for farmers to explain the nuance of air emissions and odor (and lack thereof), especially to our friends in larger cities who are far removed from farm life. If only we could take our 10 million fellow North Carolinians to visit our farms and show them, once and for all, that some groups make blatantly false claims about conditions on our farms. But we simply can't.

We can, however, turn to the latest science and data. We can turn to peer-reviewed methods for observing odor and the studies they have produced. And we can look at the

documented impressions of those people (without agendas) who have spent time on our farms.

Indeed, synthesizing such disparate sources of information can get us to the truth of the matter about air and odor, and our farms.

Consider these facts:

- A recent 15-month study of an area with numerous swine farms by the NC Department of Environmental Quality's Division of Air Quality concluded that the farms are not a source of concern about air quality. The study focused specifically on Duplin County, the nation's top hog-producing county. The NCDEQ used a range of scientific measurements of the air and, importantly, the study that was designed with input from anti-agricultural groups who had aimed it specifically at pollutants they believe are from hog farms.
- A deep analysis by Harper Consulting in conjunction with Southern Utah University found there have been

steep reductions in manure components associated with odor, confirming “industry management and production improvements have been effective” in achieving significant reductions. The study’s data is from tens of thousands of lagoon samples covering decades of time from more than 180 different North Carolina pig farms.

- A Kansas State University study found that continuous improvements in how and what pigs are fed has led to significant reductions in odor-causing emissions. The study found that the government is likely overestimating emissions from farms with lagoons by a factor of three to 11 times, underscoring how much improvement has been reached in recent years through on-farm practices.
- Dr. Pamela Dalton, who runs a prominent scientific laboratory on the human perception of odor, has conducted numerous studies around multiple North Carolina hog farms involved in recent litigation alleging nuisances. Dalton’s studies used peer-reviewed methods to evaluate both odor frequency and intensity. Her methodical odor studies found “minimal” odors at the boundary of the farm, and nothing that would be characterized as unreasonable by a neighbor. (The judge did not allow her to testify as an expert, depriving the jury of this important information. That issue is a part of an ongoing appeal in the cases.)
- Recent visitors to a variety of our farms have expressed, in objective and subjective ways, their general surprise at the lack of odor — certainly when compared with how opponents of our industry describe it. These visitors include members of the media.

You can learn more about each of these points below.

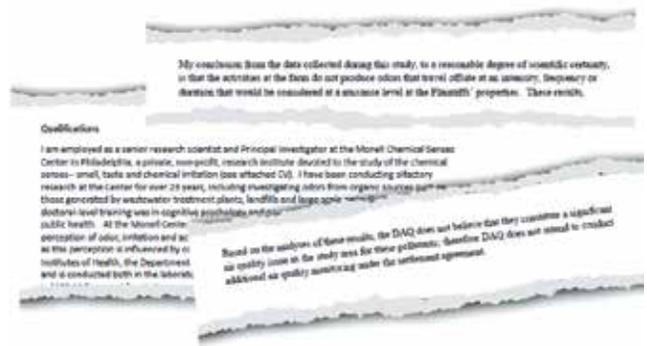
### NC DEQ: NO ISSUE WITH THE AIR

Some groups have complained that odor is common in our communities, pointing often to data from a report by Steve Wing, a committed activist and UNC-Chapel Hill professor who opposed our industry. His data was actually drawn from volunteers who were recruited by him and a community group with whom he closely worked. Wing, now deceased, said he “made arrangements” with such groups in order to “support” their interests, raising significant questions about scientific objectivity.

The recruited community volunteers were provided negative information about farms and then asked to keep a weekly diary, rating odor on a scale of zero (no odor) to eight (very strong). The data from that study of recruited volunteers was published by Wing as follows:

MEASURE	RESULT
No Odor (0)	40.6%
Very Faint (>0 to <2)	39.9%
Faint/moderate (>2 to <5)	17.2%
Strong/very strong (5 to 8)	2.3%

As shown, odor as measured by the recruited parties, was actually not frequent and was not strong, with the highest-measuring categories — and fully half of all the measured categories — collapsed into one result, which was itself a very low result: Only 2.3%.



The NC DEQ’s recent air study, then, is notable in that its monitoring results are consistent and do not show a significant air quality issue in the study area of Duplin County. The study was the result of a formal complaint filed by three activist groups who alleged that people living within 3 miles of a hog farm are impacted by the farm.

The NC DEQ focused its study on three pollutants of concern — particulate matter, hydrogen sulfide, and ammonia. The measurements were all within 0.5 miles to 2.5 miles of hog farms.

DEQ’s monitors were able to detect two unrelated episodes of smoke from open burning in the region. But the study found no concern or exceedance related to hog farms, including in the measure of particulate matter.

For hydrogen sulfide, DEQ’s data shows that 24-hour average concentrations were consistently, throughout the study, 10 times lower than the acceptable “ambient” level.

For ammonia, the acceptable level was never exceeded. And, there were very few events with even measurable concentrations — the largest being attributed to burning.

DEQ concluded: “The results, in total, do not constitute a significant air quality issue in the study area for these pollutants. Therefore, (DEQ) does not intend to conduct additional air quality monitoring...”

The North Carolina Pork Council and the North Carolina Farm Bureau both published comments to DEQ on the monitoring study, describing the results as being consistent with reliable science.

“The results of this ambient air quality study,” the Farm Bureau said, “provide a valuable counter-point to the narrative from (other groups) that swine farms are contributing to poor air quality...”

The NC Pork Council, in its comments, said: “No one who understands the legitimate science and research should be surprised by the results of this DEQ monitoring because multiple other studies show that swine farms do not have a significant adverse impact on surrounding communities. Recent research in fact points to a decrease in emissions by the swine industry over the last 20 years.”

### TWO STUDIES: AIR EMISSIONS DECLINING

The Harper Consulting/Southern Utah University study is one of them, documenting significant reductions in ammonia levels from North Carolina swine farms. Ammonia is the constituent most commonly associated with odor.

## What it Takes to Study and Document Odor

Dr. Pamela Dalton, a world-renowned expert in odor, conducted a range of studies on North Carolina hog farms with an intent to measure and understand odor. She was brought to the state as part of the recent nuisance litigation. In reports filed in court, she described how science works to understand odor.

For the North Carolina hog farm studies, she wrote, people who served as “monitors” worked in two- or five-hour shifts with a mandatory two-hour break between shifts.

“They were not allowed to eat or drink anything but water during their shift or for one hour prior to their shift. To minimize any personal odors, they were required not to wear any fragrances or scented products and to minimize consumption of foods with strong odors. Unscented sunscreen and insect repellent was provided for them to use, as needed.

“Monitoring for odor frequency and intensity was accomplished through the use of a field olfactometer device known as the Nasal Ranger™. The Nasal Ranger has become the ‘gold standard’ for conducting field olfactometry assessments in studies such as the one described here. Its use has been adopted by many states and local jurisdictions in order to objectively quantify odor intensity, both in the United States and in Europe. In addition, the Nasal Ranger instrument has been utilized in a number of peer-reviewed studies evaluating a variety of odor sources in the field...”

Dalton’s studies did not find elevated or objectionable odors. And, she noted that this was in direct contrast to what the plaintiffs were saying.

“In summary,” she wrote, “we are left with an inconsistency between the subjective reports of the Plaintiffs and the objective data collected by the odor monitors that requires explanation. When there is discordance between the exposure an individual receives and their perceptual or symptom response, this necessitates the examination of other factors that may explain the inconsistency.”

She then cited “numerous field studies of odor annoyance” in which investigators have focused on the sensory and cognitive factors present “that might cause an individual to perceive an odor where none exists or to misattribute an odor to a source.”

“In my report,” she continued, “I provide a review of factors that can shape odor perception and how these factors can lead someone to perceive an odor where none exists or to misattribute an odor to a source. I also discuss why subjective self-reports of odors are insufficient to document an elevated or objectionable odor and why a study that uses trained panelists such as the one we conducted substantially reduces the subjectivity in odor perception and is necessary to objectively establish the frequency, intensity and duration of odors in an environment.”

Among those factors are misattribution of odor to a source, which she wrote “can occur because of social influences among neighbors, through media coverage or from solicitations from attorneys.”

After collecting more than 106,000 samples from 182 North Carolina pig farms — then comparing it with decades-long data — the authors of that study found that ammonia levels in animal manure have been reduced by 22% to 54% since 2001.

The study documented a reduction of 35% to 78% in the nutrient content from market hog barns to primary lagoons and a reduction of 17% to 68% in primary lagoons for sow farms.

Lowry Harper, the president of the firm that conducted the in-depth study, explained its significance. “For an industry that is continually striving to become more sustainable,” he said, “this study shows that pig farmers are making significant progress toward reducing the environmental impact of their farms.”

A second study, conducted by Kansas State University, produced similar findings. It found that continuous improvement in feeding efficiency was producing results. It estimated that the government was currently overestimating emissions from pig farms, including ammonia by three times as much, and hydrogen sulfide emissions by a factor of seven to 11 times higher.

Both studies were supported by funding from the Pork Checkoff.

What’s behind these improvements? A big reason is the long-term, industry-wide effort to continually enhance the feed used to raise pigs, as well as breeding improvements.

Thanks to more efficient feed formulated specifically for age and gender of the animal, more effective nutrient management plans, and more sophisticated management practices, farmers are now using less feed than ever before to raise a pig. The efforts to improve feed efficiency are part of the broader, ongoing commitment to sustainability from North Carolina’s pig farmers.

Put simply: Less and different feed equals both less and different manure output — and less odor.

### ODOR EXPERT: NO ISSUE OF CONCERN AROUND FARMS

Dr. Dalton’s work to study odor around multiple farms was a part of the litigation brought in 2013 against our industry and which is now on appeal in the Fourth Circuit Court of Appeals. Attorneys representing the pork industry recently argued that excluding Dalton’s on-farm studies from the courtroom led to “slanted” views about our farms and had an impact on negative jury verdicts.

It is useful, then, to understand Dr. Dalton’s work in the cases in her role as a leader at the Monell Institute, which is “the world’s only independent, non-profit scientific institute dedicated to basic research on taste and smell.”

Dalton filed expert reports in the cases. Here is a sample from one:

“The Plaintiffs have alleged that nuisance odors from the hog waste that is generated at these facilities have impaired the use and enjoyment of their properties. It is my opinion, to a reasonable degree of scientific certainty, that operations at the farms do not produce objectionable odors at the Plaintiffs’ residences that would impair the use and enjoyment of their

properties. This opinion is based on my personal observations at the farms, my research, a review of the Plaintiffs' depositions and odor data sheets, and specifically, the odor monitoring data collected under my supervision at two locations on and near these farms..."

Dr. Dalton wrote that her data-driven studies were "conducted for the purpose of documenting the frequency, intensity and duration of odors associated with the hog farm operations."

She wrote that her studies took into account a variety of factors, including land application of effluent.

"Land application on the farm fields occurred for 8-9 hours on each of seven days during our monitoring study," she wrote. "Many of the spray activities were in full view of our odor monitors, and they were located closer to land application than most of the Plaintiffs. Despite this, a manure odor was recorded during this activity only at one time, by one rater, at a dilution" level considered very low.

Her studies found that the predominate smell on farms was described as "earthy" and "grassy."

In summarizing, Dr. Dalton wrote in one of the cases, as an example: "Out of 2,111 total readings, no hog farm odors were detected at an elevated intensity that could be considered objectionable. My conclusion from the data collected during this study, to a reasonable degree of scientific certainty, is that the activities at the farm do not produce odors that travel offsite at an intensity, frequency or duration that would be considered at a nuisance level at the Plaintiffs' properties."

## FARMERS' VIEWPOINTS SUPPORTED BY VISITORS

Science, data and studies certainly support the views of farmers, who say claims of overwhelming odors aren't true. But what about people who visit the farms? What do they think?

When the NC Farm Families organization invited a group of students from Mount Olive University to visit a hog farm in Duplin County and learn more about how the treatment lagoons work, it was also an opportunity to gauge perceptions.

Each student was asked to complete a short survey before and after their visit.

The results were telling: Nearly 75% of the students had a more favorable impression of hog farms and treatment lagoons after their visit. The other students' perceptions remained the same.

When students rated the odor near the lagoons on a scale of 1-10 (with 10 being the strongest), the group expected the odor to rank as a 6.6 before their visit.

After the visit, they rated the odor right next to the lagoon as a 2.5. Nearly two-thirds of them rated the odor as very faint (1 or 2).

An even higher percentage of students — nearly 75% — rated the odor on the farm in general as very faint (1 or 2). None of the students who visited said they would consider the hog farm a nuisance.

When we asked what surprised them most about their visit to the farm, many students focused on the lack of odor:

## How We Smell Odors

The science of smell is generally settled. But it's not widely understood.

Dr. Pamela Dalton is an expert on the subject. She serves as a faculty member at the Monell Chemical Sense Center, previously worked with the Department of Defense, and has conducted numerous studies of North Carolina hog farms.

In sworn court documents, Dr. Dalton explained some basics of smell: Odor perception comes from the migration of odorants from a source to a human, who perceives by sniffing through the nose. The brain matches that perception to previous representations of odor "for the individual to identify or characterize what they smell."

"The perception of odors is a highly subjective experience and the variation among any group of individuals in their reports of odor intensity and adverse response from smelling an odor can be quite profound," she wrote, citing multiple other academic studies.

Thus, she wrote, "it is important when attempting to objectively determine the intensity of any odor in an environment to ensure some level of consistency among the individuals who are reporting odor."

This is why scientific tests, such as ones that she has overseen and that were performed by the N.C. Department of Environmental Quality, are critical pieces of objective assessment.

"Determining whether odorants are actually present at a ... location or whether the odors perceived are actually from the alleged source is important," she wrote, "because beliefs about odors, such as whether an odor is harmful, can induce a person to perceive an odor when none is present, to misattribute an odor to a source or to perceive the odor as stronger or more persistent than it objectively is."

*"Hog farms are much cleaner and safer than the media portrays."*

*"It smelled a lot less than I imagined...The media makes them seem terrible when they are actually well-maintained and regulated."*

Of course, not all media portray our farms inaccurately.

The Charlotte Observer used the word "slight" to describe odor in a 2015 story. A publication called STIR wrote that the odor was "hardly noticeable" as well.

In 2017, a Bladen Journal reporter visited a farm and shared this impression: "Upon stepping out of a vehicle, the first thing one might notice is the absence of something — an aroma. There was no odor. Of any kind. None."

When the News & Observer of Raleigh visited in 2017, the reporter described a "light barnyard smell."

And the Associated Press, in 2018, wrote: "Even on a 90-degree day, the smell from two hog houses and a waste lagoon was almost negligible."

Indeed, these views reinforce what we know to be true: Our farms, thanks to dedicated families who manage them responsibly, are not sources of overwhelming, objectionable or unreasonable odors or air emissions. 